ABSTRACT

Title of Dissertation:	IMPROVING CHRONIC ILLNESS MEDICATION ADHERENCE: A COUNTERFACTUAL THINKING-BASED MODEL OF PERSUASIVE COMMUNICATION
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The World Health Organization estimates that, by 2020, the number of Americans affected by at least one chronic condition requiring medication therapy will grow to 157 million. Effective medications are a cornerstone of prevention and disease treatment, yet only about half of patients take their medications as prescribed, resulting in a common and costly public health challenge for the U.S. health care system. As with much of health care, drug adherence is primarily about human behavior. Therefore, patients who lack motivation to take their medication as prescribed cannot be forced or simply educated to take their medication; they must be persuaded and motivated to do so. However, existing literature on how persuasion-based behavioral change can be achieved for non-adherent patients is sparse. To help build more evidence on how effective communication can be used to promote drug

adherence for patients who have been diagnosed with chronic illness, this research tested the effectiveness of counterfactual thinking as a message design strategy aimed at increasing drug adherence among individuals at risk for nonadherence. Findings from experiments 1 and 2 showed no effect of counterfactual thinking on medication adherence. Findings from experiment 3 showed that, in a sample of 303 patients with type 2 diabetes at risk for nonadherence, messages including upward counterfactual thinking (e.g., “if only I had taken my medication as prescribed, I would not be in the hospital right now!”), compared to messages including downward counterfactual thinking (e.g., “it could have been worse and I could have died!”) or no counterfactual thinking, increased perceptions of medication adherence self- and response efficacy, and behavioral intention to take one’s medications as prescribed. Counterfactual thinking-based messages are a promising and easy to use persuasion strategy for patients who are at risk for nonadherence. Counterfactual thinking can be incorporated in interventions aimed at increasing adherence, and in doctor-patient or pharmacist-patient communications. Future studies should replicate these findings patients who have other chronic illnesses. Furthermore, measuring actual medication adherence behavior as opposed to behavioral intention, would provide a better indicator of the effectiveness of counterfactual thinking in increasing adherence.

IMPROVING CHRONIC ILLNESS MEDICATION ADHERENCE: A COUNTERFACTUAL THINKING-BASED MODEL OF PERSUASIVE COMMUNICATION

by

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List of Abbreviations

CFT - counterfactual thinking

statedUP – stated upward counterfactual thinking

statedDown – stated downward counterfactual thinking

gen_outcomes – self-generated outcomes upward counterfactual thinking

gen_behaviors - self-generated behaviors upward counterfactual thinking

genDown – self-generated downward counterfactual thinking

Chapter 1: Introduction and Rationale

It is now recognized that maintaining one's health and preventing disease or managing an illness is a matter of human behavior (Butterworth, 2008; Xu, Chomutare, & Yiengar, 2014). Specifically, adopting a balanced diet, exercising regularly, and avoiding alcohol and cigarettes, to name a few, are behaviors that individuals are advised to perform for maintaining a certain level of health. However, behavior change and fostering of healthful behaviors is a major challenge for health scholars and practitioners.

Despite health promotion and disease prevention efforts, population health statistics are far from favorable. Specifically, in 2011, 52% of adults did not meet federal guidelines for physical activity. Moreover, 90% of Americans consume too much sodium, a cause of high blood pressure, heart disease and stroke. In 2011, 23% of adults reported eating vegetables less than once a day. In 2012, one in five adults said they were current smokers and about 38 million American adults reported binge drinking about four times a month (Center for Disease Control and Prevention, 2016; CDC).

Health risk behaviors as the ones mentioned above are responsible for developing chronic diseases and conditions, "some of the most common, costly, and preventable of all health problems" (CDC, 2016). Chronic illnesses are conditions "of long duration and generally slow progression. The four main types of noncommunicable [chronic] diseases are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes" (World Health Organization, 2014; WHO). As of 2012, about half of all adults—117

million people—had one or more chronic health conditions. One of four adults had two or more chronic health conditions. Of the top ten causes of death in 2010, seven were chronic conditions, with cancer and heart disease accounting for nearly 48% of all deaths. An astonishing 86% of all health care spending in 2010 was for people with one or more chronic diseases (CDC, 2016).

As chronic disease continues to weigh more heavily on public health, adherence to treatment becomes a critical component for patient care and disease management. Adherence is defined as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider." (World Health Organization, 2016; WHO). Effective medications are a cornerstone of chronic disease treatment, yet only about half of patients take their medications as prescribed, resulting in yet another common and costly public health challenge for the US health care system (CDC, 2016). For example, only 51% of Americans treated for hypertension are adherent to their long-term medication treatment. Across conditions, between 20 to 30% of patients never fill their prescriptions and about 50% of individuals do not continue their medicated treatment as prescribed. Rates of medication adherence drop after the first six months of treatment (Brown & Bussell, 2011).

Reduced medication adherence not only results in poor health outcomes but it also has a significant impact on health care costs (National Institutes of Health, 2016; NIH). From a public health perspective, nonadherence causes approximately 30% to 50% of treatment failures and 125,000 deaths annually and 33% to 69% of medication-related hospitalizations are linked to drug nonadherence. Financially, the direct cost associated

with nonadherence is estimated at $100 billion to $289 billion annually, with a cost of $2000 per patient in physician visits annually (CDC, 2016).

Medication nonadherence, then, represents a public health issue of great magnitude. Therefore, scholars and professionals from a variety of disciplines have engaged in decades of research investigating predictors and correlates of, and potential solutions to medication nonadherence (e.g., Coomes, Lewis, Uhrig, Furberg, Harris, & Bann, 2012; Garofalo, Kuhns, Hotton, Johnson, Muldoon & Rice, 2016; Hofer, Choi, Mase, Fagerlin, Soencer, & Heisler, 2016; Kreps et al., 2011). Existing research in this area spans across multiple chronic conditions, such as hypertension, diabetes, HIV, asthma, depression, cancers, to name a few. It also evaluates patients of diverse ages, races, ethnicities, and economic status. Age, sex, education, comorbidities, medication beliefs, medication side-effects, complexity of the treatment regimen, doctor patient-communication are some of the many factors that scholars have identified as correlates or predictors of medication nonadherence.

Once these factors have been identified, researchers have tried to develop and evaluate complex interventions that may improve drug adherence (e.g., Bobrow et al., 2014; Coomes, Lewis, Uhrig, Furberg, Harris, & Bann, 2012; Foreman et al., 2012). Some of these interventions focus on improving doctor-patient and pharmacist-patient communication. Other programs have tried to enhance patients' understanding of their medication regimen through educational materials and their motivation to take their drugs through motivational interviewing. Another stream of research has tested the potential of text messages or mHealth in reducing drug nonadherence. Text messages have been used

as reminders; sending short text messages reminding patients to take their medication seems to improve adherence across multiple illnesses and populations.

However, even though communication is an important component in all of these interventions, there remains a gap in understanding how effective communication can enhance medication adherence and research and recommendations on how to design messages aimed at increasing drug adherence are sparse. For example, studies reporting educational programs discuss what information should be communicated to patients and some of them provide sample messages in this regard (i.e., the content of the communication), however, they do not explore or compare different message designs and contents (i.e., the structure or features of the communication) (e.g., Berrien et al., 2004; DeVries, McClintock, Morales, Small, & Bogner, 2015). More importantly, they do not answer the question of how to motivate patients to take their drugs (motivational interviewing-based interventions constitute an exception). This shortcoming becomes a problem when understanding that adherence is related to a patient's intrinsic motivation to follow therapy with the goal of improving his/her health (Horne, 2006; Noble, 1998) and that quite a few patients are resistant to medication regimens. The reasons given for this resistance vary: they do not like taking medication, they do not think that their condition is severe enough to warrant behavior modification, or they do not think they can. In other words, for some patients, adhering to medication is similar to quitting smoking, exercising, or eating healthfully.

Therefore, patients who are resistant to medication adherence cannot be forced or simply educated to take their medication; they must be persuaded and motivated to do so. For this group of patients, persuasive messages that convince them of the importance of

taking their medication and their ability to take their medication as prescribed are likely to be much more impactful than education and reminders (Mayer & Pharm, 2007, p.1).

However, the existing literature is thin on how persuasion-based behavioral change can be achieved for non-adherent patients. As O'Keefe (2012) writes, "messages do not necessarily map easily or straightforwardly onto psychological processes or states" (p. 15). What this means is that an understanding of the psychological factors that affect behavior (e.g., medication adherence) is not sufficient basis for effective communication; rather, one must test various message designs to understand what constitutes effective communication. In other words, if a patient believes that taking their medication as prescribed is not important, simply telling them they can die if they do not do it may not be the most effective strategy; rather, perhaps providing them with statistics about the effectiveness of their particular medication or another patient's testimonial on how the medication saved their lives may be more impactful. However, whereas it is known that beliefs about one's medication affect adherence, it is less known what the most effective communication strategy is to change those beliefs. As O'Keefe (2012) puts it, "the best evidentiary basis for conclusions about effective message design is direct evidence about message effects" (p. 15).

Therefore, this research attempts to address this gap in the drug adherence literature and conceptualize a theory-based model of persuasive communication aimed at increasing adherence intentions by positively changing individuals' self- and response efficacy, and outcome expectancy. Self-efficacy refers to an individual's belief that he/she has the ability to carry out a behavior (Bandura, 1994), in this case, to take their medication as prescribed. Response efficacy is defined as an individual's belief that a

specific recommendation (i.e., the response) that is being communicated to him/her is efficient in avoiding a threat (Witte, 1992). In the present context, high response efficacy would occur when an individual believes that the recommendation to take their medication as prescribed would be efficient in helping them manage their illness appropriately and avoid health complications. In general, when an individual believes that 1) a behavior is efficient in avoiding a threat (i.e., taking medication is efficient in avoiding medical complications) and 2) that he/she is able to carry out that behavior (i.e., he/she has the ability to take their medication as prescribed), the likelihood that the individual will engage in that behavior is the highest (McCann, Clark, & Lu, 2008; Witte, 1992). In the particular context of medication adherence, self- and response efficacy have been identified as important predictors of adherence, as well (Bane, Hughe, & McElnay, 2006; Chao, Nau, Aikens, & Taylor, 2005; Criswell, Weber, Xu, & Carter, 2010; McCann, Clark, & Lu, 2008).

Related to response efficacy is the concept of "outcome expectancy", or "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). These outcomes include psychological, social, and physical consequences of engaging with a specific behavior; when an individual believes a behavior will increase the likelihood of said outcomes, he/she is more likely to perform that behavior (Bandura, 2001). The concept of outcome expectancy and its role in motivating medication adherence will, thus, also be explored in this research. It is expected that a persuasive message that increases individuals' self- and response efficacy, and outcome expectancy is likely to elicit behavioral change in the form of increased medication adherence, as well.

To achieve these goals, this research proposes the use of counterfactual thinking (CFT) as a message design strategy aimed at increasing drug adherence among individuals with low motivation to take their drugs through increasing perceptions of self- and response efficacy, and outcome expectancy. Counterfactual thinking is a pervasive mode of thinking that involves thoughts about how things could have been different if a different behavior had been performed (Roese, 1994). For example, one might think that their health would be in better shape had they given up smoking ten years ago when their doctor advised them to. A vast body of literature documents the impact of counterfactual thinking on a variety of cognitive processes, including information processing patterns, regulatory focus, perceptions of self-efficacy and control, responses to persuasive messages, with consequences for behavioral intentions and subsequent behaviors (e.g., Aboulnasr & Sivaraman, 2010; Arora, Haynie, & Laurence, 2011; Baek, Shen, & Reid; Gleicher, Boninger, Strathman, Armor, Hetts, & Ahn, 1995; Krishnamurthy & Sivaraman, 2002; Nan, 2008; Page & Colby, 2003; Roese, 1994, 1997, 1999; Sanna, 1996; Tal-Or, Boninger, Poran, & Gleicher, 2004).

The ubiquity of counterfactual thinking and its power on behavior is skillfully summarized in an article by Landman and Petty (2000). The article explains how lottery advertising often exploits the normal human capacity for counterfactual thinking in convincing individuals to repeatedly purchase lottery tickets, despite their losing time after time. Specifically, the authors argue that an inherent feature of all lottery purchases, i.e., the negative outcome of not winning because of not having purchased a ticket, induces counterfactual thinking (i.e., If only I had bought a ticket, I could have been enjoying $1 million now!). Moreover, a great deal of lottery advertisements directly

invite individuals to generate counterfactual thinking by asking them to imagine what they would do if they won the big prize. Landman and Petty conclude that counterfactual thinking-based advertising tactics are tremendously effective (as illustrated by lottery tickets sale), so effective that they have been banned from being used in other domains, such as finances (p. 316).

Despite the persuasive potential of counterfactual thinking and its impact on variables relevant to persuasion (i.e., information processing, self-efficacy beliefs, behavioral intentions, and behaviors), the use of counterfactual thinking in persuasive communication has received scant research attention. Furthermore, when studied in a persuasion context, counterfactual thinking has been manipulated as a factor incidental to the message and analyzed as a mechanism or a moderator that enhances or reduces the effects of specific persuasive strategies, such as gain and loss frames (Baek, Shen, & Reid, 2013) or message regulatory focus (Nan, 2007). Only two studies have explored the persuasive potential of counterfactual thinking as a message component, concluding that, indeed, messages that include counterfactual thoughts outperform those that do not (Gleicher et al., 1995; Tal-Or, Boninger, Poran, & Gleicher, 2004). This research will continue past work and provide an in-depth examination of the power of counterfactual thinking as a persuasion tool.

The implications for communication theory and research are multiple. First, this research is just one possible inquiry into the role of counterfactual thinking in persuasion. Future research can build upon these findings and investigate how robust counterfactual thinking-based persuasive communication is. Second, counterfactual thinking, due to its close relationship to emotional reactions as it will be explained later on in detail, offers

communication scholars another excellent opportunity to study the intersection of cognition and emotion and their joint effect on individuals' responses to persuasion. Third, it is hoped that the present inquiry will serve as a springboard for incorporating counterfactual thinking with other well-established persuasion theories. From a practical perspective, this work aims to provide concrete advice on how to construct theory-grounded health messages aimed at increasing drug adherence, a research area that is far from well represented in the literature.

To conclude, this is the first research effort to employ counterfactual thinking as a persuasive message design strategy and to explore the underlying mechanisms through which it affects behavioral outcomes in the context of increasing individuals' intentions to adhere to medication as prescribed.

The next chapter of this manuscript defines medication nonadherence and provides an inventory of factors that affect medication adherence. The third chapter describes prior interventions designed to increase medication adherence. Counterfactual thinking and its potential for persuasive communication are introduced in chapter four. Chapter five describes the proposed study and hypotheses to be tested. In chapter six, findings from a pilot study and two experiments are presented and discussed. Findings from a third experiment are introduced and discussed in chapter seven. Finally, chapter eight provides a discussion of the findings across all studies, implications and limitations of the studies, and directions for future research.

Chapter 2: Medication Nonadherence

Defining Adherence and Nonadherence

The World Health Organization defines medication adherence as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider." (WHO, 2016). Adherence to medication is measured either directly through biological markers (a sensitive but invasive method) or indirectly, through self-reporting, questionnaires, pill counts, or, more recently, electronic pharmacy records (Guillausseau, 2005; Ho, Bryson, & Rumsfeld; 2009). Adherence is usually defined as the proportion of patients taking between 80 and 90% of their prescribed medication and it has been usually measured in patients continuing medication, rather than in newly diagnosed individuals (Caro, Ishak, Huybrechts, Raggio, & Naujoks, 2004; Donnan, MacDonald, & Morris, 2002).

Researchers have distinguished among several types of nonadherence. First, there is voluntary and involuntary nonadherence. Voluntary nonadherence refers to patients who choose not to take their medication as prescribed and it is related to patients' beliefs, attitudes, and expectations that influence their motivation to begin and persist with their medication treatment (Jimmy & Jose, 2011). Some of the most important reasons that people choose not to take their medication are: 1) fear or experience of side effects; 2) beliefs that the medication is not needed or important in their treatment plan; 3) beliefs that a medication is not working/is not effective; 4) perceived stigma of the diagnosis or

treatment; 5) beliefs that they are taking too many medications; or 6) negative press about the prescribed medication.

Involuntary nonadherence occurs when a patient wants to take their medication and believes that their medication is needed and effective, however, they encounter barriers such as 1) forgetting to take their medication; 2) forgetting to refill their prescription; 3) financial problems; or 4) a hectic everyday schedule (Gadkari & McHorney, 2010; Haynes, McDonald, & Carg, 2002; Osterberf & Blaschke, 2005; WHO, 2003). Given that this research attempts to increase motivation to take one's medication through theory-based persuasive communication and that barriers such as financial limitations cannot be changed with a persuasion approach, the focus will be on voluntary nonadherence.

Predictors and Correlates of Medication Nonadherence

Predictors and correlates of chronic illness medication nonadherence are multiple. Numerous studies have explored potential predictors and correlates of adherence to medication across a variety of conditions. Whereas earlier studies explored largely unmodifiable variables such as age, sex, race/ethnicity, income, education, and co-occurring illnesses, more recent studies have begun to explore more alterable predictors of adherence such as provider–patient communication, regimen complexity, medication cost, health literacy, and health and medication beliefs (Gazmararian, Kripalani, Miller, Echt, Ren, & Rask, 2006; Mann, Ponieman, Leventhal, & Halm, 2007; Rieckmann et al. 2006).

Demographic characteristics

Demographic variables such as age, race, and gender have been some of the first factors studied in the context of medication nonadherence. However, their relationship with drug adherence has been inconsistent. For example, in the case of diabetes, some survey studies report a higher degree of nonadherence among older patients (e.g., Soumerai, Ross-Degnan, Avorn, McLaughlin, & Choodnovskiy, 1991), whereas others report the opposite (Ahmad, Ramli, Islahudin, & Paraidathathu, 2013). Other survey studies note that older patients become less adherent when they must follow complex medication regimens (Khoza & Kortenbout, 1995) or when they cannot afford their medication (Col, Fanale, & Kronholm, 1990).

For chronic health failure, a systematic analysis of 17 studies which provided data for 727 patients concluded that older age alone is not related to medication adherence; the authors concluded that younger newly diagnosed patients with chronic health failure are in fact more at risk for nonadherence and they should be closely monitored (Krueger, Botermann, Schorr, Griese-Mammen, Laufs, & Schulz, 2015). Yet another systematic analysis found that medication adherence across eight conditions (depression, hypertension, hyperlipidemia, diabetes, asthma or chronic obstructive pulmonary disease, multiple sclerosis, cancer, and osteoporosis) was higher in older patients (Rolnick, Pawloski, Hedblom, Asche, & Bruzek, 2013). Finally, Granger and his colleagues (2009) found no association between age and drug adherence for patients with heart failure when adjusting for other variables.

Mixed results were also found for gender. Whereas Granger et al. (2009) and Rolnick et al. (2013) found women to be slightly less adherent than men, another study

found the relationship between gender and medication adherence to be insignificant (Horne & Weinman, 1999).

Regarding race and education, survey studies have been inconsistent, as well; it is uncertain whether more or less educated patients or whether White versus non-White individuals are more adherent (Osterberg & Blaschke, 2005; Misra, & Lager, 2009; Ramli, Ahmad, & Paraidathathu, 2012). In a randomized controlled trial in which participants were assigned to one of two models of community health worker-led diabetes medication decision support, Hofer and her colleagues (2016) tested whether gender, race/ethnicity (only Latinos and African Americans were included in their study), age, and education moderated the relationship between medication knowledge, satisfaction with medication information, and decisional conflict (i.e., the confidence that the patient felt about key aspects of decision making regarding their medication) and medication adherence, however, none of these variables emerged as moderators.

Comorbidities (co-occurring illnesses)

Whereas the presence of comorbidities has been initially found to decrease adherence due to the complexity of treatment regimens necessary to treat multiple conditions (Mateo, Gil-Guillen, Mateo, Orozco, Carbayo, & Merino, 2005; survey study), other survey studies and systematic reviews did not find a relationship between the complexity of medication treatment measured in terms of number of drugs that a person must take on a daily basis and adherence (Ahmad et al., 2013; Cramer, 2004). The only comorbid illness that has been consistently found to be related to adherence is depression. Specifically, patients diagnosed with depression and another chronic illness are less likely to adhere to their medication therapy than patients who have one or multiple chronic

conditions but who do not have depression (Sirey, Greenfield, Weinberger, & Bruce, 2013; survey study).

Health literacy

Health literacy is "the degree to which individuals have the capacity to obtain, process, and understand the health information needed to make appropriate health decisions" (Ingram & Ivanov, 2013, p. 22). Most studies have found that patients with low health literacy are less likely to follow their medication regimen. In a survey of HIV positive men and women (60% ethnic minorities), education and health literacy were significant and independent predictors of adherence, even after controlling for age, ethnicity, income, HIV symptoms, social support, substance abuse, emotional distress, and attitudes toward health care providers. Patients with low health literacy had lower adherence rates due to confusion about the medication or forgetfulness (Kalichman, Ramachandran, & Catz, 1999). Similar findings were observed in surveys of patients with diabetes, glaucoma, or heart failure: individuals with inadequate health literacy were less likely to take their medication as prescribed (Bauer et al., 2013; Muir et al., 2006; Noureldin, Plake, Morrow, Tu, Wu, & Murray, 2012).

Ingram and Ivanov (2013), however, found no association between adherence and health literacy in a survey of hypertensive African American older adults: though most patients had inadequate health literacy, their adherence levels were not affected by it. Age and health status, however, did predict adherence, such that younger adults with poorer health status reported lower adherence levels. Similarly, in another survey, Mosher, Lund, Kripalani, and Kaboli (2012) noticed that, even though patients with low health literacy have less medication knowledge and less understanding of medication purposes,

their level of adherence was not different from that of patients with higher health literacy. Finally, systematic reviews of the literature in this area concluded that evidence on the association between health literacy and therapy adherence is weak (Geboers et al., 2015; Loke, Hinz, Wang, & Salter, 2012; Zhang, Terry, & McHorney, 2014).

Treatment-related factors

Medication side effects. The stronger the side effects associated with a medication regimen, the less likely patients are to adhere to treatment (Garcia-Perez, Alvarez, Dilla, Gil-Guillen, & Beltran, 2013; narrative review). For instance, patients with type 2 diabetes are often overweight or obese when diagnosed and some of the treatments available are associated with further weight gain; therefore, some of these patients may decide to discontinue treatment if their weight situation worsens (Dilla et al., 2008; survey study; Mannucci, Monami, Lamanna, Gori, & Marchionni, 2009; meta-analysis). Other less serious side effects such as gastrointestinal issues, headaches, or nausea may also affect treatment adherence (Donnelly, Morris, & Pearson, 2009; survey study).

To better understand the relationship magnitude between side effects and nonadherence, Pollack and colleagues (2010) conducted a survey of 2,074 patients with type 2 diabetes, between 2006 and 2008. They found that the association between side effects and nonadherence was significant (*Pearson's r* = .20, $p < .01$), with each additional side effect being associated with a 28% increase in likelihood for nonadherence.

Medication perceptions. In addition to experienced side effects, perceived side-effects may also predict nonadherence. For example, patients with type 2 diabetes who

believe that their medication would cause unpleasant side effects report less adherence (Farmer, Kinmonth, & Sutton, 2006; survey study). Kreps and colleagues (2011) also found in their survey and focus groups that, across a variety of medical conditions (i.e., high blood pressure, multiple sclerosis, hypertension, diabetes, depression, HIV, and asthma), patients who expected side effects were less likely to be adherent.

Similarly, if a patient believes that their medication is not helping them manage their disease or that taking their medication is not making a difference, nonadherence is likely (Kreps et al., 2011). In a survey of 49 patients with type 1 diabetes and 108 patients with type 2 diabetes, patients' perceptions of control over their glycemic levels and of prevention of cardiovascular complications were associated with higher medication, exercise, and diet adherence (Broadbent, Donkin, & Stroh, 2011). Kreps and colleagues (2011) found that lack of commitment about the need for and importance of the medication was the number one reason for nonadherence in a sample of 30 interview participants with various chronic illnesses.

Perceived stigma associated with certain medications, such as antidepressants, may also lower adherence (Chai, Anderson, Wong, & Hussein, 2014; survey study). Some patients also believe that medication is not necessary if they are feeling well and, as such, might stop taking their drugs when disease symptoms are absent. In support of this idea, Mann, Ponieman, Leventhal, and Halm (2009) found that surveyed individuals with type 2 diabetes believed they should take their medication only when their sugar was high.

Patient-provider communication. Not surprisingly, the quality of the communication between patient and provider has also been found to have implications

for adherence (Chiecanowski, Katon, Russo, & Walker, 2001; survey study; Rubin, Peyrot, & Simnerio, 2006; survey study). Providers are in the unique position of correcting patient misperceptions, explaining how a medication is to be taken, providing information about side effects probability and duration, and addressing any fears and concerns a patient might have. More importantly, providers are also among the few that can identify patient nonadherence. Though health care professionals have reported difficulty with predicting nonadherence in their patients, clear communication with their patients and regular follow-ups can improve medication adherence (CDC, 2013; Chiecanowski, Katon, Russo, & Walker, 2001; Rubin, Peyrot, & Simnerio, 2006).

Perceived self-efficacy, response efficacy, and outcome expectancy. More recent studies have begun to examine drug adherence from the perspective of behavioral change models (e.g., health belief model, self-regulation model, theory of planned behavior, social cognitive theory). Whereas some of the variables analyzed in this body of literature overlap with the ones summarized in previous sections (e.g., financial costs, low health literacy, regimen complexity), other factors are unique to this research. Specifically, research notes that medication adherence is affected by one's self-efficacy, response efficacy, and outcome expectancy.

Self-efficacy refers to one's belief that they have the ability to perform a behavior, for example, that they are able to take their medication as prescribed. Self-efficacy is different from perceived behavioral control (the perception that performance of behavior is within one's control, for example, that one is in control of taking their medication; Azjen, 1991), although the two variables can be correlated. For example, one may believe that they have the ability to do something, such as fishing, however, one may believe that

fishing is not under their control, perhaps because of lack of a fishing permit. Empirically, studies using factor analytic techniques have concluded that perceived behavioral control can be separated from self-efficacy (e.g., Armitage & Conner, 1999a; Povey, Conner, Sparks, James, & Shepherd, 2000). Moreover, self-efficacy has been shown to predict behavioral intentions above and beyond perceived behavioral control (Norman & Hoyle, 2004). Finally, in experimental studies, manipulations of self-efficacy did not affect perceptions of perceived control (Trafimov, Sheeran, Conner, & Finlay, 2002). Together, these findings show that self-efficacy is different from perceived behavioral control.

The role of self-efficacy in medication adherence has been studied rather widely and results show a pretty consistent pattern: increased self-efficacy is associated with better adherence. These results have been observed for patients with type 2 diabetes (Chao, Nau, Aikens, & Taylor, 2005; survey study); patients with hypertension (Bane, Hughe, & McElnay, 2006; Criswell, Weber, Xu, & Carter, 2010; survey studies); patients with HIV (Colbert, Sereika, & Erlen, 2013; survey study); patients with chronic kidney disease (Wierdsma, van Zuilen, & van der Bijl, 2011; intervention study in which participants in the treatment group discussed medication adherence self-efficacy). In most studies, self-efficacy has been tested as a mediator between various background variables (e.g., depressive symptoms, health literacy, provider-patient interactions) and adherence.

The importance of self-efficacy for medication adherence is also stressed by McCann, Clark, and Lu (2008) in their self-efficacy model of medication adherence in chronic mental illness. Developed from insights from researchers' own practice and a comprehensive review of research relating self-efficacy with mental illness medication

adherence, the model describes self-efficacy as a central concept, influenced by four interrelated factors: perceived medication efficacy, access to, and relationship with, health professionals; significant other support and supported living circumstances. McCann, Clark, and Lu describe self-efficacy as the cornerstone of medication adherence and note its strong relationship with coping abilities, health beliefs, and behavior (Bandura, 1994; Glanz & Rimmer, 1995). Specifically, individuals with a strong belief in their abilities to perform a behavior (in this case, drug taking) cope better with complex medication treatments, make better decisions about medication taking, and regard medication taking more positively.

The conceptualization and measurement of self-efficacy, however, has been rather confusing across studies. Specifically, some research defined self-efficacy as "medication taking self-efficacy" or one's belief in one's ability to take their medication as prescribed (e.g., Colbert, Sereika, & Erlen, 2013; Nokes et al., 2012). Other research, however, seemed to have conflated the concepts of self-efficacy and response efficacy (i.e., one's belief that a specific recommendation is effective in avoiding a threat; for example, heart disease medication adherence response efficacy is one's belief that the advice to take their medication is an effective strategy to avoid a stroke).

For example, Bane and colleagues (2006) and Criswell and colleagues (2010) defined self-efficacy as a person's perception that he or she is able to successfully perform a given behavior (i.e., drug taking), however, they measured this variable with items such as "I am confident that I could take my blood pressure medication as prescribed, even if I didn't think that my medicine was useful". Such items combine self-efficacy beliefs (I am confident that I can take my medication as prescribed) with

response efficacy beliefs (I think that taking my medication as prescribed by my doctor is/is not useful). Whereas such items better describe real situations that patients face on a day to day basis (i.e., a person is likely to assess his/her ability to take medication in the face of barriers such as beliefs that the medication is not helping), it is important to separately measure these two constructs and understand if and how they separately impact adherence.

Such separation is even more important for interventions aimed at increasing adherence: increasing both confidence in ability to take medication and confidence in the benefits of taking medication are likely to be associated with higher and stronger adherence. Going back to the literature looking at how medication perceptions influence adherence, one can observe that beliefs that a medication is/is not useful in managing a disease affect adherence (e.g., Kreps et al., 2011). Although those studies did not label such beliefs "response efficacy", the similarity is apparent. Furthermore, in the self-efficacy model of medication adherence, McCann and colleagues (2008) emphasize that individuals are more likely to carry out behaviors if both self-efficacy and response efficacy are high. In fact, studies have consistently found that patients' perceptions of how much a medication is helping them achieve recovery or manage their illness are the most important factors affecting adherence (Kikkert et al., 2006; Kreps et al., 2011; Loffler, Kilian, Toumi, & Angermeyer, 2003). In conclusion, future research should simultaneously consider the effects of self-efficacy and response efficacy on adherence.

The relationship between outcomes expectancy (a concept related to response efficacy, though not identical) and medication adherence has also been studied. In a survey of patients with glaucoma, Sleath and his colleagues (2014) concluded that

outcome expectancy (conceptualized and operationalized as beliefs that a medication was helping patients with their illness) was positively related to medication adherence.

Outcome expectancy is "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). These outcomes include psychological, social, and physical consequences of engaging with a specific behavior (Bandura, 2001). For example, an individual's outcome expectancy of wearing a condom may include beliefs about protection against sexually transmitted illness (physical outcome), being perceived as an "uncool person" (social outcomes) or fear that their partner would perceive them as distrustful (psychological outcome). Response efficacy perceptions, on the other hand, encompasses a person's belief about whether a prescribed remedy or course of action can protect against a health threat. For example, response efficacy refers to one's belief that wearing a condom can help protect against sexually transmitted infections. To conclude, though similar, the concepts of outcome expectancy and response efficacy are different; outcome expectancy is a broader concept, whereas response efficacy is more specific and included in outcome expectancy (i.e., physical outcomes are similar to response efficacy).

Given that both response efficacy and outcome expectancy have an effect on medication adherence (McCann et al., 2008; Sleath et al., 2014), it would be useful to study these factors in conjunction with self-efficacy. Given the overlap between response efficacy and outcome expectancy, in the context of this research, outcome expectancy is defined as expectations about social and psychological outcomes of taking one's medication as prescribed, whereas response efficacy is defined as expectations about physical outcomes.

Chapter 3: Interventions to Improve Medication Adherence

Scholars have tried to develop and evaluate complex interventions that may improve drug adherence. These interventions often involve multiple components, such as programs focusing on improving doctor-patient and pharmacist-patient communication; educational materials aimed at enhancing patients' understanding of their medication regimen and motivational interviewing aimed at increasing patients' motivation to take their drugs. Other interventions have tested the potential of text messages or mHealth in reducing drug nonadherence. Finally, a few studies have looked into effective communication strategies to increase medication adherence. Exemplars for each intervention category are reviewed below. Of note, all interventions include communication as an important component, however, only few use communication and persuasion theory to develop their medication adherence messages. Thus, the studies presented below are segmented based on this criterion (i.e., interventions that do/do not use communication and persuasion theory).

Interventions that Do Not Use Communication/Persuasion Theory

Multifaceted interventions

Decades of research have shown that adherence entails a complex interaction of patient characteristics, the social environment, and health care professionals (Lin & Chiecanowski, 2008). As a result, the public health literature is ripe with descriptions of interventions targeting a combination of these factors. Evaluations of such interventions

suggest that the use of multiple interventions is more effective than the use of just one intervention; education alone is unlikely to produce significant change; successful interventions are tailored to the individual and include teaching self-determination to patients, discussing barriers with patients, simplifying the dose regimens, practicing joint patient-doctor decision making, addressing social and family support, following up with calls by health care professionals, and sending reminders for taking medication (Haynes et al., 2008; Mundt et al., 2001; Schroeder, Fahey, & Ebrahim, 2008). Motivational interviewing is a frequently used technique in these interventions (e.g., Duff & Latchford, 2010). Motivational interviewing is "a clinical patient-centered interview that helps to investigate and resolve ambivalence in unhealthy behaviors and/or habits to promote changes toward healthier lifestyles and it is more likely to be successful when the patient already has a positive attitude toward change" (Leiva et al., 2010, p. 46).

Pakpour and associates (2015) conducted a multimodal behavioral intervention trial for improving antiepileptic drug adherence. The intervention included three sessions of face-to-face motivational interviewing in which patients were encouraged to express their experiences, struggles, readiness, and confidence for behavior change. The health psychologist conducting these sessions employed open-ended questions, affirmations, reflective statements and drug taking planning to address the barriers expressed by patients and to encourage drug adherence. Patients enrolled in the study were also provided with calendars to self-monitor their medication taking behavior. Moreover, family members and health care professionals were also invited to take part in one of the motivational interviewing sessions with the goal of improving collaboration and communication among the three parties. At one month and six months follow up, patients

in the intervention group, compared to those in the control group, reported significantly higher medication adherence and perceptions of control for taking medication regularly.

Levy et al. (2004) sampled a group of HIV positive adults and worked with them to identify patient-specific barriers to adherence and strategies to overcome such barriers. Medication dossette boxes, electronic alarms, and an online medication planner (www.aidsmap.com) were also distributed. In addition, pharmacists and/or nurses educated patients about HIV infection and the importance of adherence to successful medication therapy. Compared to the control group, there was a significant decrease in the number of missed doses at four, seven, and 28 days follow-up in the intervention group, indicating an improvement in medication taking behavior.

Berrien and colleagues (2004) worked with a sample of HIV positive pediatric patients over the course of three months. The intervention consisted of eight structured home visits aimed at improving knowledge and understanding of HIV infection and at identifying and resolving barriers to medication adherence. The visits were conducted by experienced nurses and included role playing and comic books as educational materials. Patients and caretakers were asked to keep a written diary of the progress made toward overcoming specific barriers. Patients were rewarded for each completed medication dose and overcome barrier with medication boxes, pill cutters, and other age appropriate toys. The knowledge score and medication refill history improved significantly in the intervention versus control group; although the adherence self-report score improved in the intervention group compared to the control group, the difference was not significant.

De Vries, McClintock, Morales, Small, and Bogner (2015) developed an integrated care intervention for improving adherence to diabetes medications. Patients

assigned to the intervention condition were paired with trained integrated care managers who offered education, treatment recommendations, and medication taking monitoring. The patient-care manager interactions addressed the influence of factors such as depression, chronic medical conditions, side effects, and lack of social support. The intervention took place over a three-month period and resulted in improved medication adherence and understanding of the importance of medication therapy for diabetes management.

A similar intervention was used with asthma patients (Park et al., 2010). Using motivational interviewing principles, trained care managers discussed barriers to medication adherence with patients over the phone, twice. The phone interviews were followed with three educational mailings. Participants in the intervention reported fewer adherence barriers and better asthma control.

Text message-based interventions

Text messages are cheap, personal, easy to send to patients individually, have the potential to be tailored to ensure relevancy, and are accessible to almost everyone, regardless of social economic status or location. According to Pew Internet Project, 91% of American adults own and use a cell phone device as of May 2013. Moreover, 67% of cell owners admitted checking their phone for message, alerts, or calls without the device even ringing or vibrating. These percentages hold even when ethnicity, education, urbanity, household income, and age are factored in.

As a result, text messages have been explored as a potential tool for increasing medication adherence, as a stand-alone intervention or as part of more comprehensive programs, and across a variety of conditions (e.g., HIV, diabetes, hypertension, or

contraceptive pill adherence) (Arora, Peters, Burner, Lam, & Menchine, 2014; Bubrow et al., 2014; Coomes, Lewis, Uhrig, Furberg, Harris, & Bann, 2012; Garofalo, Kuhns, Hotton, Johnson, Muldoom, & Rice, 2016; Hou, Hurwitz, Kavanagh, Fortin, & Goldberg, 2010; Suffoletto, Calabria, Ross, Callaway, & Yealy, 2012). A systematic review of text message interventions to promote adherence to antiretroviral therapy concluded that larger effects are observed when texts were sent less frequently than daily; invited doctor-patient interaction; and included personalized content (Finitsis, Pellowski, & Johnson, 2014). Similarly, Park, Howie-Esquivel, and Dracup (2014) noted that successful SMS interventions deliver tailored educational and motivational content, whereas unsuccessful interventions tended to include a simple medication reminder.

Text message interventions have been used to target different adherence issues. Some text message-based interventions fulfill the primary function of "reminders" for those who might forget taking their medication: each day, patients would receive a short text reminding them to take their medication (e.g., "Please remember to take your birth control pill"; Hou et al., 2010; Foreman et al., 2012; Wang et al., 2014) and/or ask patients to confirm having taken their medication (Hardy et al., 2011; Harris et al., 2010, Suffoletto et al., 2012).

Other interventions, in addition to addressing forgetfulness, also target patient concerns and medication knowledge. For example, Petrie and colleagues (2012) used text messages to change illness and medication beliefs in a sample of asthma patients (e.g., fact sheet-type of messages: "Your asthma is always there even when you don't have symptoms"; "Take your preventer every day and control your asthma before it controls you"; "The medicine in your preventer doesn't work immediately but used regularly it

will reduce the inflammation that causes asthma") and Mao, Zhang, and Zhai (2008) encouraged their patients to ask medication questions to pharmacists. Bobrow et al. (2014) interspersed reminder messages (reminders to take one's medication, to pick-up one's prescription) with medication adherence support and hypertension-related education messages (e.g., goals and planning, "A pill box can help you to remember when to take you high blood pills. We encourage you to get one. For more info ask PHARMACY."; social support, "Ask someone you trust to help you remember to take your medicine as directed."; nonadherence consequences, "Pls remember your high blood can't be cured. To keep healthy pls keep on with your pills, come on your clinic dates, exercise&eat healthy food."; self-efficacy support, "You're doing very well. Pls keep on with your pills, come on your clinic dates, exercise&eat healthy food.").

Suffoletto et al. (2012) included warning messages: if in response to a text message about dosing, a participant replied with a wrong amount, he/she would receive a warning message: "We are concerned you have taken too many doses of [Antibiotic], which may be dangerous to your health. Remember to take only [X] doses per 24-hour period and to separate doses as recommended".

Results regarding the efficacy of text messages for improving adherence have been mixed. On the one hand, some researchers have found that text messaging has been associated with short-term significant reductions in missed doses (Fairley et al., 2003), clinical improvements over time (Benhamou et al., 2011; Simoni et al., 2009), and increases in self-reported adherence (Hardy et al., 2011). On the other hand, other researchers found no differences between intervention and control groups (Hou et al., 2010; Suffoletto et al., 2012). A recent systematic review of text message interventions

across chronic conditions concluded that 65% of the 20 studies analyzed reported beneficial effects, however, due to the variety of study designs, no definite conclusions could be made (Park, Howie-Esquivel, & Dracup, 2014).

More importantly, text message interventions have been criticized for their lack of theory. In a quantitative systematic review of the efficacy of mobile phone interventions to improve medication adherence for both acute and chronic conditions, Park, Howie-Esquivel, and Dracup (2014) concluded that "While the majority of investigators found improvement in medication adherence, long-term studies characterized by rigorous research methodologies, appropriate statistical and economic analyses and the test of theory-based interventions are needed to determine the efficacy of mobile phones to influence medication adherence." (p. 1932). Finally, Hall, Cole-Lewis, and Bernhardt (2015), in their systematic review of reviews on mobile text messaging for health, advise that future research identify recommended text messaging intervention characteristics that are most effective and that could then be applied in practice.

Communication/Persuasion Theory-Grounded Interventions

One way, among others, to theoretically ground interventions and understand what message elements successfully increase adherence is to use persuasive health and risk message design theories and principles from the field of health communication. Yet, very few studies specifically focused on how to communicate about drug adherence or on how to design communications aimed at increasing adherence based on a theoretical understanding of communication processes. These studies are critical in light of a vast and complex literature on health communication emphasizing that certain words, foci, frames, and message structures work significantly better than others in bringing about

behavioral change and in correcting perceptions, attitudes, and beliefs (Dillard & Pfau, 2002).

In a study conducted by Kreps et al. (2011), participants who self-identified as low, medium, and high risk for nonadherence were randomly assigned to three message conditions – no message (control), positively framed, and negatively framed messages. A positive frame emphasized the advantages and benefits individuals might gain by following message recommendations, and a negative framed emphasized the disadvantages and losses of failing to follow such recommendations. Both positively and negatively framed messages addressed medication commitment issues, medication concerns, or costs of prescription medication. Both positively and negatively framed messages increased adherence intention compared to control, however, they had no advantage over no message on attitudes, subjective norms, and self-efficacy.

Zhao et al. (2012) investigated the interaction between message framing and time perspective (operationalized as an individual's consideration of future consequences) in adherence-promoting persuasive messages. Consideration of future consequences is a measure of individual difference in the extent to which people consider the immediate versus the long-term consequences of their current behaviors. People who score high on consideration of future consequences tend to focus on the future and are concerned with the implications that present behaviors and outcomes may have on their future goals. People who score low on consideration of future consequences focus on the present and are less concerned with the implications that present behaviors and outcomes may have for the future (Gleicher, Boninger, Strathman, Armor, & Ahn, 1995).

Participants in Zhao et al.'s study were individuals who indicated low need for their medication, high perceived concerns about their medication, or both. Participants were assigned to matched message topics based on their suboptimal medications beliefs: need, concern, or both. Results showed that message exposure did not make a difference in intention or attitude for low- and medium-consideration of future consequences participants. For high- consideration of future consequences participants, however, both gain- and loss-framed messages enhanced intention and attitude relative to the no-message control. The concern message resulted in greater intentions than the need and combined messages. The need and concern messages generated more favorable attitudes than the combined message, but the interactions between topic and time perspective were not significant. Framing had no effect on perceived message strength, message derogation, message liking, or message engagement among participants low and medium in consideration of future consequences. However, for participants high in consideration of future consequences, a consistent pattern emerged: the gain-framed messages generated more favorable responses than the loss-framed messages on all message perception variables.

A third study focused on a smoking cessation drug and investigated individuals' preferences for messages aimed at increasing their adherence to that drug. Across a series of focus groups, participants indicated that they preferred simple and encouraging messages that emphasized tobacco cessation and not drug adherence, and that served as a reminder about health goals (Krebs et al., 2015).

Conclusions

Drug nonadherence constitutes a major public health issue, one that is incredibly complex and that likely necessitates a combination of strategies and interventions for addressing it. There are multiple factors associated with nonadherence and past literature has done a good job inventorying them. Interventional studies, however, have had mixed success at addressing some of these factors and increasing adherence.

One way of improving the impact of drug adherence interventions is more focus on the communicative aspect of these programs. Although all these interventions include communication as an important component, recommendations on how to design communications/messages aimed at increasing drug adherence are sparse. For example, studies reporting educational programs discuss what information should be communicated to patients and some of them provide sample messages in this regard, however, they do not explore or compare different message designs and contents and no theory guides their message design. An exception are motivational interviewing studies which mention the importance of acknowledging patients' concerns and barriers when discussing drug adherence with them, as many behavioral change theories suggest (e.g., Health Belief Model; Rosenstock, Strecher, & Becker, 1994).

Whereas reminders and information are without a doubt useful, as with much of health care, drug adherence is a matter of human behavior. There is a subset of patients who do embrace the medication plan that is necessary to manage their conditions. In these cases, education and follow-up are adequate. However, many more patients are resistant to medication regimens. The reasons given for this resistance vary: they don't like taking medication, they don't think that their condition is severe enough to warrant

behavior modification, or they don't think they can. For this group of patients, persuasive messages that convince them of the importance of taking their medication and their ability to take their medication as prescribed are likely to be much more impactful than education and reminders. However, advice on how to design effective persuasive communications aimed at increasing drug adherence are severely lacking. Only three studies on this matter were identified for this review. In the intervention studies literature, only one study that attempted to change medication beliefs and motivate patients was identified (Petrie et al., 2012), however, their message design choices were not grounded in theory.

It follows that research in this area is critically needed. This research ought to focus on communication strategies that positively change motivational factors, such as self-efficacy, response efficacy, and outcome expectancy, given that these factors are most likely to lead to behavior change among low motivated patients (e.g., Chao, Nau, Aikens, & Taylor, 2005; Criswell, Weber, Xu, & Carter, 2010; Kreps et al., 2011; Sleath et al., 2014; Wierdsma, van Zuilen, & van der Bijl, 2011). Prior studies have provided a thorough inventory of individuals' perceptions, motivations, and barriers that influence medication adherence. An in-depth understanding of how effective communication can influence individuals' intentions to take or reject taking their medication as prescribed would be a valuable addition to the literature. This understanding requires an assessment of the relative importance and influence of multiple factors, including message properties, in the decision-making process.

With this aim in mind, this research will put forth a model of communication using counterfactual thinking (CFT; thoughts about what could have been) as a message

design strategy to increase medication adherence intentions. This research will also explain the mechanisms through which CFT operates on intentions to adhere to medication as prescribed, mainly self- and response efficacy, and outcome expectancy, given their importance in individuals' decision to adhere to their medication as prescribed. Finally, this research will test the role of emotion in limiting or amplifying CFT's effectiveness as a persuasive message design strategy in a drug adherence context. Specifically, the effect of regret, an emotion that precedes counterfactual thinking, on the relationship between counterfactual thinking, self-efficacy, response efficacy, outcome expectancy, and behavioral intentions will be considered. The following chapter outlines the concept of counterfactual thinking, how counterfactual thinking is generated, and its implications for perceptions and behavior.

Chapter 4: Counterfactual Thinking

Counterfactual Thinking Defined

Counterfactual thoughts are thoughts contrary to the facts. The process of counterfactual thinking (CFT) involves thoughts about what might have been, provided that a different decision had been made or a different behavior had been performed (Epstude & Roese, 2008). For example, one might think "if only I had taken my pills, I would not be in the emergency room right now". The ability to imagine alternative or counterfactual versions of actual occurrences appears to be a pervasive, perhaps even essential feature of our mental lives (Roese & Olson, 1995) and it is present across nations and cultures (Sanna, Stocker, & Clarke, 2003). Individuals develop the capacity for CFT as early as the age of two (Beck, Robinson, Carroll, & Apperly, 2006; Perner, Sprung, & Steinkogler, 2004).

Counterfactual thoughts have long fascinated psychologists, behavioral economists, and consumer research scholars. Research in this area has found counterfactuals to influence an array of cognitive processes, including information processing patterns, regulatory focus, perceptions of self-efficacy and control, with consequences for behavioral intentions and subsequent behaviors (e.g., Aboulnasr & Sivaraman, 2010; Arora, Haynie, & Laurence, 2011; Baek, Shen, & Reid; Gleicher, Boninger, Strathman, Armor, Hetts, & Ahn, 1995; Krishnamurthy & Sivaraman, 2002; Nan, 2008; Page & Colby, 2003; Roese, 1994, 1997, 1999; Sanna, 1996; Tal-Or, Boninger, Poran, & Gleicher, 2004).

Though a heavily studied matter in some domains of the social sciences (e.g., psychology, political sciences, decision making), counterfactual thinking has received less attention in the communication discipline. Given counterfactuals' influence on a variety of processes and factors of relevance to persuasion (e.g., information processing, perceptions, behaviors and intentions), research in this area represents an opportunity to expand our knowledge. The following sections provide an overview of CFT, including types of counterfactual thoughts, how CFT are generated, and consequences of CFT for the individual.

Counterfactual Thinking Types

Previous research has classified counterfactual thoughts according to four criteria: direction of comparison, structure, person of reference, and valence (Epstude & Roese, 2008; Nan, 2008; Roese, 1997, 1999). Along the dimension of direction, counterfactual thinking can be either upward or downward (Roese, 1994, 1997; Roese & Olson, 1993b). Upward counterfactuals compare a present outcome to a better alternative (e.g., I didn't take my medication and I am now sick -> I should have taken my medication). Downward counterfactuals, on the other hand, compare the present outcome with a worse alternative (e.g., I didn't take my medication and I am now sick -> At least I didn't have to deal with medication side effects!).

The dimension of structure refers to the addition or subtraction of an antecedent (action) from the present state (Roese, 1994, 1997; Roese & Olson, 1993b). Additive counterfactuals, then, add antecedents to reconstruct reality (e.g., If I had taken my medication, I would be enjoying my daughter's graduation now); whereas subtractive

counterfactuals remove antecedents (e.g., If I had not taken my medication, I wouldn't feel so nauseous right now).

Counterfactuals are also categorized based on the person they are referring to. Counterfactuals may focus on the actions or features of oneself (e.g., I should have taken my medication) or of other people (e.g., My colleague should have taken his medication) (Epstude & Roese, 2008). Finally, counterfactuals can be categorized based on valence (Nan, 2008). Positive counterfactuals undo previous absence of positive outcomes (e.g., If I had taken my medication, I would be able to travel across the country now); whereas negative counterfactuals undo previous presence of negative outcomes (e.g., If I had taken my medication, I would not be in the hospital now).

Antecedents of Counterfactual Thinking

Several factors have been identified to determine the generation of counterfactual thinking. Each of them are discussed in turn.

Affect and/or negative emotions

In general, affect and/or negative emotions are the main determinant of CFT generation (Roese, 1994, 1997; Roese & Hur, 1997). Of note, although the focus in this research is on emotions rather than mood or affect, research on counterfactual thinking and both emotions and affect is reviewed. This is because research looking at specific emotions and counterfactuals is sparse.

It is important to first distinguish between the concepts of affect, emotion, and mood. According to the Dictionary of Psychology (Cardwell, 1996), affect is "a loose term referring to our emotions or mood" (p. 4). Similarly, Lerner and colleagues (2015)

define affect as “unspecified feelings” and as an umbrella term for emotions, moods, and emotion-related traits (p. 801). Affect is an undifferentiated emotional state; affect can be interpreted as a specific emotion once an individual appraises the meaning of an event to oneself and to one’s goals and makes attributions about the causes of that event (Frijda, 1986; Lazarus, 1991; Lerner, Li, Valdesolo, & Kassam, 2015; Roseman, 1984; Smith & Ellsworth, 1985). Specifically, individuals assess whether a negative event impedes or facilitates their goals, whether that event is controllable, whether they or someone else is responsible for the event, and whether the event can be dealt with or not (Niedenthal, Krauth-Gruber, & Ric, 2006). Friedrickson and Cohn (2008) describe moods as diffuse feelings that are not experienced in relation to a particular object; that persist in time; and that “occupy the background of consciousness” (p. 778).

Regarding emotions, the dictionary notes the difficulty to define these concepts (Cardwell, 1996). Despite such difficulties, there seems to be consensus regarding the multifaceted nature of emotional reactions. Emotions may give rise to: 1) affective experiences that can be pleasurable or unpleasurable; they can be caused by an external (e.g., when seeing a dangerous animal) or an internal object (e.g., as a result of a particular thought or image); 2) cognitive processes in which we label our affective experience and appraise our reaction to it (e.g., seeing a tiger at the zoo will be different from seeing it in front of our house); 3) physiological adjustments to the source of arousal (e.g., increased heart rate, sweat); and/or 4) goal-directed, adaptive behavior (i.e., distancing ourselves from the source of displeasure or prolonging whatever is causing us pleasure). As compared to moods, emotions are acute and momentary; they are intense, rather than moderate; they can initially be characterized by behavioral disorganization;

however, due to their evolutionary roots, they will soon enact adaptive behaviors (Cardwell, 1996; Lerner, Li, Valdesolo, & Kassam, 2015; Nabi, 2003). Typically, emotions are experienced in relation to an object and occur after the assessment of an object's meaning, whereas moods are objectless (Rosenberg, 1998).

Research on counterfactual thinking and affect or specific emotions has concluded that negative affect and negative emotions (i.e., guilt, shame, disappointment, regret) precede counterfactual thinking (Roese, 1997; Niedenthal et al., 1994). That negative affect or negative emotions are an antecedent of CFT is related to the fact that CFTs are generated much more frequently following negative rather than positive outcomes (e.g., Davis et al., 1995; Sanna & Turley, 1996). Negative affect or emotions usually accompany such negative outcomes and, in line with evolutionary explanations, they signal to the individual that something is not right and that resources should be allocated for addressing the issue (Roese, 1994, 1997). Counterfactual thinking, among other cognitive responses, helps identify the source of negative affect or negative emotion and, even though it cannot change the present situation, it offers suggestions about future corrective behaviors to avoid the unfortunate situation from happening again.

The majority of past research has examined negative affect as a preceding factor of CFT generation (see McMullen, Markman, & Gavanski, 1995 for a review), however, a few studies provide evidence that specific emotions can also function as antecedents. Specifically, Niedenthal and his colleagues (1994) asked their participants to either read about or describe situations that elicited shame and guilt. Participants were then instructed to generate counterfactual alternatives to undo the distressing outcomes. The type of emotion experienced constrained the content of the CFT generated, such that

individuals feeling shame generated counterfactuals focused on altering qualities of the self (e.g., if only *I was more attentive*…), whereas individuals experiencing guilt generated counterfactuals focused on altering actions (e.g., if only *I did X*…). In a similar study, Zeelenberg and colleagues found that regret experienced due to an unfavorable outcome led to counterfactual thoughts about one's actions; disappointment, however, resulted in counterfactual statements that undid aspects of the situation in which the negative outcome occurred.

Outcome closeness

Outcome closeness has also been found to lead to CFT generation (Kahneman & Tversky, 1982; Kahneman & Varey, 1990; Roese, 1997). Outcome closeness is defined as the perceived proximity to reaching a goal. This proximity can be temporal (e.g., missing your flight by 10 vs. 30 minutes), physical (e.g. missing the golf hole by 200 centimeters versus 1 meter), or numerical (e.g., having marked '38' on your lottery ticket when '39' was the lucky number). In research studies, having nearly avoided a negative outcome (i.e., forgetting to submit an insurance policy three days versus six months before a fire) was associated with increased counterfactual thought generation (Meyers-Levy & Maheswaran, 1992).

Abnormal events and actions

Deviations from normality or abnormal events, compared to normal ones, are also more likely to result in CFT (Kahneman & Miller, 1986). Through counterfactual thinking, the deviation will be shifted back to its normal state. For example, if an accident occurred because of one's driving on a new route to work, then the counterfactual

generated will likely undo the outcome (the accident) by stating that the outcome would have been different if the normal/usual route to work was chosen. Numerous studies provide support to the idea that counterfactual content is determined by normality (e.g., Buck & Miller, 1994; Kahneman & Miller, 1986; Kahneman & Tversky, 1982; Miller, Taylor, & Buck, 1991; Miller, Turnbull, & McFarland, 1990; Wells, Taylor, & Turtle, 1987).

Counterfactuals are also more likely to follow actions than inactions (Kahneman & Miller, 1986). Whereas inactions are perceived as normal (because they preserve the status quo), actions are seen as abnormal, as deviations from the norm (Kahneman & Miller, 1986). Put differently, people assume that outcomes are the result of actions (and not of inactions) (Gavanski & Wells, 1989). The importance of action versus inaction in the generation of counterfactual thought has received some empirical support (Gleicher, Kost, Baker, Strathman, Richman, & Sherman, 1990; Landman, 1987; Miller et al., 1990; Turley, Sanna, & Reiter, 1995). However, the findings of such studies have been criticized on grounds of methodology (see N'gbala & Branscombe, 1994 for a review) and the idea that counterfactual thinking is more likely to follow actions as opposed to inactions has been considered an oversimplification (Roese, 1997).

Event controllability

Another factor that stimulates CFT generation is the perceived controllability of the event; specifically, controllable events are more easily undone that uncontrollable events (Girotto, Legrenzi, & Rizzo, 1991; Miller et al., 1990; N'gbala & Branscombe, 1995). For example, one can cogitate on how outcomes would have been different if having taken their medication, but one cannot undo the occurrence of an earthquake.

Therefore, counterfactuals tend to follow actions that could have been manipulated or avoided by the individual to circumvent the outcome. Several study findings provide support for this idea (Davis & Lehman, 1995; Davis, Lehman, Silver, Wortman, & Ellard, 1996; Mandel & Lehman, 1996).

Consequences of Counterfactual Thinking

Research has documented a wide range of psychological consequences that can be attributed to counterfactual thinking (Gleicher et al., 1995; Landman, 1993; Miller, Turnbull, & McFarland, 1989; Miller & Taylor, 1995; Olson, Roese, & Zanna, 1996; Roese & Olson, 1993a). Specifically, counterfactuals can influence affect and emotion, behavior, information processing, and perceptions.

Note that the theoretical argument regarding the effects of counterfactual thinking is framed in terms of actual behaviors; however, studies on counterfactual thinking have looked at both behaviors and behavioral intentions. Behaviors are more often measured in psychology studies in which participants engage in laboratory-type of tasks in which behavior can be directly observed; however, in studies looking at health behaviors, researchers have usually measured behavioral intentions (O'Keefe, 2002). Nonetheless, the effect of counterfactuals on both behaviors and behavioral intentions is apparent. In the review below, for each study it is specified whether the authors measured behavioral intentions as proxies for behavior or actual behaviors.

CFT, behavioral intentions, and behavior

CFT has been consistently found to affect behavior and behavioral intentions. The causal inference mechanism and the content-specific pathway have been frequently used

to explain the influence of counterfactuals on behavior. Causal inference effects occur when a counterfactual, through its content, emphasizes the causal link between an antecedent behavior and a desired outcome (Eepstude & Roese, 2008; Roese, 1997). For example, to say that if I had taken my medication, I would not be in the hospital now is to underscore the causal impact of medication on my being in the hospital. Causal inference effects underlie the preparative function of counterfactuals, meaning that the identification of an antecedent as responsible for a particular outcome suggests that its removal in future similar situations would lead to a different outcome (Wells & Gavanski, 1989).

The content-specific pathway explains how counterfactuals influence behaviors through a transfer of information from the counterfactual inference to behavioral intentions and ultimately to behaviors (Epstude & Roese, 2008). For example, if one is unsatisfied with being in the hospital, one might reason that "If only I had taken my medication, I wouldn't be in the hospital now." This counterfactual indicates the behavior that should be performed in the future for achieving the desired outcome (taking one's medication). Thus, the content of the counterfactual (I should have taken my medication) is used for changing future behaviors (I will take my medication) through a transfer of information from the counterfactual thought to future behavioral intentions and actual behavior (Epstude & Roese, 2008).

Previous findings suggest that certain types of counterfactual thoughts are more likely to have an impact on subsequent behavior and/or behavioral intentions (Roese, 1994; Roese & Olson, 1995). In terms of direction, upward counterfactuals (thoughts of "if only"), as opposed to downward counterfactuals (thoughts of "well, at least"), have

been found to have a significant influence on future behaviors due to their focus on corrective actions that may facilitate future success (Roese, 1994). Downward counterfactuals, on the other hand, are less likely to significantly influence behavior, given that they do not focus on what needs to be changed to achieve future success (Roese, 1994). Supporting this idea, Roese (1994) found that individuals who generated upward CFT in response to failure, as opposed to those who generated downward CFT or no CFT, reported higher behavioral intentions to perform behaviors that would increase the chance for future success; moreover, these participants performed better on a similar subsequent task (i.e., an impact on actual behaviors was also observed). Similarly, Gleicher et al. (1995) and Hetts et al. (2000) found that imagining outcomes to decisions yet to be made (a process called "upward prefactuals") influenced behavioral intentions and actual behaviors across multiple contexts.

In terms of structure, both theory and research suggest that additive counterfactuals are more efficient in changing behavior and behavioral intentions than subtractive counterfactuals (e.g., Page & Colby, 2003). Additive counterfactuals, through their focus on ways to avoid the recurrence of a negative outcome, help establish paths to future success. Moreover, as argued by Roese (1994), additive counterfactuals allow individuals to think of behavioral alternatives outside of the original event and thus, encourage individuals to be more creative and to generate solutions for future similar scenarios that are more meaningful to oneself. Subtractive counterfactuals, on the other hand, contain no suggestion for future action, given that they merely remove an antecedent from the original event (Roese, 1994; Roese & Olson, 1993a).

Few studies have investigated the impact of CFT on behavior and behavioral intentions in a health persuasion-related context. These studies primarily considered the effect of self-generated CFT on behavioral intentions and attitudes. The CFTs in these studies were either incidental or integral to the health matter of interest. An integral CFT is one that is relevant to the topic considered; for example, if the message describes negative outcomes related to not taking one's medication, the integral CFT undoes those negative outcomes, such as "If only I had taken my medication, I wouldn't be at the hospital now". An incidental CFT is one that is irrelevant to the topic considered.

Page and Colby (2003) asked their participants to generate various types of counterfactual thoughts in response to a detrimental smoking scenario (i.e., integral CFTs). They found that additive, as opposed to subtractive CFT, had a significant and positive effect on individuals' behavioral intentions to schedule a lung capacity test. Baek, Shen, and Reid (2013) tested the interaction between self-generated CFTs and message framing on binge drinking behavioral intentions. Participants in their study generated either additive or subtractive CFTs about a specific life event (i.e., incidental CFTs); participants then read either a gain-framed or a loss-framed anti-drinking message. Findings showed that participants in the additive CFT X gain-framed message reported lower binge drinking intentions than those in the additive CFT X loss-framed message. The interaction was not significant for the subtractive CFT condition.

Two studies tested the impact of CFT as part of a persuasive message on behavioral intentions. In the first study, participants listened to a presentation by an HIV-positive speaker. In the control condition, the speaker ended his presentation with facts about HIV and AIDS; in the experimental condition, the speaker asked participants to

imagine that they themselves had engaged in unsafe sex and contracted HIV as a result. Participants were also directed to think about an alternative behavior that would have resulted in a different outcome (i.e., that they had used a condom and had not contracted HIV; an integral CFT generation exercise). Following this simulation, participants in the experimental condition, as opposed to those in the control condition, reported more positive attitudes toward condom use; behavioral intentions to use a condom, however, although higher in the experimental condition, were not significantly different between the two groups (Gleicher et al., 1995). The findings, however, were likely contaminated by differences between the two study conditions, other than the CFT simulation. Specifically, whereas the experimental condition consisted of a narrative, the control condition included facts about HIV and AIDS. Therefore, further research was needed to disentangle the effect of the narrative itself from that of the CFT (Tal-Or, Boninger, Poran, & Gleicher, 2004).

Tal-Or and colleagues (2004) conducted an experiment in which they compared the persuasive effects of a narrative that either included or did not include a self- vs. other-focused CFT (i.e., integral CFT). The narrative described the story of a woman who became paralyzed after a traffic accident. In the CFT condition, the narrative began and ended with either a self- or other-focused CFT (i.e., "if only I had yielded, I could have avoided the accident" versus "if only the other driver had yielded, the accident would have been avoided"). As hypothesized, participants exposed to the narrative with CFT reported more positive attitudes toward traffic safety rules than those exposed to the narrative only (no CFT); the results were stronger in the self- versus other-focused CFT condition. Whereas the authors did not measure behaviors or behavioral intentions, their

findings are still relevant, given that attitudes are usually precursors of intentions and behaviors (e.g., Ajzen & Fishbein, 1980).

To conclude, CFT are a potentially powerful persuasion strategy in influencing a variety of behavioral intentions and actual behaviors. Both incidental and integral CFT appear to have a positive effect on behavior and behavioral intentions, although their relative effects are unclear. Also, upward CFT seem to have a persuasive advantage over downward CFT or no CFT (control). However, more research is needed to understand the persuasive effect of CFT when used as a persuasive message design strategy.

CFT and self-efficacy

Self-efficacy refers to one's belief that one has the necessary abilities to successfully engage in and accomplish a task (Bandura, 1986). Self-efficacy is an important antecedent of behavior and a strong predictor of performance (Bandura, 1989). As such, counterfactual thinking, given its enhancing effect on both intentions to perform success-facilitating behaviors and actual performance (Roese, 1997, 1999), is likely to influence perceptions of self-efficacy, as well.

The positive effect of counterfactuals on self-efficacy has been explained using the causal-inference and content-specific mechanisms described earlier. Specifically, upward counterfactuals provide explicit information about what behaviors ought to be performed in the future for achieving success; this explicit information should increase individuals' confidence in their abilities and likelihood of successfully reaching a goal. That is, any threat to self-efficacy that an unsatisfactory outcome may pose is likely to be neutralized by the information provided by the counterfactual and the concurrent recognition that "I know I can do better next time…" (Tal-Or, Boninger, & Gleicher,

2004). In Roese's (1997) review of the counterfactual literature, he speculates along these exact lines: "To the extent that counterfactually mediated causal inferences suggest future efficacious action, they extend to generalized expectancies of personal efficacy" (Roese, 1997, p. 143).

Prior research has only investigated the effect of self-generated CFT on self-efficacy. In a study investigating the relationship between counterfactuals and self-efficacy, Tal-Or and his colleagues (2004) found that generation of integral upward counterfactuals enhanced self-efficacy; whereas integral downward counterfactuals decreased self-efficacy. Downward counterfactuals, rather than providing assurances of success, highlight how easily things could have been worse. Thus, the information provided by the downward counterfactual may undermine one's confidence and decrease feelings of self-efficacy in the context of a similar, future event.

Two studies have looked at how perceptions of control, a variable related to self-efficacy, are influenced by counterfactual thinking. Participants in McMullen, Markman, and Gavanski's studies (1995) who imagined upward counterfactuals perceived themselves as having more control over the target situation than did participants who imagined downward counterfactuals. Similarly, Nasco and Marsh (1999) found upward counterfactual generation to be positively correlated with perceived changes in one's circumstances and to increased perceptions of control.

The impact of CFT as part of a persuasive message, rather than self-generated, on self-efficacy awaits testing. The same mechanism is expected to operate: a CFT included in a message provides the same information about the action that needs to be performed

to obtain a certain outcome; thus, such CFT should still increase individuals' confidence that they can successfully reach a future goal by engaging in that behavior.

CFT, response efficacy, and outcome expectancy

Response efficacy refers to an individual's beliefs that a recommended behavior effectively deters or alleviates a threat (Witte, 1992). For example, if an individual believes that the recommendation to take her/his medication will help with managing disease, then that individual's response efficacy regarding medication adherence is high. Outcome expectancy is "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). These outcomes include psychological, social, and physical consequences of engaging with a specific behavior (Bandura, 2001). In the context of this research, outcome expectancy is defined as expectations about social and psychological outcomes of taking one's medication as prescribed, whereas response efficacy is defined as expectations about physical outcomes.

When self-efficacy, response efficacy, and outcome expectancy are high, behavioral change is more likely to occur. In other words, when an individual believes that he/she can perform a behavior, that the behavior will help him/her avoid a negative outcome and will result in positive psychological and social effects, then that individual is most likely to engage in said behavior. Concretely, if Tom believes that medication will help him avoid illness (response efficacy), that he is capable of taking the medication as prescribed (self-efficacy), that taking his medication will help him enjoy life and that his family and friends will like him more for adhering to treatment (outcome expectancy), Tom is very likely to take his medication.

The question is whether counterfactual thinking has an effect on response efficacy and outcome expectancy. If Tom reads the following CFT (or he engages in the following CFT): "If only I had taken my medication, I wouldn't be in the hospital now", will he also believe that taking medication (adopting the response in the message) will be effective in reducing the threat of hospitalization, in fostering life enjoyment and in increasing others' liking and trusting of Tom (relative to when Tom does not read such a CFT)? Although not previously hypothesized or tested, an effect of CFT on response efficacy can be derived from the causal and content-specific mechanisms underlying the psychological consequences of CFT.

Consider an upward-additive CFT (If only I would have done X, Y wouldn't have happened). When an individual engages in upward-additive counterfactual thinking, the resulting thought provides two types of information. First, it identifies a causally potent antecedent action, X, and a consequent of that action, Y: If I had done X, Y wouldn't have happened. The revelation of this causal link between X and Y triggers an expectancy of the consequences of that action in the future (Roese & Olson, 1995, p. 171). That expectancy may be translated as "If I do X in the future, Y can be avoided", which is a response efficacy statement. The second type of information that a CFT as the one above provides is specific content for X and Y: If I had taken my medication (= X), I wouldn't be in the hospital now (= Y). Consequently, an individual engaging in upward counterfactual thinking not only knows that behavior X can help avoid outcome Y, but also what specific X can help avoid a specific Y. Therefore, an effect of upward-additive CFT on response efficacy should be present. Because downward-additive CFT do not provide the information outlined above, such an effect is likely absent.

Two additional explanations for the presence of an effect of CFT and response efficacy can be gleaned from prior research unrelated to CFT. The first explanation draws from the regulatory fit literature and argues that a message that aligns with an individual's regulatory focus will result in higher response efficacy appraisals than one that does not. In a study by Bosone, Martinez, and Kalampalikis (2015), participants were exposed to a message narrated by either a positive (an individual who has achieved desirable outcomes) or a negative role model (an individual who experiences undesirable outcomes). The negative/positive role models were hypothesized to activate a prevention/promotion focus. Therefore, when the message narrated by the role model fit this focus, persuasion was stronger. Specifically, when the negative role model message described preventative actions that an individual could take to avoid a threat, response efficacy was the highest. Similarly, when the positive role model message described promotion actions that an individual could engage in to achieve a positive outcome, appraisals of response efficacy were the highest.

Past research has shown that negative CFT (a CFT that undoes the previous presence of negative outcomes) induce a prevention orientation (Nan, 2007). At the same time, negative CFT contain information about how to avoid a threat (if X is done, Y will not happen). Thus, in light of Bosone and colleagues' findings, it is possible that negative CFT have a positive impact on response efficacy. Of note, a negative CFT is essentially an upward-additive CFT, as it combines direction with structure (for comparison, see Roese & Olson, 1995, p. 180). The counterpart of an upward-additive CFT is a downward-additive CFT (If I had done X, it could have been worse; If I had taken my

medication, it could have been worse). This type of CFT clearly does not tell you how to avoid a threat so its impact on response efficacy should be null.

The second explanation comes from research on message repetition. Shi and Smith (2015) found that after repeated exposure to a fear appeal message about preventing melanoma, participants' appraisals of response efficacy regarding various actions (e.g., refraining from tanning beds, using sunscreen, checking skin regularly) significantly increased. In a way, when an upward CFT is added at the end of a message (versus not added) it functions as a repetition of the information in that message. Thus, it is possible that similar effects to those in Shi and Smith's study could be observed. A downward CFT, on the other hand, does not summarize the message, but it adds new information (it could have been worse). Therefore, an impact of downward CFT in terms of repetition should not occur.

An effect of counterfactual thinking on outcome expectancy defined as expectations about social and psychological outcomes is hard to predict. If the content of a counterfactual thought reflected such expectations (e.g., if only I had taken my medication as prescribed, my family would not be upset), as with response efficacy, the causal and the content-specific mechanisms would predict a positive effect of that counterfactual on social expectations. However, if the content of a counterfactual thought focuses on health consequences of medication nonadherence (e.g., if only I had taken my medication as prescribed, I would not be in the hospital right now), it is unclear if any effect would be observed. It is an empirical question if such messages have an effect on outcome expectancy.

CFT, affect, and emotion

Counterfactuals also cause negative affect and negative emotions or, more precisely, they can amplify the negative effect/emotions experienced prior to counterfactual thinking (i.e., make people feel *worse*, relative to how they felt prior to engaging in CFT; Roese, 1995). The affect/emotion amplification consequence of counterfactual thinking is often explained in terms of contrast effects (Roese, 1997). Contrast effects occur when a judgment is made more extreme through its comparison with an anchor or standard (Sherif & Hovland, 1961). In the case of counterfactuals, an actual outcome will seem worse when a better, alternative outcome is salient; conversely, an outcome will appear better when a worse alternative outcome is salient (Medvec & Savitsky, 1997; Roese, 2000; Roese & Olson, 1995). Upward counterfactuals, by showing how things could have been better, amplify negative affect (Sherman & McConnell, 1995). Downward counterfactuals, on the other hand, by showing how things might have been worse, are typically, but not always, associated with increase in positive affect (Mandel, 2003; Roese, 1997).

Niedenthal and colleagues (1994) asked participants to imagine themselves in a situation that evoked either guilt or shame. Participants were then instructed to undo the situation by mutating aspects of either the self (in the shame scenario) or the situation (in the guilt scenario). Mutation manipulations amplified feelings of shame or guilt. Similar results were obtained in the Zeelenberg et al. (1998) study: participants who were induced to experience regret or disappointment and were then led to undo the negative emotion-causing event by altering one's actions or aspects of the situation, reported feeling more regret and disappointment, respectively.

The moderating role of affect and/or emotions. Of more relevance to the present research is the possibility that the emotions and affect associated with CFT may change the effect that CFT has on self- and response efficacy appraisals, however, research in this area is scarce. Two studies provide some evidence in this regard. In a first study, Sanna (1997) examined the role of self-efficacy as a moderator of reactions to downward and upward counterfactuals. Participants in his study performed in an anagram test and their level of self-efficacy was manipulated by giving them high or low performance feedback. After receiving feedback, participants were asked to engage in counterfactual thinking and their emotional reactions were then measured. Sanna observed a self-efficacy by CFT type interaction, such that, at high levels of self-efficacy, the negative affect typically associated with upward counterfactuals was attenuated and people reported feeling better prepared for the future. At low levels of self-efficacy, the reverse was true: negative affect remained high and participants reported feeling unprepared in the aftermath of upward counterfactuals. What these findings suggest is that, when negative affect is an antecedent of counterfactual thinking, it may reduce the positive effect of upward CFT on self-efficacy.

In a second study, in an entrepreneurial context, Arora and associates (2013) found that, as the intensity, frequency, and unpleasantness of counterfactual thinking increased, entrepreneurs' self-efficacy decreased. The authors operationalized the intensity and unpleasantness of counterfactuals as the intensity and unpleasantness of the regret that accompanies upward counterfactuals (Roese, 1997) and found that more regret was associated with less self-efficacy. Thus, these authors did not study the relationship

between counterfactuals, regret, and self-efficacy, but, rather, used regret as a proxy for counterfactual thinking. Nonetheless, regret was negatively associated with self-efficacy.

However, it is not clear in what capacity negative emotions/affect have an impact of the effect of CFT on self- and response efficacy, and outcome expectancy. Do negative emotions/affect function as a mediator between CFT and efficacy perceptions/outcome expectancy or do they moderate the relationship between CFT and such perceptions? If negative emotions/affect are considered a consequence of CFT, then the mediation hypothesis makes sense; counterfactual thinking leads to emotion/negative affect generation, which then affects behavioral intentions. The Arora et al's (2013) study seems to suggest the mediation hypothesis: counterfactuals are associated with feelings of regret which then reduce perceptions of self-efficacy.

However, if negative emotions/affect are considered an antecedent of CFT, then the moderation hypothesis is plausible, as suggested by Myers, McCrea, and Tyser (2014). Their argument builds upon the content-neutral pathway put forth by Epstude and Roese (2008) to explain the psychological consequences of CFT. The content-neutral mechanism explains how different types of counterfactual thoughts influence attention, cognition, and motivation (Epstude & Roese, 2008). Motivation effects result from the negative affect that accompanies upward counterfactual thinking and that motivates behavior change in order to alleviate the uncomfortable feeling (Markman & McMullen, 2003; Markman, McMullen, Elizaga, & Mizoguchi, 2006; McMullen & Markman, 2000). Myers et al. (2014) argue that, when individuals engage in upward CFT, the negative affect that led to CFT generation is amplified. The resulting affect is used as input into decisions about future actions. Specifically, the experience of negative affect should

enhance willingness to pursue the goals that were not attained. Therefore, upward CFT should lead to intentions to correct behaviors in the future only to the extent that negative affect is experienced: “in other words, resultant affect should moderate the consequences of upward counterfactual thinking.” (Myers et al., 2014, p. 168). The authors tested this hypothesis by manipulating the ability of affect to serve as a cue to judgments of goal progress. They found that, as long as negative affect could not be attributed to an intervening task, upward CFT improved performance on an anagram test as a function of negative affect; however, when negative affect was attributed to a different event, the effects of CFT on anagram test performance were eliminated. It seems, then, that negative affect/emotions may moderate the relationship between CFT and behavior and self- and response efficacy perceptions, and outcome expectancy, as long as the negative affect or emotion is experienced prior to CFT generation.

In light of the research reviewed in this chapter, the following chapter describes the present research and its hypotheses.

Chapter 5: Present Research

Research Purpose and Overview

The main goal of the present research is to propose and test a model of communication that uses counterfactual thinking (CFT) as a persuasive message component aimed at increasing medication adherence intentions. This research also attempts to explain the mechanisms through which CFT-based persuasive messages operate on intentions to adhere to medication as prescribed; specifically, perceptions of self-efficacy and appraisals of response efficacy (i.e., physical outcomes) and outcome expectancy (i.e., social and psychological outcomes) are evaluated as mediators between the message with an embedded CFT component and the corresponding behavioral intentions.

The focus on self-efficacy, response efficacy, and outcome expectancy is a reflection of prior drug adherence research which has found these variables to play an important role in patients' decisions to take medication as prescribed (e.g., Chao, Nau, Aikens, & Taylor, 2005; Kreps et al., 2011; Sleath et al., 2014). Therefore, a persuasive message that enhances adherence intentions through increased self-efficacy, response efficacy, and outcome expectancy constitutes a promising solution to be incorporated in future interventions.

CFT as a persuasive message component

Given that much of the previous literature has investigated upward (If only I had taken my medication, I wouldn't be in the emergency room now!) and downward CFT (I could have died! [but I am in the emergency room instead]), these two types of CFT are chosen for this research, as well. Downward and upward CFT should ideally be added at the end of a message that describes a medication nonadherence negative outcome. The reason for adding a CFT at the end of a message rather than using CFT as a stand-alone message is that individuals naturally engage in CFT after a negative outcome occurs. Thus, providing context for the counterfactual thought in the message will likely make more sense to individuals receiving the message.

Additionally, both incidental and integral CFT are examined. An integral CFT is one that is relevant to the topic considered; for example, if the message describes negative outcomes related to not taking one's medication, the integral CFT undoes those negative outcomes, such as "If only I had taken my medication, I wouldn't be at the hospital now". An incidental CFT is one that is irrelevant to the topic considered; for example, if the message describes negative outcomes related to not taking one's medication, the incidental CFT following the message undoes a different outcome, such as "If only I had my dog with me at the hospital, then I wouldn't be so bored".

The inclusion of both incidental and integral CFT is also derived from prior literature suggesting that both have an impact on a variety of dependent variables. However, their relative strength in influencing such variables has yet to be tested. If integral CFT are a more powerful persuasion strategy, then their usage is recommended. If, however, the differences between integral and incidental CFT are not significant, then

perhaps it is the process of thinking counterfactually that matters, rather than the content of such thinking. Such a finding would open a host of new possibilities for incorporating CFT in health communication.

The role of regret

In light of studies suggesting that negative emotions may moderate the effect of CFT on perceptions and behavior (Arora et al., 2013; Myers, McCrea, & Tyser , 2014; Sanna, 1997), this research also explores the effect of regret, a negative emotion, on the persuasiveness of CFT-based messages.

Regret is a negative emotion experienced in response to outcomes that could have been more positive if a different choice had been made (Zeelenberg et al., 1998). Specifically, "regret arises from comparing an obtained outcome with a better outcome that might have occurred if a different choice had been made; that is, regret stems from bad decisions" (Zeelenberg et al., 1988, p. 222). Although several negative emotions have been found to accompany CFT (e.g., regret, guilt, shame, disappointment; McMullen, Markman, & Gavanski, 1995; Roese, 1997; Zeelenberg et al., 1998), regret is of particular interest in a drug adherence context for several reasons.

When experiencing regret, an individual makes several appraisals that are specific to this emotion, among all negative emotions (Roseman et al., 1994). First, the individual feels responsible for the less-than-optimal outcome (e.g., *I am responsible for being sick* and not someone else, such as my doctor or the weather) **(**Zeelenberg et al., 1998). Second, regret is associated with believing that the outcome can be changed through one's actions as opposed to someone else's actions or to feeling hopeless and/or helpless (e.g., *"I can change my being sick by taking my medication as prescribed in the future"*

versus “My doctor will make me healthy” or “I can’t do anything about my sickness, I feel so helpless”; Roseman et al., 1994). Thus, regret fosters counterfactual thoughts focused on modifying one’s actions (as opposed to someone else’s actions) in an attempt to undo a negative event (e.g., “*I could have taken my medication as prescribed and I wouldn’t be sick now”* versus “My doctor could have suggested a different therapy and then I wouldn’t be sick now”). Shame and disappointment, on the other hand, foster thoughts that attempt modify one’s traits (e.g., “If only I was more responsible…”) or other’s actions, respectively (e.g., “If only my doctor had warned me about the dangers of not taking my medication…”) (Zeelenberg et al., 1998; Niedenthal et al., 1994).

Third, regret motivates behaviors that change the negative outcome and the behaviors altered are typically the ones that caused the outcome (Zeelenberg et al., 1998). Shame and disappointment are associated with inaction or behaviors that have little to do with correcting one’s past mistakes and dysfunctional behaviors (i.e., correcting not taking one’s medication). When experiencing shame, an individual’s tendency is to hide (Lazarus, 1991). When experiencing disappointment, individuals engage in complaining behavior because they attribute the negative outcome to others rather than the self (Zeelenberg et al., 1998). None of these behaviors are desirable when the goal is to change individuals’ medication taking behaviors.

Guilt, another emotion that has been studied in a counterfactual thinking context, may also encourage correcting behaviors that are considered to be the cause of the negative outcome (Niedenthal et al., 1994; Lazarus, 1991). However, guilt is experienced in response to moral transgressions that often affect a person different from the self (Lazarus, 1991). Though this may be a possible scenario in relation to drug adherence

(e.g., I didn't take my medication, I became sick, and my wife is now upset), the focus in this study is on actions that affect the self. Also, guilt is an emotion that can backfire when experienced by individuals with depressive symptoms. Specifically, these individuals experience increased feelings of guilt about past behaviors than in the absence such symptoms (*Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition,* 2013; DSM-5).

Moreover, in the presence of depression or depressive symptoms, guilt co-occurs with feelings of helplessness and despair (DSM-5, 2013). Helplessness likely leads to maladaptive behavior (i.e., physical inactivity) (Abramson, Seligman, & Teasdale, 1978). In other words, individuals with high levels of depressive symptoms might experience overwhelming feelings of guilt and, thus, choose to give up treatment altogether rather than work on their medication adherence. These predictions have been supported in a study on guilt, depressive symptoms, and physical activity (Iles & Nan, manuscript in preparation). Finally, justifying one's actions is a frequent regulation process associated with guilt, whereas resolving is the most frequent strategy used in regret situations (Banninger-Huber, Juen, Exenberger, & Ganzer, 2001). The latter is preferable in the present context. It seems, then, that regret is an important and appropriate negative emotion to study in the context of counterfactual thinking.

In a persuasive communication situation, regret as a moderator (rather than a mediator) is a more favorable scenario. If regret is experienced prior to a counterfactual thought, the individual is already feeling responsible for the negative outcome that the counterfactual thought undoes (cf. Roseman et al., 1994). This attribution of responsibility to the self is likely to make the content of the CFT in the message more

acceptable or more natural. For example, if I feel responsible for my sickness, I am more amenable to reading about how *I could have done something differently to protect my health* (i.e., if I only I had taken my medication). Therefore, the moderation hypothesis is of interest in the present study.

Regret is a moderator of the effects of CFT on efficacy perceptions and behavioral intention to the extent that it can be experienced prior to CFT. In a persuasive message context, then, if the information in the message provided before the counterfactual thought included in the message allows for regret to be experienced, then regret is an antecedent of CFT. Regret is experienced in response to a negative event that is controllable, that can be attributed to one self's actions, and that can be dealt with or changed through the performance of a corrective action (Niedenthal, Krauth-Gruber, & Ric, 2006). If these appraisals can be made prior to exposure to CFT, regret may be considered an antecedent of CFT that then moderates the relationships between CFT and behavior and between CFT and efficacy perceptions (cf. Myers, McCrea, & Tyser, 2014).

Such appraisals are possible if the message that precedes the CFT provides information regarding controllability, responsibility, and solvability of the event that caused the negative emotion (Niedenthal et al., 1994; Zeelenberg et al., 1998). A message that depicts a person experiencing a negative health outcome as a result of medication nonadherence could elicit regret, particularly if that message clearly suggests that 1) the protagonist was responsible for what happened; 2) the protagonist could have avoided the outcome; 3) the protagonist strongly feels that he/she should and can correct their mistake (Roseman et al., 1994; van Dijk & Zeelenberg, 2002).

How, then, does regret moderate the relationship between counterfactual thinking, self-efficacy, response efficacy, outcome expectancy, and behavioral intentions? Studies on regret have found that experiencing this emotion motivates behavior that corrects or alleviates the negative outcome that caused the feeling of regret (Roseman et al., 1994); thus, regret should amplify the positive effect of CFT on behavioral intention/behavior. In light of Arora et al.'s (2013) and Sanna's (1997) findings, regret should reduce the positive effect of CFT on self-efficacy. Given lack of prior research, the effect of regret on the relationship between CFT and response efficacy, and CFT and outcome expectancy, is hard to predict and it should be posed as a research question.

Hypotheses and Research Questions

For the purpose of clarity, hypotheses and research questions are formulated for integral CFT only, with the understanding that the same hypotheses and research questions will be tested for incidental CFT, as well, and that comparisons between messages including incidental versus integral CFT will be undertaken. The following hypotheses and research questions are advanced.

Direct effects

Considering findings from previous studies in which upward counterfactuals (thoughts of "if only"), as opposed to downward counterfactuals (thoughts of "well, at least"), have been found to have a significant influence on future behaviors and behavioral intentions due to their focus on corrective actions that may facilitate future success (Roese, 1994), the following hypothesis is proposed:

H1. There is a positive direct effect of the experimental condition on behavioral intention, such that individuals exposed to a health message that includes an integral upward CFT (compared to a health message that includes an integral downward CFT or no CFT [control]) will report higher intentions to adhere to medication as prescribed.

Upward counterfactuals, as opposed to downward counterfactuals, provide explicit information about what behaviors ought to be performed in the future for achieving success; this explicit information should increase individuals' confidence in their abilities and likelihood of successfully reaching a goal. This idea has also received empirical support (e.g., Tal-or et al., 2004). Thus, the following hypothesis is proposed:

H2. There is a positive direct effect of the experimental condition on self-efficacy, such that individuals exposed to a health message that includes an integral upward CFT (compared to a health message that includes an integral downward CFT or no CFT [control]) will report higher self-efficacy to adhere to medication as prescribed.

Upward counterfactuals, as opposed to downward counterfactuals, highlight a causal link between a past behavior and a present outcome. Moreover, upward counterfactuals activate a prevention orientation, while also providing information about how to avoid a threat. In light of past research that has found that individuals in which a prevention regulatory focus has been activated report higher response efficacy when exposed to messages that contained preventative actions for avoiding a threat, the following hypothesis is advanced:

H3. There is a positive direct effect of the experimental condition on response efficacy, such that individuals exposed to a persuasive health message that includes an integral upward CFT (compared to a health message that includes an integral downward

CFT or no CFT [control]) will report higher response efficacy about the recommendation to adhere to medication as prescribed.

Due to lack of prior research on CFT and outcome expectancy, a research question is asked:

RQ1. Is there a direct effect of the experimental condition on outcome expectancy? If there is, how do individuals exposed to a persuasive health message that includes an integral upward CFT differ from individuals exposed to a health message that includes an integral downward CFT or no CFT (control) in terms of outcome expectancy?

Indirect effects

Considering past research that has identified self-efficacy, response efficacy, and outcome expectancy as intervening variables between independent variables, including persuasive messages, and behavioral intentions (e.g., Bosone, Martinez, & Kalampalikis, 2015), the following indirect effects hypotheses and research questions follow:

H4. There is a positive indirect effect of messages including an integral upward CFT (compared to messages including an integral downward CFT or no CFT [control]) on intention to adhere to medication treatment, through self-efficacy.

H5. There is a positive indirect effect of messages including an integral upward CFT (compared to messages including an integral downward CFT or no CFT [control]) on intention to adhere to medication treatment, through response efficacy.

RQ2. Is there an indirect effect of messages including an integral upward CFT (compared to messages including an integral downward CFT or no CFT [control]) on

intention to adhere to medication treatment, through outcome expectancy? If there is, what is the nature of that effect?

It is important to note that Hayes' view (2009) on using the terms "mediation" and "indirect effects" is adopted here. Specifically, Hayes argues that the independent variable need not be associated with the dependent variable in order for an indirect effect to exist. When such an association is not present, some argue that the term "indirect effect" rather than "mediation" or "mediator" is more appropriate (e.g., Mathieu & Taylor, 2006), however, Hayes (2009) maintains that such distinctions are not relevant. Thus, the terms "indirect effect" and "mediation" will be used interchangeably in this manuscript.

Interaction effects

Previous studies on counterfactual thinking suggest that regret, an emotion that often precedes counterfactual thinking, may modify the effect of counterfactual thoughts on self-efficacy, such that, at higher levels of negative affect or regret, the effect of CFT on self-efficacy is reduced (Arora et al., 2013; Sanna, 1997):

H6. There is an interaction between messages including an integral upward CFT versus an integral downward CFT or no CFT and feelings of regret, such that greater feelings of regret reduce the positive effect of messages including an integral upward versus downward CFT or no CFT on self-efficacy.

Given the lack of previous research on counterfactual thinking, emotional reactions, and response efficacy, and outcome expectancy, two research questions are advanced for these variables:

RQ3. Is there an interaction effect between messages containing an integral upward CFT versus an integral downward CFT or no CFT and feelings of regret on response efficacy? If there is, what is the nature of that interaction?

RQ4. Is there an interaction effect between messages containing an integral upward CFT versus an integral downward CFT or no CFT and feelings of regret on outcome expectancy? If there is, what is the nature of that interaction?

Drawing from cognitive theories of emotion, the experience of regret motivates the individual to correct behaviors that have caused this distressing emotion (Lazarus, 1991). Therefore, it is expected that regret will amplify the positive effect of counterfactual thinking on behavioral intentions:

H7. There is an interaction between messages containing an integral upward CFT versus a downward CFT or no CFT and feelings of regret, such that greater feelings of regret amplify the effect messages including an integral upward versus downward CFT or no CFT on intention to adhere to medication treatment.

Moderated (conditional) indirect effects (moderated mediation)

From the hypotheses stated above, the following conditional indirect effect hypothesis follows:

H8. There is a conditional indirect effect of messages including an integral CFT (upward versus downward CFT or no CFT) on intentions to adhere to medication as prescribed through self-efficacy, such that the positive indirect effect through self-efficacy decreases as the amount of regret experienced increases.

RQ5: Is there a conditional indirect effect of messages including an integral CFT (upward versus downward CFT or no CFT) on intentions to adhere to medication as prescribed through response efficacy?

RQ6: Is there a conditional indirect effect of messages including an integral CFT (upward versus downward CFT or no CFT) on intentions to adhere to medication as prescribed through outcome expectancy?

The model is represented visually in Figure 1.

Chapter 6: Pilot Study, Experiment 1, and Experiment 2

This chapter presents the research design and findings from one pilot study and two experiments. The purpose of the pilot study was to obtain participant feedback on the messages that were designed to be tested in the experiments. The purpose of experiments 1 and 2 was to test the proposed model with two chronic illnesses, type 2 diabetes (experiment 1) and hypertension (experiment 2).

Method

Study design and procedures, participant recruitment strategy, and experimental conditions were identical for both the pilot study and the two experiments.

Study design and procedures

The pilot study and the two experiments followed a 2 (counterfactual type: integral versus incidental) X 2 (counterfactual direction: downward versus upward) + 1 (control: no counterfactual) experimental design (a description of each experimental condition follows below). Both the pilot study and the two experiments included individuals who self-identified with one of two chronic illnesses: hypertension or type 2 diabetes.

The proposed model was tested with two different chronic illnesses to verify the generalizability of the effects observed. In choosing the two chronic illnesses, several factors were considered. First, the prevalence of two chronic illnesses and the associated health care costs should be significant so that prompt and effective intervention is

justified. Second, the two illnesses should affect people with a diverse demographic background rather than be gender or age-specific in order to provide a broad assessment of the persuasive effect of counterfactual thinking.

Hypertension and type 2 diabetes affect a significant amount of people in the United States, are associated with high healthcare costs, and affect people of both genders, various ages and races (American Heart Association, 2014; American Diabetes Association, 2016; CDC, 2012, 2016). According to the American Diabetes Association, type 2 diabetes was the seventh leading cause of death in the United States in 2010. In 2015, almost 29 million Americans had type 2 diabetes. The total healthcare costs associated with this illness top $200 billion annually. Medication treatment and lifestyle changes are critical for preventing or delaying onset of health complications, yet, medication adherence among diabetes patients is low (American Diabetes Association, 2016; CDC, 2016). Hypertension affects approximately 75 million American adults and it was a primary or contributing cause of death for more than 400,000 Americans in 2014 (CDC, 2016). High blood pressure costs the nation $48.6 billion each year. Yet, only about half of individuals diagnosed with hypertension take their medication as prescribed (CDC, 2016). Therefore, hypertension and type 2 diabetes were appropriate choices for testing a model of communication purported to persuade patients to adhere to their medication treatment.

Participants

Recruitment. Participants for the pilot study and experiments 1 and 2 were recruited using Amazon Mechanical Turk (MTurk), an online labor system run by Amazon.com. Recruitment was restricted to workers from the U.S. only. MTurk workers

are considered to be more representative samples of the U.S. population than traditional student samples (Parker & Fischoff, 2005) and even more diverse than some community samples (Buhrmester et al., 2011). Moreover, prior research has found that MTurk workers have similar income levels and ages compared to the U.S. population (Ipeirotis, 2010) and that they exhibit similar judgment and decision biases (e.g., framing effects) as traditional college students do (Paolacci et al., 2010). For the model of moderated mediation tested, a sample of 500 participants ensures .991 power for detecting small conditional indirect effects (i.e., coefficients of approximately .14 magnitude; Preacher, Rucker, & Hayes, 2007; Table 7).

Screening. A screener was used to select participants for each of the studies. First, individuals were required to be least 18 years of age and to self-identify as having been clinically diagnosed with either hypertension or type 2 diabetes at least six months prior to the date of the study. The six-month cutoff was chosen because prior studies on drug adherence have consistently shown that individuals are most likely to stop taking their medication as prescribed approximately six months after diagnosis (Gadkari & McHorney, 2010; Haynes, McDonald, & Carg, 2002; Osterberf & Blaschke, 2005; WHO, 2003). Second, eligible participants were required to be currently taking blood pressure lowering or diabetes medication, respectively. Third, participants must not have been pregnant or within three months postpartum because pregnancy might be related to specific reasons for medication nonadherence, such as concern of harming the fetus or the baby through breastfeeding.

Fourth, individuals were screened for risk for nonadherence. For patients with hypertension, studies have identified the following nonadherence risk factors: 1) beliefs

that the medication is not necessary; 2) beliefs that the medication is not effective; 3) lack of symptoms; 4) low perceived severity of the illness; and 5) concerns over side effects (Miller, 1997; Ross et al., 2004; Stevenson, Kjellgren, Ahlner, & Saljo, 2000). Patients with type 2 diabetes are non-adherent due to 1) low perceived severity of the illness; 2) weight gain concerns associated with the medication; 3) perceptions of increased cardiovascular risk associated with the medication; 4) beliefs that the medication is not effective; and 5) beliefs that the medication is not necessary (Broadbent, Donkin, & Stroh, 2011; Farmer, Kinmonth, & Sutton, 2006; Garcia-Perez et al., 2013; Hauber, Mohamed, Johnson, & Falvey, 2009).

To summarize, individuals who had been diagnosed with either type 2 diabetes or hypertension at least six months prior to the study; who were currently taking medication to treat hypertension or type 2 diabetes; who were not pregnant or within three months postpartum; and who answered 'yes' to at least one of the nonadherence risk items identified for each illness were eligible to participate in the studies. An affirmative answer to at least one of the risk factor items rather than to all of these items was preferred because previous studies did not conclude that all factors must be met in order for a patient to be at risk for nonadherence (e.g., Garcia-Perez et al., 2013; Ross et al., 2004). For example, some patients decide not to take their medication because of their belief that the medication is not helping them, whereas others might be nonadherent because of side effects and medication effectiveness concerns. A similar less conservative approach to identifying nonadherent patients was used by Zhao et al. (2012), as well.

After screening, eligible individuals were redirected to the study website, hosted by the Qualtrics survey software and assigned to either the diabetes or the hypertension group, depending on their respective answers.

Random assignment. Qualtrics allows for the random assignment of study participants to experimental conditions. Thus, after being redirected to Qualtrics, participants in both the pilot study and in the two experiments were randomly assigned to one of the five experimental conditions and read a corresponding vignette (described below). After reading the vignettes, participants responded to a battery of questions including demographic characteristics, other covariates, and the dependent variables of interest.

Experimental conditions

Participants in the pilot study and in experiments 1 and 2 were exposed to a short vignette describing negative outcomes of drug nonadherence. Participants were instructed to imagine that they were the protagonist of the story in the vignette. The story used first-person language to facilitate perspective taking among participants and it depicted a situation in which an individual decided to stop taking his/her medication as prescribed because he/she did not believe the medication was helping him/her manage his/her condition (either diabetes or hypertension, depending on participants' self-reported medical condition). As a result, the individual ended up in an emergency room where doctors notified him/her that the symptoms of his/her condition had aggravated significantly.

The story ended with a CFT corresponding to each experimental condition (or no CFT for the control condition) (see Appendix A for the actual vignettes). The vignettes

appeared as black text on a white background. Each vignette remained on the screen for 20 seconds and participants were not allowed to advance to the subsequent survey before this amount of time had passed. This measure was taken to ensure that participants read the vignettes carefully rather than just scroll through the text.

There are several reasons for which short vignettes in the form of black text on white background as opposed to other message formats were chosen. First, the use of counterfactual thinking as a persuasive message design strategy is a novel idea and only one prior study has tested its potential in a health context (Tal-Or, Boninger, Poran, & Gleicher, 2004). A vignette represents one of the simplest message formats available to test the persuasive effects of counterfactual thinking. More complex message elements such as sound and video can be added in future research. Second, short vignettes can be easily incorporated into mHealth interventions or doctor-patient conversations, if the findings show that counterfactual thinking is a promising persuasive strategy for patients who are nonadherent.

Pilot Study

The vignettes in Appendix A were tested prior to including them in the main study. This pilot testing ensured that the messages developed were comprehensible, relevant, interesting to target individuals, provided reasonable information, and that participants could identify with the story.

Participants

A total of 103 individuals participated in the pilot study (42 in the type 2 diabetes group and 62 in the hypertension group). Data were collected over the course of three

days, from December 8th to December 10th, 2016. All individuals were compensated with 50 U.S. cents for their participation.

Participants in the type 2 diabetes group were, on average, 38.20 years old (*Min* = 19; *Max* = 71; *SD* = 12.87); 36.6% were female (63.4% were male and 2.4% declined to answer); 69% were White (9.5% African American; 14.3% Hispanic/Latino; 4.8% Asian/Pacific Islander; and 2.4% declined to answer). Participants in the hypertension group were, on average, 41.05 years old (*Min* = 22; *Max* = 74; *SD* = 13.41); 49.2% were female (49.2% were male and 1.6% declined to answer); 78.7% were White (6.6% African American; 4.9% Hispanic/Latino; 4.9% Asian/Pacific Islander; 3.3% were mixed; and 1.6% declined to answer).

Measures

The following measures were used for both the diabetes and hypertension groups. Results for each medical condition are reported below.

Relevance. Participants rated the relevance of the messages on a scale from 1 – strongly disagree to 7 – strongly agree: The story I just read said something highly relevant to me.

Believability. Participants rated the relevance of the messages on a scale from 1 – strongly disagree to 7 – strongly agree: The story I just read was believable.

Comprehension. Whether the message was easy to understand was gauged by the following items, rated on a scale from 1- strongly disagree to 7 – strongly agree: 1) The story I just read was easy to understand; 2) I had no difficulty in understanding the story I just read.

Interest in the message. If the story was interesting to participants or not was measured using the following item (1 – strongly disagree to 7 – strongly agree): The story I just read grasped my attention immediately.

Message derogation. Participants were also asked whether the messages were reasonable as opposed to exaggerated using the following items: To what extent do you think the story you just read was 1) exaggerated; 2) distorted; 3) overblown? Responses will be rated on a scale from 1- strongly disagree to 7 – strongly agree.

Identification with the message. Participants reported how much they identified with the story in the message by rating the following items on a scale from 1 – strongly disagree to 7 – strongly agree: 1) I could easily relate to what happened in the story; 2) I think that the events I just read could happen to me in real life.

Qualitative feedback. Finally, participants were encouraged to write down any thoughts they had about the stories they just read: *In the space provided below, please mention any thoughts you might have about the story you just read. Please focus on what aspects (words, ideas) in the story should be changed to make it more relevant and easier to understand by people like you.*

Results

Diabetes. The two items used to measure comprehension were significantly and highly correlated with one another (*Pearson's r* = .77, $p < .001$); the items were averaged. Similarly, the two items measuring identification were significantly and positively correlated (*Pearson's r* = .86, $p < .001$) and they were averaged. Finally, the three items used to measure message derogation formed an internally consistent measure (Cronbach's alpha = .95) and they were averaged.

Overall, participants in the diabetes condition perceived the vignettes as highly relevant (M = 5.20; SD = 1.76 on a scale from 1 to 7); believable (M = 5.17; SD = 1.87 on a scale from 1 to 7); interesting (M = 5.24; SD = 1.88 on a scale from 1 to 7); easy to understand (M = 5.84; SD = 1.38); and easy to identify with (M = 5.16; SD = 1.64). Comparatively, message derogation was below the mid-point of the scale (M = 3.22; SD = 1.87). The vignettes in the integral CFT, incidental downward CFT, and control conditions were rated similarly on relevance, believability, interest, comprehension, and identification; whereas the same ratings for the vignette in the incidental upward CFT condition were around two points lower (on a scale from 1 to 7). All messages were rated on average, at around three for message derogation, with the exception of the incidental downward CFT condition, which was rated at 4.42. Please see Table 1 for a summary.

The qualitative feedback echoed participants' ratings. In their comments, participants noted that the story was easy to read, credible, and that what happened to the character resonated with them (e.g., "it made sense as written and it sounds like something that could be experienced in real life"; "This story is rather sad, and makes me scared to stop taking my medication. It is very relevant and a possible outcome if I followed the same steps.").

Participants also had suggestions for improvement. Specifically, participants recommended to include information on why the character stopped taking the medication (e.g., "It might help if you mention, why the medication was discontinued."); for how long the character had stopped taking the medication before feeling ill (e.g., "I feel like it should mention how long they have been not taking the medication. That would help me relate to the time frame."). Finally, participants thought that the incidental counterfactuals

were out of place and comments such as “The beginning of the story was believable. But then when it brought up the dog and not being bored it just went off the rails and didn't make too much sense. That needs to be removed.” were common.

Hypertension. Results were similar in the hypertension condition. First, the two items used to measure comprehension were significantly and highly correlated with one another (*Pearson’s r* = .59, $p < .001$); the items were averaged. Similarly, the two items measuring identification were significantly and positively correlated (*Pearson’s r* = .70, $p < .001$) and they were averaged. Finally, the three items used to measure message derogation formed an internally consistent measure (Cronbach’s alpha = .90) and they were averaged.

Overall, participants in the hypertension condition perceived the vignettes as highly relevant (*M* = 5.21; *SD* = 1.28 on a scale from 1 to 7); believable (*M* = 5.67; *SD* = 1.27 on a scale from 1 to 7); interesting (*M* = 5.49; *SD* = 1.15 on a scale from 1 to 7); easy to understand (*M* = 6.13; *SD* = 1.15); and easy to identify with (*M* = 5.19; *SD* = 1.31). Comparatively, message derogation was below the mid-point of the scale (*M* = 2.78; *SD* = 1.29). The vignettes in the integral CFT and control conditions were rated similarly on relevance, believability, interest, comprehension, and identification; whereas the same ratings for the vignettes in the incidental upward and downward CFT conditions were around one point lower (on a scale from 1 to 7). All messages were rated on average, at around three for message derogation. Please see Table 2 for a summary.

Regarding qualitative feedback for improving the messages, as with the diabetes vignettes, participants suggested that the stories include the symptoms the patient experienced prior to his hospitalization (“hypertension is a ‘silent killer’ supposedly, but

you CAN feel dizzy if you are not on medication. I would include in the story a symptom or two experienced by the patient.") and explain why the patient stopped taking the medication (e.g., "The story is easy to understand but the persons actions are difficult to comprehend. Why quit taking medicine?"). Participants also suggested that the writing be made more conversational ("I thought it could be written more conversationally (i.e., using 'I've' instead of 'I have') - it would make it seem more realistic and personal") and reconsider the incidental counterfactuals (e.g., "Who thinks about their dog while they're lying in the hospital bed because they did something that made their own health worse?").

Pilot study conclusions

Overall, the initial vignettes were perceived as relevant, believable, interesting, relatable, and reasonable. Therefore, the basic content of the vignettes was preserved and several small changes proposed by participants were implemented. Specifically, the language was made more conversational (e.g., "I have" was replaced with "I've") and information on why the character stopped taking the medication (i.e., it was causing uncomfortable side effects), on symptoms experienced prior to hospitalization (i.e., I felt really dizzy, I could barely walk or talk), and on how long the character did not take the medication (i.e., about a week) was added.

Finally, given the overall negative sentiment toward the two incidental counterfactuals which were seen as inappropriate, the afferent conditions were changed such that the incidental counterfactual thinking would be presented in relation to an unrelated story introduced prior to the medication adherence vignette. This unrelated story features an individual reflecting on his decision to buy a cheaper, but

underperforming laptop; the reflection ends with either an upward counterfactual thought (i.e., if only I had bought a more expensive laptop, I wouldn't have these issues now!) or a downward counterfactual thought (i.e., Oh well, at least I have a laptop now!), respectively. After this story, the medication adherence vignette is introduced (followed by no counterfactual). A similar approach was used by Nan (2008) and this method is frequently employed in the emotions literature when inducing incidental emotions (e.g., Lerner & Keltner, 2000). The new stimuli can be found in Appendix B. To facilitate an organic transition between the laptop and the medication adherence stories, the following question was introduced: Do you think buying a cheaper laptop is a good or a bad idea? (1 – very bad idea to 7 – very good idea). After this question, an introduction to the medication adherence story appeared on the screen.

Experiments 1 and 2

Participants

Data collection for experiments 1 and 2 took place between December 15th and December 27th, 2016. A total of 6113 individuals accessed the screener survey. Out of those, 947 were eligible for participation in either the type 2 diabetes experiment (N = 461) or the hypertension experiment (N = 486). Of note, individuals who participated in the pilot study were not eligible for the two experiments. All 947 individuals were compensated with $1 for their participation.

A total of 188 participants were deleted from the dataset (i.e., 100 from the diabetes sample and 88 from the hypertension sample) prior to analyses for one or more of the following reasons: they took less than seven minutes to complete the study

(reading through the survey items only should have taken around seven to eight minutes); they took more than two hours to finish the study (which suggested that they did not finish the study in one sitting, allowing for confounding factors to intervene); they were "straight liners" (i.e., they answered all questions by marking '1', '7' or '4' throughout); they missed the attention check (described below). This deletion brought the total sample down to 759 participants ($N_{diabetes}$ = 361; $N_{hypertension}$ = 398). The average study completion time was 10.56 minutes (*SD* = 16.22 min; *Min* = 7.02 minutes; *Max* = 93.38 minutes).

Demographic characteristics. Findings regarding the relationship between demographics and drug nonadherence have been mixed, yet, differences between men and women, younger and older people, the more and the less educated, white and non-white patients might still exist. Thus, these variables were measured and controlled for in the analyses.

Among participants with type 2 diabetes, individuals were, on average, 36.65 years old (*SD* = 12.09; *Min* = 18; *Max* = 79); 57.8% were women (41.1% were men and 1.1% identified as gender fluid); 69.3 % were White (12.0% Black/African American; 6.1% Latino/Hispanic; 6.4% Asian/Pacific Islander; 2.8% Native American; 3.4% Mixed); 37.8% were college graduates (1.7% had some high school; 12.9% were high school graduates; 37.8% had some college; and 9.8% had post-college education). A total of 8.7% reported their household yearly income below $15,000 (12.3% between $15,000 and $25,000; 27.1% between $25,001 and $45,000; 27.4% between $45,001 and $65,000; 17.9% between $65,001 and $100,000; 5.9% more than $100,000 and 0.8% did not know). Finally, 28.8% of participants with type 2 diabetes reported having been diagnosed with their illness less than a year ago; 16.2% one year ago; 19.6% two years

ago; 14.2% three years ago; 4.7% four years ago; 5.3% five years ago; 1.7% six years ago; and 9.5% more than six years ago. Please see Table 3 for a summary of type 2 diabetes sample characteristics.

Among participants with hypertension, individuals were, on average, 42.39 years old (*SD* = 13.07; *Min* = 19; *Max* = 80); 61.0% were women (38.2% were men and 0.8% identified as gender fluid); 73.8 % were White (11.3% Black/African American; 7.9% Latino/Hispanic; 4.1% Asian/Pacific Islander; 1.8% Native American; 1.0% Mixed); 39.2% were college graduates (0.8% had some high school; 11.8% were high school graduates; 31.5% had some college; and 16.7% had post-college education). A total of 8.2% reported their household yearly income below $15,000 (13.3% between $15,000 and $25,000; 29.0% between $25,001 and $45,000; 20.8% between $45,001 and $65,000; 18.2% between $65,001 and $100,000; 9.2% more than $100,000 and 1.3% did not know). A total of 25.6% of participants with hypertension reported having been diagnosed with their illness less than a year ago; 11.3% one year ago; 14.9% two years ago; 14.4% three years ago; 8.2% four years ago; 7.4% five years ago; 1.3 six years ago; and 16.9% more than 6 years ago. Please see table 4 for a summary of hypertension sample characteristics.

Measures

Dependent variables

Self-efficacy. Self-efficacy was measured with seven items adapted from Ogedegbe, Mancuso, Allegrante, & Charlson (2005) and Erlen, Cha, Kim, Caruthers, & Sereika (2010). The items were rated on a scale from 1- not confident at all to 7 – very confident and included: How confident are you that you can follow the medication

treatment that your doctor prescribed to you for your chronic condition?; How confident are you that you can make taking medication part of your routine?.

In the type 2 diabetes group, principal components analysis showed that, based on the 60/40 criterion, the items formed a unidimensional scale and they all loaded on one component that explained 68.11% of variance in the construct. The items were also internally consistent (Cronbach's alpha = .92). The items were, thus, averaged to form an overall index of type 2 diabetes medication adherence self-efficacy (*M* = 5.31; *SD* = 1.28; *Min* = 1; *Max* = 7).

Similarly, in the hypertension group, items all loaded on one component that explained 66.35% of the variance and were internally consistent (Cronbach's alpha = .91). The items were averaged to form an overall index of hypertension medication adherence self-efficacy (*M* = 5.45; *SD* = 1.26; *Min* = 1; *Max* = 7).

Response efficacy and outcome expectancy. Response efficacy was measured with seven items rated on a scale from 1- strongly disagree to 7 – strongly agree (adapted from Erlen et al., 2010). Sample items include: I believe that taking my medication as prescribed by my doctor will help me stay healthy; I believe that taking my medication as prescribed by my doctor will improve the quality of my life. Outcome expectancy was measured with seven items also rated on a scale from 1 – strongly disagree to 7 – strongly agree, including: I believe that taking my medication as prescribed by my doctor will make my family and friends happy; I believe that taking my medication as prescribed by my doctor will allow me to enjoy life; I believe that taking my medication as prescribed by my doctor will allow me to live the life that I want.

Given the conceptual overlap between response and outcome expectancy, a principal components analysis was ran including all 14 items (for each group separately). For both the type 2 diabetes and hypertension groups, results showed that the ten items tapping into expectations about medication adherence effects on one's health and quality of life loaded on one component and the four items tapping into expectation about medication adherence effects on one's family and friends loaded on a second component. The ten items and four items, respectively, were also internally consistent as gauged by Cronbach alphas. As a result, for both the diabetes group and the hypertension group, the ten items were averaged into overall indices of medication adherence response efficacy (type 2 diabetes: items explained 72.92 % of variance in the construct; Cronbach's alpha = .96; *M* = 5.51; *SD* = 1.20; *Min* = 1; *Max* = 7; hypertension: items explained 75.60% of variance in the construct; Cronbach's alpha = .96; *M* = 5.61; *SD* = 1.24; *Min* = 1; *Max* = 7); and the four items were averaged into overall indices of medication adherence family and friends outcome expectancy (type 2 diabetes: items explained 55.95 % of variance in the construct; Cronbach's alpha = .74; *M* = 4.76; *SD* = 1.31; *Min* = 1; *Max* = 7; hypertension: items explained 60.99% of variance in the construct; Cronbach's alpha = .79; *M* = 4.55; *SD* = 1.41; *Min* = 1; *Max* = 7).

Behavioral intention. Intentions to adhere to medication were measured with the following items, rated on a scale from 1 – not strong at all to 7 – very strong: 1) Think about this moment. How strong is your intention to take your medication as advised by your doctor right now?; 2) Think about tomorrow. How strong do you think your intention to take your medication as advised by your doctor will be tomorrow?; 3) Think

about one week from today. How strong do you think your intention to take your medication as advised by your doctor will be one week from today?.

For both the diabetes and the hypertension groups, the items formed a unidimensional scale and were internally consistent; therefore, they were averaged into overall indices of medication adherence behavioral intention (type 2 diabetes: items explained 88.06% of variance in the construct; Cronbach's alpha = .93; *M* = 5.87; *SD* = 1.28; *Min* = 1; *Max* = 7; hypertension: items explained 90.22% of variance in the construct; Cronbach's alpha = .94; *M* = 5.99; *SD* = 1.32; *Min* = 1; *Max* = 7).

Moderator

Regret. Regret was measured with three items rated on a scale from 1 – not at all to 7 – very much: Think about the story you just read and rate how much 1) regret; 2) remorse; 3) repentance you are experiencing right now (adapted from Zeelenberg et al., 1998). For both the diabetes and the hypertension groups, the items formed a unidimensional scale and were internally consistent; therefore, they were averaged into overall indices of regret experienced (type 2 diabetes: items explained 81.54% of variance in the construct; Cronbach's alpha = .89; *M* = 3.84; *SD* = 1.81; *Min* = 1; *Max* = 7; hypertension: items explained 77.99% of variance in the construct; Cronbach's alpha = .86; *M* = 3.46; *SD* = 1.69; *Min* = 1; *Max* = 7).

Covariates

The literature on drug nonadherence has identified a variety of factors that impact an individuals' medication-related perceptions and behaviors. These variables were measured and their effect on the dependent variables was controlled for in the present

analyses in order to ensure that the effects observed could be attributed to the experimental manipulation as opposed to other confounders.

Doctor-patient communication. The quality and content of the communication between a doctor and a patient can influence an individual's willingness to take their medication, their beliefs in the effectiveness of medication to manage their illness and avoid complications, and their perceptions of how able they are to follow the treatment. Thus, participants' assessment of their communication with their doctor was measured and entered as a covariate in the analyses.

Doctor-patient communication was measured with items adapted from Bieber, Muller, Nicolai, Hartmann, and Eich's (2010) quality of physician-patient interaction scale. The items selected from the original scale were the ones that addressed doctor-patient communication specifically. A total of eight items were rated on a scale from 1-strongly disagree to 7 – strongly agree, including: The physician gave me detailed information about the available treatment options; The physician and I made all treatment decisions together; The physician's explanations were easy to understand.

For both the diabetes and the hypertension groups, the items formed a unidimensional scale and were internally consistent; therefore, they were averaged into overall indices of doctor-patient communication (type 2 diabetes: items explained 68.18% of variance in the construct; Cronbach's alpha = .93; M = 5.06; SD = 1.41; Min = 1; Max = 7; hypertension: items explained 66.66% of variance in the construct; Cronbach's alpha = .93; M = 4.93; SD = 1.51; Min = 1; Max = 7).

History of medical complications. Whether an individual has experienced health complications caused by medication nonadherence might influence responses to the

response efficacy and behavioral intention items. For example, an individual who refused to take their medication and then had to go to the emergency room might respond positively to these items, independent of exposure to a persuasive message. Therefore, this variable was measured and included in the model as a covariate. Individuals were asked the following questions: 1) Have you ever experienced health complications, such as chronic illness symptom aggravation, due to not taking your medications? (yes, one time; yes, more than once; no, never); 2) Have you ever been hospitalized because you did not take your medications? (yes, one time; yes, more than once; no, never).

In the diabetes group, 39.1% of participants reported having experienced health complications due to nonadherence once; 26.3% more than once; and 34.6% never. A total of 22.9% reported having hospitalized due to nonadherence once; 7.5% more than once; and 69.6% never. In the hypertension group, 28.4% of participants reported having experienced health complications due to nonadherence once; 26.6% more than once; and 45.0% never. A total of 13.3% reported having hospitalized due to nonadherence once; 6.4% more than once; and 80.3% never. For both groups, the two items were dummy coded (1 for yes and 0 for no) to be used in subsequent analyses.

Experience of medication side effects. Whether an individual has experienced medication side effects or not may also influence their responses. Most patients fear side effects, however, not all of them have actually experienced them. It is not clear, however, if patients who fear versus experience side effects are less likely to take their medication as prescribed. Therefore, participants were asked whether: 1) they fear that their chronic illness medication will cause side effects (1 – not at all to 7- very much); and 2) they

experienced side effects caused by their chronic illness medication (1 – not at all to 7-very much).

The two items correlated significantly (diabetes: *Pearson's r* = .56, $p < .001$; hypertension: *Pearson's r* = .63, $p < .001$) and they were averaged (diabetes: *M* = 4.69; *SD* = 1.50; *Min* = 1; *Max* = 7; hypertension: *M* = 4.21; *SD* = 1.65; *Min* = 1; *Max* = 7).

Depressive symptoms. Among a variety of comorbidities, depression is the only illness that has been consistently found to interfere with medication adherence (Sirey, Greenfield, Weinberger, & Bruce, 2013). Given the nature of the study (an online experimental survey), only a measure of depressive symptoms could be incorporated. Symptoms of depression were measured using a four-item psychological distress scale adapted from the National Health Interview Survey, 1997, Adult Core Questionnaire (item ACN.471). Respondents rated the following symptoms as experienced during the past two weeks (1 – not at all to 7 – very much)*:* (1) little interest or pleasure in doing things; (2) feeling down, depressed, or hopeless; (3) feeling nervous, anxious, or on edge; and (4) not being able to stop or control worrying.

The four items formed a unidimensional and internally consistent scale in both the diabetes and the hypertension groups and the items were averaged to form an index of depressive symptoms (type 2 diabetes: items explained 79.70% of variance in the construct; Cronbach's alpha = .92; *M* = 3.55; *SD* = 1.70; *Min* = 1; *Max* = 7; hypertension: items explained 79.52% of variance in the construct; Cronbach's alpha = .91; *M* = 3.56; *SD* = 1.86; *Min* = 1; *Max* = 7).

Attention check. The following attention check appeared in the survey as a separate item after the behavioral intention measure and before the covariates

measurement: “For this question, please select option ‘5’, this is an attention check”. A total of 56 people missed this attention check and their data were deleted prior to running analyses.

Following O’Keefe’s (2003) argument that when the research claim refers to the effect of a specific message variation on the outcome (such as in the present case), a manipulation check can actually be omitted, participants were not asked whether the message they read included a counterfactual thought or not.

For a summary of measures please see Table 5. Bivariate correlations between variables are presented in Table 6.

Hypothesis testing

Analysis of covariance. ANCOVA analyses were ran first to assess group differences and the effect of the covariates on each of the dependent variables (i.e., self-efficacy, response efficacy, outcome expectancy, and behavioral intention). Prior to running the ANCOVAs, the data were analyzed for skewness and kurtosis. Behavioral intention measures in both the diabetes and hypertension group were negatively skewed; and the response efficacy measure in the hypertension group only was also negatively skewed. Following the ladder of powers (Fink, 2009), the three variables were squared.

Self-efficacy. Levels of self-efficacy did not differ based on experimental condition in the diabetes group (F (4, 353) = 1.12, p = .35). Among covariates, doctor-patient communication and age had a significant effect on self-efficacy. Regression analyses showed that the more positive the communication between the participant and their doctor was evaluated, the higher the medication adherence self-efficacy reported (b = .45, p < .001, 95% CI = [0.32; 0.49]); the confidence interval associated with the effect

of age on self-efficacy in regression analyses included zero; therefore, an effect of age on self-efficacy was not supported (b = .01, p = .05, 95% CI = [0.00; 0.02]).

Levels of self-efficacy did not differ based on experimental condition in the hypertension group either (F (4, 387) = 0.64, p = .64). Among covariates, depressive symptoms, doctor-patient communication, gender, and age were significant. According to regression analyses, the higher the levels of depression symptoms reported, the lower the levels of medication adherence self-efficacy reported (b = -.13, p = .01, 95% CI = [-0.15; -0.02]); the more positive the communication between the participant and their doctor was evaluated, the higher the medication adherence self-efficacy reported (b = .38, p < .001, 95% CI = [0.24; 0.39]); the older the participant, the higher their self-efficacy (b = .10, p = .04, 95% CI = [0.01; 0.02]). Finally, women reported higher self-efficacy than men (b = .10, p = .03, 95% CI = [0.03; 0.49]).

Response-efficacy. In the diabetes group, response efficacy did not differ depending on experimental condition (F (4, 353) = 0.86, p = .49). Among covariates, doctor-patient communication and age had a significant effect on response efficacy. Follow-up regression analyses showed that, as with self-efficacy, the more positive doctor-patient communication was evaluated, the higher the levels of response efficacy reported (b = .58, p < .001, 95% CI = [0.42; 0.56]); and the older the participant, the higher their response efficacy (b = .01, p = .04, 95% CI = [0.001; 0.02]).

In the hypertension group, participants' response efficacy did not differ based on the experimental condition they were assigned to either (F (4, 386) = 1.56, p = 18). Depressive symptoms, doctor-patient communication, and gender were significant covariates. Follow-up regression analyses revealed that response efficacy decreased with

higher depressive symptoms (b = -.13, p = .007, 95% CI = [-0.15; -0.02]); it increased with more positive doctor-patient communication evaluations (b = .40, p < .001, 95% CI = [0.26; 0.40]); and it was higher among women compared to men (b = .11, p = .01, 95% CI = [0.07; 0.50]).

Outcome expectancy. In the diabetes group, levels of outcome expectancy did not differ among experimental conditions (F (3, 353) = 1.36, p = .25) and none of the covariates were significant for this variable.

Experimental condition did not result in different levels of outcome expectancy in the hypertension group either (F (4, 386) = 1.14, p = .34). Only doctor-patient communication and age emerged as significant covariates such that outcome expectancy increased with more positive doctor-patient communication evaluations (b = .34, p < .001, 95% CI = [0.23; 0.41]) and decreased with age (b = -.11, p = .03, 95% CI = [-0.02; -0.001]).

Behavioral intention. In the diabetes group, behavioral intention to adhere to medication as prescribed did not differ based on experimental condition (F (4, 353) = 1.22, p = .30). Among covariates, doctor patient communication, race, and age were significant. Regression analyses showed that the more positive doctor-patient communication was evaluated, the higher the intention reported (b = .48, p < .001, 95% CI = [0.35; 0.51]); the older the participant, the higher their intention to adhere to medication (b = .20, p < .001, 95% CI = [0.01; 0.03]); and that white participants had higher intention to adhere to medication as prescribed than non-white participants (b = .13, p = .01, 95% CI = [0.11; 0.60]).

Finally, participants' intention to adhere to their medication did not differ based on experimental condition in the hypertension group either (F (4, 386) = 0.85, p = .50). Depressive symptoms, doctor-patient communication, and age were significant covariates such that the higher the levels of depressive symptoms, the lower the medication adherence intention reported (b = -.13, p = .01, 95% CI = [0.35; 0.51]); the older the participant, the higher their response efficacy (b = .20, p < .001, 95% CI = [0.02; 0.16]); the more positive the doctor-patient communication evaluation, the higher the intention to adhere (b = .40, p < .001, 95% CI = [0.27; 0.43]); and the older the participant, the higher their intention to take their medication as prescribed (b = .14, p = .04, 95% CI = [0.04; 0.02]).

Mediation and moderation analyses. The mediation and moderated mediation analyses using SPSS Indirect Macro mirrored the ANCOVA findings and they were by and large non-significant. Specifically, there was no difference between participants in the integral/incidental upward CFT condition and participants in the integral/incidental downward CFT condition in terms of self-efficacy, response efficacy, outcome expectancy, and behavioral intention (all ps > .20). It follows that the indirect effects of the integral/incidental upward CFT (compared to the integral/incidental downward CFT condition) through self-efficacy, response efficacy, outcome expectancy on behavioral intention were not significant either (all ps > .20). Finally, regret did not moderate the effects of any of the conditions on self-efficacy, response efficacy, outcome expectancy, or behavioral intention (all ps > .20).

Experiments 1 and 2 discussion

The purpose of experiments 1 and 2 was to test the persuasive effects of counterfactual-thinking-based messages on individuals' intention to take their medication as prescribed by their doctor. The study also aimed to explore potential underlying mechanisms of the effects of counterfactual thinking on intention. Specifically, the roles of self-efficacy, response efficacy, and outcome expectancy as mediators of the effect of counterfactual thinking on medication adherence were considered. The proposed counterfactual thinking model of communication was examined in two health contexts: type 2 diabetes and hypertension, two illnesses that affect an overwhelming number of U.S. adults and that are associated with high healthcare costs and low medication adherence rates (American Heart Association, 2014; American Diabetes Association, 2016; CDC, 2012, 2016).

Despite the body of literature documenting the positive effects of upward counterfactual thinking, as opposed to downward counterfactual thinking, on behavioral intentions and self-efficacy, no such effects were observed in the present study. Participants who read a vignette that ended with an upward counterfactual thought did not report higher levels of self-efficacy, response efficacy, outcome expectations, or behavioral intentions than participants who read a vignette that ended in a downward counterfactual thought or no counterfactual thought (i.e., control condition).

Similar non-significant results were found for the incidental counterfactual conditions such that participants exposed to an incidental story that ended in an upward counterfactual thought and who then read the medication adherence vignette were no different than participants exposed to an incidental story that ended in a downward

counterfactual thought/no counterfactual thought (control) and who then read the medication adherence vignette. The non-significant results held across both participants who self-identified as having type 2 diabetes and those who self-identified as having hypertension.

Why results were largely non-significant requires a complex and nuanced discussion. The most readily available answer is that counterfactual thinking-based messages have no effect on medication adherence intentions, nor do they have an effect on medication adherence self-efficacy, response efficacy, and outcome expectancy. Other potential explanations have to do with the stimuli used; the sample; and how participants processed the messages they read.

Health context-related factors. First, it is possible that counterfactual thinking is not an efficient persuasive message design strategy in the context of medication adherence. Indeed, that findings were non-significant across two health contexts seems to give credence to this interpretation. Only a handful of studies have researched the persuasive effects of counterfactual thinking in health contexts. These studies have looked at smoking-related behaviors (Page & Colby, 2003), binge drinking (Baek et al., 2013), physical activity (Nan, 2008, Experiment 3), and traffic safety (Tal-Or et al., 2004) and have found a positive effect of counterfactual thinking on the investigated behaviors/behavioral intentions and attitudes.

However, these studies differed from the present study in that they used primarily incidental self-generated counterfactual thinking (i.e., CFTs generated by participants themselves and that were irrelevant to the judgment task; Baek et al., 2013; Nan, 2008), integral self-generated counterfactual thinking (i.e., CFTs generated by participants

themselves and that were related to the judgment task; Page & Colby, 2003) or a combination of integral stated and self-generated counterfactual thinking (i.e., CFTs generated by participants themselves and CFTs that were given to participants, and that were related to the judgment task; Tal-Or et al., 2004). These distinct strategies of studying counterfactual thinking and the different health contexts may account for why findings in prior research were significant.

Additionally, although research suggests that adhering to medication is a behavior similar to, for example, adhering to a healthy diet and, thus, convincing people to take their medication as prescribed should follow principles similar to those used for changing eating behaviors (Mayer & Pharm, 2007), research also notes that barriers such as medication cost, lack of access to healthcare, and forgetfulness are factors that significantly hinder adherence (Gazmararian, Kripalani, Miller, Echt, Ren, & Rask, 2006; Mann, Ponieman, Leventhal, & Halm, 2007; Rieckmann et al. 2006). It is possible, then, that addressing these types of barriers (i.e., cost, forgetfulness, access to healthcare) takes precedence over using persuasive messages to reduce nonadherence. Of course, medication cost and access to healthcare cannot be easily addressed and necessitate governmental intervention. Although access to healthcare was not measured, participants' evaluation of their communication with their doctor did emerge as a significant predictor of self-efficacy, response efficacy, and intention to adhere to medication, suggesting that having a healthcare provider who clearly explains the treatment plan, includes the patient in the decision-making process, and who listens to patient concerns can positively impact medication adherence. This finding is in line with prior research (Chiecanowski, Katon, Russo, & Walker, 2001; Rubin, Peyrot, & Simnerio, 2006).

Yet, this is not to say that persuasion attempts are futile. In fact, they are an integral part of the numerous interventions that aim to increase medication adherence. For instance, interventions have used motivational interviewing (Pakpour et al., 2015) and therapy (De Vries et al., 2015), both of which include persuasive elements. Moreover, text messaging-based interventions have included belief changing statements such as "Your asthma is always there even when you don't have symptoms; Take your preventer every day and control your asthma before it controls you" (Petrie et al., 2012); such statements are persuasive messages. Finally, Zhao et al. (2012) found that message framing, a popular persuasive message design strategy, had a persuasive effect. To conclude, then, the lack of significant findings in this study should not be interpreted as an indication that effective persuasive message design for medication adherence should not be given as much importance as interventions addressing cost issues or knowledge gaps that patients might have.

Stimuli-related factors. Insight into why the analyses yielded non-significant results can also be gathered from looking at the stimuli used. The vignettes were designed and refined using patient feedback. Moreover, even the vignettes that did not include such feedback (i.e., the ones tested in the pilot study) were rated as relevant, believable, and interesting. It is possible, however, that although the stories overall were satisfactorily written, the counterfactual thinking statements were lacking.

Specifically, only one counterfactual thinking statement per vignette was used and perhaps participants failed to notice and/or process that statement. If that were indeed the case, it is not surprising that the means for the dependent variables measured were similar across conditions, including the control condition in which no counterfactual thinking

statement was used. It was not possible, however, to check for this issue, given that a manipulation check was not included in either of the two experiments (following O'Keefe, 2003).

Tal-Or et al.'s (2004) study on the effect of counterfactual thinking on attitudes related to traffic safety support this argument. In their study, the authors included a counterfactual thought statement at the beginning of the narrative stimulus and also as a question in which participants were asked to write down how they thought things could have been different for the protagonist in the narrative. As Tal-Or and colleagues explained, "this question served as both an additional check on the counterfactual manipulation and as a reinforcement of the manipulation." (p. 311).

Another potential indication that the counterfactual thinking manipulation used in this study was likely weak is the low partial etas squared (a measure of effect size) and post-hoc observed power estimations in the ANCOVA output. Specifically, partial etas squared all hovered around .01 (or 1%) and observed power estimations varied from as low as .27 to a highest value of .49. These numbers barely changed when the data for diabetes and hypertension groups were collapsed to increase sample size (and, thus, statistical power).

It is unclear what the effect size of counterfactual thinking on variables such as intention and efficacy perceptions should be as the majority of studies in the literature do not report effect size measures. Only one study in which counterfactual thinking was applied to a public health-related context (traffic accidents) reported effect sizes (Tal-Or et al., 2004). In this study, the partial etas squared associated with upward counterfactual thinking were at around .35, much higher than the .01 partial etas squared observed in the

present research. Yet, the counterfactual thinking in Tal-Or and colleagues' study was generated by participants, rather than given to them as part of a message, so the effect size to be expected in a study like the present one is still unclear.

Participant-related factors. Finally, the sample recruited for the study may have influenced the significance of the results. It is possible that participants in the study were not actually at risk for nonadherence. Indeed, participants reported high levels of self-efficacy, response efficacy, outcome expectancy, and behavioral intention, with means for all of these variables above five on a 7-point scale. However, these participants did pass the study screener, meaning that they expressed concerns about their medication and/or their illness. These concerns have been found to be significant predictors of nonadherence and are considered risk factors for future nonadherence (e.g., Kreps et al., 2011; Zhao et al., 2012). Perhaps participants were dishonest in their answers to the screener questions, but it is unlikely that so many of them did so to threaten the effectiveness of the messages across the board.

It is also possible that participants did not pay attention to the messages and the survey questions and they hurried to finish without too much thought. Regarding the messages, they were scheduled to remain on the screen for 20 seconds before participants could move forward specifically for the purpose of increasing the likelihood that individuals would actually read the messages versus mindlessly scrolling through them. However, this precaution might not have been sufficient (i.e., one can still choose to stare at a screen for 20 seconds without reading and processing the information on that screen). Regarding the survey questions, "straight liner" participants were deleted from the dataset during the data cleaning process. Finally, participants who finished the survey in less than

seven minutes were also excluded, lessening the concern that individuals who rushed to finish the survey might have affected the results.

It is more likely that participants did not engage with the messages. Maybe the format of the messages (i.e., black text on a white screen) was not conducive to cognitive engagement and information processing, particularly given that the study was conducted as an online experiment. Also, as stated previously, it is possible that participants failed to notice the one counterfactual statement at the end of their respective message.

To further probe the impact of counterfactual thinking on medication adherence (or lack of), experiment 3 was designed in which several changes were implemented to address the concerns identified above. Chapter 7 presents experiment 3.

Chapter 7: Experiment 3

The purpose of experiment 3 was to try to address the stimuli- and sample-related issues identified at the conclusion of the first two experiments. If after addressing these issues to the best extent differences between experimental conditions are not observed, one could more strongly conclude that counterfactual thinking is not an effective persuasive strategy in a medication adherence health context.

Overview of Implemented Changes

Changes were implemented to strengthen the experimental manipulation; to facilitate participant engagement; and to include self-generated counterfactual thinking conditions, in light of past research that has found persuasive effects of self-generated CFT.

Two changes were undertaken to strengthen the counterfactual thinking manipulation in experiment 3. First, to ensure that participants notice the counterfactual thinking statements, the vignettes used in experiment 3 included two such statements instead of just one (also see Tal-Or et al., 2004). Second, a manipulation check was added to verify that participants' perceptions of the upward versus downward counterfactual thinking statements were distinct (the manipulation checks are further detailed when describing the study measures below).

To facilitate participant engagement, the new vignettes were created in audio format, as there is research to suggest that formats other than text are more effective in eliciting reactions (Stanczyk, De Vries, Candel, Muris, & Bolman, 2016). Moreover,

verbal channels, such as audio, are believed to reduce the cognitive effort needed to process the information and, thus, lead to better understanding and more in-depth processing of information (Stanczyk et al., 2016). Relatedly, in a meta-analysis of effectiveness of internet-based procedures for inducing affect, Ferrer, Grenen, and Taber (2015) found that video inductions (i.e., having participants watch a clip), compared to text or writing-based inductions, were most effective at inducing affect.

Whereas video and audio experimental manipulations are not the same, they are more similar to one another than they are to text-based manipulations. Specifically, both video and audio stimuli contain sound, whereas text-based stimuli do not. Because the goal was for participants to engage with the information in the message (i.e., the counterfactual thinking included in the story) rather than the character delivering it (through identification with the character, for example) or with other characteristics present in a video versus an audio message (e.g., character appearance, colors, environment), an audio as opposed to a video message was preferred. In support of this argument, a study comparing video with audio messages on the topic of amniocentesis found that audio messages were more effective at increasing perceptions of miscarriage likelihood; the authors reasoned that, compared to video messages, the audio messages did not offer visual alternatives for counteracting the information delivered (Muller & Cameron, 2014).

To further ensure participant engagement throughout the survey, several strategic attention checks were added to separate participants who carefully considered the survey from those who paid less attention (described below). Moreover, each survey page was

timed to ensure that participants spent a minimum amount of time reading and answering the survey items.

Finally, drawing insight from prior studies, the two incidental counterfactual thinking conditions from experiment 1 and 2 were replaced with three integral self-generated counterfactual thinking conditions. As already mentioned, prior research that found strong effects of counterfactual thinking on behavior and other perceptions in health contexts primarily looked at participant-generated counterfactual thinking (as opposed to stated or "spoon-fed" counterfactual thinking) or a combination of both self-generated and stated counterfactual thinking. Including these conditions has several advantages. First, if effects are not observed for self-generated counterfactual thinking either, the conclusion that counterfactual thinking may not work as a persuasive strategy for medication adherence is strengthened. Second, any effects (or lack of) observed will be comparable to prior studies that used a similar design. Finally, strictly from a communication perspective, integral counterfactual thinking, as opposed to incidental counterfactual thinking, is more useful because the goal is to understand what elements within the message (as opposed to elements outside the message as it is the case with incidental cognitions) are effective in eliciting change.

Regarding the relative persuasiveness of the stated versus self-generated counterfactual thinking conditions, only one prior study has compared the two. In this study, Tal-Or and colleagues (2004; Experiment 2) asked participants to watch a video depicting the story of a person severely injured in a car accident. Then, some participants were asked to generate their own upward counterfactuals, whereas other participants were asked to simply review the upward counterfactuals already stated in the narrative.

Participants' attitudes toward traffic safety regulations did not differ depending on whether the upward counterfactual thinking statements were stated in the story or were generated by participants; and, although attitudes in the stated upward counterfactual condition decayed slightly more than those in the self-generated upward counterfactual condition at a one-week follow-up, this difference was not significant. It appears, then, that the stated and self-generated upward counterfactual conditions should not be significantly different. However, because the dependent variables explored in experiment 3 (i.e., self-efficacy, response efficacy, and behavioral intentions) are different from those explored by Tal-Or and colleagues (i.e., attitudes), the self-generated and stated counterfactual thinking conditions will be compared with one another.

The following section details these changes and the design of experiment 3.

Method

Sample and procedures

The experimental conditions in experiment 3 varied based on whether the counterfactual thinking statements were stated or self-generated and on whether the counterfactual thoughts in those statements were upward or downward. A control condition in which no counterfactual thinking was present was also included. Experiment 3 was conducted in the context of type 2 diabetes.

The same recruitment method was used as in experiments 1 and 2. Participants were recruited using Amazon Mechanical Turk (MTurk) and were similarly screened for type 2 diabetes medication nonadherence risk. In the recruitment ad, participants were informed that the study required audio equipment and that they will be listening to

information and answering questions regarding that information throughout their participation in the study. Individuals who participated in experiment 1 and the pilot study were not eligible for participation in experiment 3.

Qualified participants were redirected to experiment 3 hosted by Qualtrics. Here, participants first answered a few questions about their medication-related behavior and perceptions (detailed in the Measures section). They were then instructed to turn on their audio system. After that, they took part in a brief trial to ensure they could properly hear the audio messages. In this trial, participants listened to a character named Robert introducing himself. At the end of this introduction, participants answered a multiple-choice question about Robert's favorite animal. Participants who correctly answered this question were instructed to proceed to the main study. Participants who incorrectly answered this question were instructed to double check their audio system and to make sure they paid attention to subsequent information presented in the study; then, they were instructed to proceed to the main study.

After this exercise, participants were randomly assigned to one of the experimental conditions and listened to the corresponding vignette. All participants then answered questions similar to the ones in experiment 1.

Stimuli

The story preceding counterfactual thinking remained the same as in experiment 1. Specifically, participants were exposed to the story of an individual who had been diagnosed with type 2 diabetes. The character then confessed that the type 2 diabetes medication that his doctor had prescribed was causing uncomfortable side effects, so he stopped taking it, thinking that he would be alright. After about one week of not taking

the medication, the character started feeling dizzy, so he went to the emergency room, where the doctors told him his diabetes worsened.

In the two stated counterfactual thinking conditions, this story ended with the character reflecting on his situation using two upward/downward counterfactual thinking statements. Specifically, in the stated upward counterfactual thinking condition the following statements were used: “I couldn’t help but think that if only I had taken my medication as prescribed, I would have been fine! If only I had taken my medication as prescribed, my condition wouldn’t have worsened and I would not be in the hospital right now!”. In the downward counterfactual thinking condition, the following statements were used: “I couldn’t help but think that it could have been worse! I could have died!”.

In the self-generated counterfactual thinking conditions, participants were instructed to generate their own counterfactual thinking statements. In research using this method, participants are usually instructed to fill in sentences with actions that undo the negative outcome, meaning that the negative outcome is stated and participants are asked to fill in the statements with alternative actions that could change that outcome (e.g., Baek, Shen, & Reid, 2013; Nan, 2008; Page & Colby, 2003). For instance, if the outcome is a car accident, participants are asked to fill in sentences such as this one: “If only I had _____, I wouldn’t have gotten in a car accident!”. Translating this method to this experiment, participants would be asked to fill in sentences such as this one: “If only the character had _____, his illness wouldn’t have gotten worse!”.

Yet, the key behavior that the messages in this study are trying to promote is taking one’s medication. If participants are asked to think about actions that would undo the worsening of the character’s illness, they may or may not come up with “if the

character had taken his medication, his illness wouldn't have worsened" (unlikely given the story preceding the counterfactual thinking generation, but still possible).

It is not clear if and how this issue would affect the results. In one scenario, none of the participants would fill in such statements with the key behavior of taking one's medication, in which case, the effect of this experimental condition on medication adherence-related factors would likely not be significant. In another scenario, all participants would fill in these statements with the key behavior of taking one's medication. In a more probable scenario, participants would be somewhere in between, thinking about a mix of actions, some of which would be taking one's medication.

Given the uncertainty, experiment 3 included two different self-generated upward counterfactual thinking conditions. In one of the conditions, in line with prior research, participants were instructed to think what the character in the story could have done differently to prevent his illness from getting worse; they were then asked to fill in two sentences with alternative behaviors that would undo the outcome. In the other condition, participants were instructed to think about how things could have been better if the character had taken their medication as prescribed; they were then asked to generate two alternative outcomes, given a different behavior than the one performed in the vignette: "If only the character had taken the medication, he wouldn't have _____". No predictions were made about potential differences between these two conditions.

Participants in the self-generated downward counterfactual condition were instructed to think about how the character's situation could have been worse than it is and fill in two statements such as this one: "The character could have____". Finally, the

control condition did not include any type of counterfactual thinking at the end of the story.

In all conditions, the vignettes were in audio format. Participants listened to the story as being verbally narrated by a man. Please see Appendix D for the stimuli.

Results

Participants

Data collection occurred between July 18th and August 1st, 2017. A total of 1,631 participants accessed the screening survey. Out of those, 341 qualified for participation in the study. All 341 individuals were compensated with $1 for their participation. Out of the 341, 38 missed attention checks and their data were not saved. Thus, the total sample included 303 individuals. The average study completion time was 15.44 minutes (*SD* = 12.25; *Min* = 8.34 minutes; *Max* = 103.02).

Participants were, on average, 37.43 years old (*SD* = 12.38; *Min* = 18; *Max* = 80; 2 participants did not report their age); 52.5% were women (47.5% were men; no one self-identified as gender fluid); 68.0 % were White (13.5% Black/African American; 7.9% Latino/Hispanic; 5.6% Asian/Pacific Islander; 3.0% Native American; 1.7% Mixed; 1 participant declined to answer this question); 41.9% were college graduates (3.0% had some high school; 11.6% were high school graduates; 33.0% had some college; and 10.6% had post-college education). A total of 7.6% reported their household yearly income below $15,000 (12.2% between $15,000 and $25,000; 22.4% between $25,001 and $45,000; 27.7% between $45,001 and $65,000; 19.5% between $65,001 and $100,000; 9.6% more than $100,000 and 1% did not know). Finally, 57.8% of

participants reported having been diagnosed with their illness for less than one year; 16.2% for two years; 8.9% for 3 years; 6.3% for 4 years; 4.3% for 5 years; 0.7% for 6 years; and 5.9% for more than 6 years. Table 7 provides a summary of these characteristics.

Measures

Manipulation checks. To ensure that participants in the stated counterfactual thinking conditions perceived the counterfactual thinking statements as intended, a manipulation check was used. Participants in the stated counterfactual thinking conditions and those in the control conditions were asked to rate the following items on a scale from 1- strongly disagree to 7 – strongly agree: The character in the story mentioned what he could have done to avoid the negative situation he is now in; The character in the story mentioned how his situation could have been worse. The manipulation check items appeared later in the survey so that they would not affect participants' answers to the items measuring the dependent variables in the study.

A manipulation check was not used for the self-generated counterfactual thinking conditions because in these conditions participants provided their own counterfactual thoughts following a prompt that explicitly instructed to frame their statements as counterfactual thoughts (of note, prior studies in which participants generated their own counterfactual thinking statements did not use a manipulation check either).

Dependent variables. For measuring dependent variables, the same items as the ones in experiment 1 were used in experiment 3, as well, unless otherwise noted.

Self-efficacy. The seven items used to measure this construct formed a unidimensional construct and loaded on one component that explained 69.97% of

variance in the construct. The items were also internally consistent (Cronbach's alpha = .93). The items were averaged to form an overall index of medication adherence self-efficacy (*M* = 4.91; *SD* = 0.98; *Min* = 1; *Max* = 7).

Response efficacy and outcome expectations. Similar to experiment 1, there was overlap between the seven items used to measure response efficacy and the seven items used to measure outcome expectations, respectively. Specifically, the ten items tapping into expectations about medication adherence effects on one's health and quality of life loaded on one component that explained 50.33 % of the variance in the construct; the items were internally consistent (Cronbach's alpha = .94) and they were averaged into an overall index of medication adherence response efficacy (*M* = 4.91; *SD* = 1.00; *Min* = 2; *Max* = 7).

Out of the remaining four items, only two of them loaded on the same factor (i.e., "I believe that if I take my medication as prescribed by my doctor, my family and friends will like me more."; and "I believe that if I take my medication as prescribed by my doctor, my family and friends will trust me more."), with the other two items cross-loading on two factors (i.e., "I believe that taking my medication as prescribed by my doctor will make my family and friends happy"; "I believe that if I take my medication as prescribed by my doctor, my family and friends will support me."). The first two items were averaged into an overall index of outcome expectations (*Pearson's r* = .87, $p < .001$; *M* = 4.32; *SD* = 1.86; *Min* = 1; *Max* = 7).

Behavioral intentions. The items used to measure this construct loaded on one component that explained 76.64% of the variance; the items were also internally

consistent (Cronbach's alpha = .92) and were averaged into an overall index of medication adherence behavioral intention (*M* = 4.68; *SD* = 1.01; *Min* = 1; *Max* = 7).

Moderator

Regret. The three items used to measure regret were also unidimensional (the component explained 83.99% of the variance in the construct) and internally consistent (Cronbach's alpha = .90). They were, thus, averaged together (*M* = 3.30; *SD* = 1.28; *Min* = 1; *Max* = 7).

Covariates

Doctor-patient communication. The eight items formed a unidimensional scale and were internally consistent; therefore, they were averaged into an overall index of doctor-patient communication (items explained 69.27% of variance in the construct; Cronbach's alpha = .97; *M* = 5.16; *SD* = 1.38; *Min* = 1; *Max* = 7).

History of medical complications. A total of 29.0% of participants reported having experienced health complications due to nonadherence once; 20.5% more than once; and 50.5% never. A total of 10.6% reported having hospitalized due to nonadherence once; 5.3% more than once; and 84.2% never. The two items were dummy coded (1 for yes and 0 for no) to be used in subsequent analyses.

Experience of medication side effects. The two items, fear of medication side effects and having experienced side effects, correlated significantly and were averaged together (*Pearson's r* = .52, $p < .001$; *M* = 3.95; *SD* = 1.54; *Min* = 1; *Max* = 7).

Depressive symptoms. The four items formed a unidimensional and internally consistent scale and the items were averaged to form an index of depressive symptoms

(items explained 80.05% of variance in the construct; Cronbach's alpha = .92; *M* = 3.12; *SD* = 1.76; *Min* = 1; *Max* = 7).

Prior medication adherence behavior. Participants in experiment 3 were also asked about their medication adherence prior to exposure to the study stimuli. Participants answered the following question: Are you currently taking your diabetes medication consistently as prescribed by your doctor?; which they answered by choosing one of the following options: No, I stopped taking my medication; I take my medication inconsistently, most of the days I don't take it; I take my medication inconsistently, but I do take it most days; yes, I take my medication as prescribed every day. Only 1% of participants reported that they had stopped taking their medication altogether; 8.3% reported not taking their medication most of the days; 20.1% reported taking their medication most days; and 70.6% reported taking their medication as prescribed every day.

Medication nonadherence risk. Also prior to message exposure, participants rated six items that tapped into their risk for nonadherence on a scale from 1 - strongly disagree to 7 – strongly agree: 1) I think the severity of my diabetes is low. 2) I am concerned that I will gain weight if I take my diabetes medication. 3) I am concerned that my risk for cardiovascular illness will increase if I take my diabetes medication. 4) I think my diabetes medication is not effective. 5) I think that my diabetes medication is not necessary; 6) I don't think it's such a big deal if I don't take my diabetes medication every day. The first three items cross-loaded on two components, whereas the last three loaded on the same component and explained 40.95% of the variance in the underlying construct. The three items were also internally consistent (Cronbach's alpha = .78),

therefore, they were averaged together into an overall index of risk for medication nonadherence (*M* = 3.06; *SD* = 1.32; *Min* = 1; *Max* = 7).

For a summary of measures please see Table 8. Bivariate correlations between variables are presented in Table 9.

Attention checks. Three attention checks were used in experiment 3. The first attention check was included in the trial exercise (described above in the Stimuli section) and its purpose was twofold: 1) to ensure participants can hear the audio messages properly; and 2) to remind participants of the importance of paying attention to the information and questions in the study. Therefore, if participants incorrectly answered this attention check, they were not terminated from the study.

The second attention check appeared after exposure to the study stimuli and asked participants when the character in the story started feeling sick after deciding not to take their medication anymore (correct answer: after about one week). Given that carefully listening to the main message in the study was critical, participants who provided an incorrect answer to this question were terminated from the survey immediately and the data they provided up to that point were deleted.

Finally, a third attention check or "clicker trap" was included among the self-efficacy measures to filter out participants who might mindlessly go through the survey items and rate them all as a "1" or a "7" on the 7-point scales used. This clicker trap read as follows: "How confident are you that you are paying attention? Please select option '5', this is an attention check." If participants selected an option other than 5, they were, again, terminated from the study and their data were deleted. Of note, participants were

informed about these attention checks and about their termination from the study if they provided incorrect answers in the consent form.

Hypothesis testing

Manipulation checks. An analysis of variance including the stated upward counterfactual, stated downward counterfactual, and control conditions was run to check if the experimental manipulation was successful. In the stated upward counterfactual thinking condition, participants reported higher agreement levels with the statement "The character in the story specifically mentioned what he could have done to avoid the negative situation he is now in." (F (2, 156) = 36.43, $p < .001$; partial $\eta^2 = .32$; $M = 6.20$, 95% CI = [5.69; 6.71]) than both participants in the stated downward counterfactual thinking condition ($M = 3.82$, 95% CI = [3.32; 4.31]) and participants in the control condition ($M = 3.31$, 95% CI = [2.81; 3.81]). As illustrated by overlapping 95% confidence intervals, there was no significant difference between the stated downward counterfactual condition and the control condition.

Similarly, in the downward counterfactual thinking condition, participants reported higher agreement levels with the statement "The character in the story specifically mentioned how his situation could have been worse" (F (2, 156) = 44.56, $p < .001$; partial $\eta^2 = .37$; $M = 5.50$, 95% CI = [4.99; 6.00]) than both participants in the stated upward counterfactual thinking condition ($M = 2.52$, 95% CI = [1.99; 3.04]) and participants in the control condition ($M = 2.54$, 95% CI = [2.03; 3.05]). As illustrated by overlapping 95% confidence intervals, there was no significant difference between the stated downward counterfactual condition and the control condition. The experimental manipulation was, then, successful.

Analysis of covariance. As in experiments 1 and 2, ANCOVA analyses were ran first to assess group differences and the effect of the covariates on each of the dependent variables (i.e., self-efficacy, response efficacy, outcome expectancy, and behavioral intention). Given that skeweness and kurtosis levels fell within appropriate values (i.e., [-.80; .80]) for all variables, data transformation was not necessary (Fink, 2009).

Self-efficacy. Reported levels of self-efficacy differed based on experimental condition (F (5, 301) = 15.11, $p < .001$; partial $\eta^2 = .21$). Participants in all upward CFT conditions reported higher levels of self-efficacy ($M_{statedUP}$ = 5.03, 95% CI = [4.78; 5.27]; $M_{gen\_outcomes}$ = 5.41, 95% CI = [5.17; 5.66]; $M_{gen\_behaviors}$ = 5.54, 95% CI = [5.29; 5.79]) than participants in the stated downward CFT condition ($M_{statedDown}$ = 4.42, 95% CI = [4.18; 4.65]) and those in the control condition ($M_{control}$ = 4.46, 95% CI = [4.22; 4.69]). The stated upward and the self-generated downward CFT conditions were not significantly different from one another, as illustrated by overlapping 95% confidence intervals ($M_{genDown}$ = 4.69, 95% CI = [4.44; 4.94]); however, the self-generated upward CFT conditions were significantly different form the self-generated downward CFT condition. Among upward CFT conditions, participants who generated alternative behaviors ($M_{gen\_behaviors}$ = 5.54, 95% CI = [5.29; 5.79]) reported higher levels of self-efficacy than participants in the stated CFT condition ($M_{statedUP}$ = 5.03, 95% CI = [4.78; 5.27]); no other significant differences emerged. There were no significant differences among participants in the two downward CFT conditions and those in the control condition.

Among covariates, doctor-patient communication had a significant effect on self-efficacy. Regression analyses showed that the more positive the communication between

the participant and their doctor was evaluated, the higher the medication adherence self-efficacy reported (b = .18, p = .005, 95% CI = [0.04; 0.22]). Because the effect of gender on self-efficacy approached significance (p = .07), gender was included as a covariate in subsequent mediation and moderation analyses.

Response-efficacy. Levels of response efficacy also differed based on experimental condition (F (5, 301) = 14.99, p < .01; partial η^2 = .20). Specifically, participants in all upward CFT conditions reported higher levels of response efficacy ($M_{statedUP}$ = 5.11, 95% CI = [4.89; 5.36]; $M_{gen\_outcomes}$ = 5.36, 95% CI = [5.11; 5.60]; $M_{gen\_behaviors}$ = 5.56, 95% CI = [5.31; 5.81]) than participants in all downward CFT conditions ($M_{statedDown}$ = 4.34, 95% CI = [4.10; 4.57]; $M_{genDown}$ = 4.63, 95% CI = [4.39; 4.89]) and those in the control condition ($M_{control}$ = 4.55, 95% CI = [4.31; 4.79]). There were no significant differences among participants in the upward CFT conditions or among participants in the two downward CFT conditions and those in the control condition.

Among covariates, doctor-patient communication had a significant effect on response efficacy. The more positive the communication between the participant and their doctor was evaluated, the higher the medication adherence self-efficacy reported (b = .23, p < .001, 95% CI = [0.08; 0.25]). No other significant covariates emerged.

Outcome expectancy. Levels of outcome expectancy did not differ among experimental conditions (F (5, 301) = 0.70, p = .62). Among covariates, doctor-patient communication and risk for nonadherence emerged as significant, while income approached significance (p = .08). The more positive participants evaluated their communication with their doctor, the higher their outcome expectancy was (b = .35, p <

.001, 95% CI = [0.31; 0.64]). Similarly, the higher participants' risk for nonadherence was, the higher their outcome expectancy was, as well (b = .21, p = .002, 95% CI = [0.11; 0.47]).

Behavioral intention. Finally, behavioral intention to take one's medication as prescribed was different among experimental conditions (F (5, 301) = 17.34, p < .001; partial η^2 = .23). Pairwise comparisons showed that participants in all upward CFT conditions reported higher medication adherence intentions ($M_{statedUP}$ = 4.86, 95% CI = [4.61; 5.11]; $M_{gen\_outcomes}$ = 5.26, 95% CI = [5.02; 5.51]; $M_{gen\_behaviors}$ = 5.34, 95% CI = [5.09; 5.60]) than participants in all downward CFT conditions ($M_{statedDown}$ = 4.32, 95% CI = [4.08; 4.55]; $M_{genDown}$ = 4.20, 95% CI = [4.95; 4.45]) and those in the control condition ($M_{control}$ = 4.22, 95% CI = [3.98; 4.46]). There were no significant differences among participants in the upward CFT conditions or among participants in the two downward CFT conditions and those in the control condition.

Among covariates, doctor-patient communication, education level, and gender were significant. Regression analyses showed that the more positive doctor-patient communication was evaluated, the higher the intention reported (b = .19, p = .003, 95% CI = [0.05; 0.23]); that more educated individuals had higher intention to adhere to medication (b = .15, p = .015, 95% CI = [0.03; 0.31]); and that women had higher intention to adhere to medication as prescribed compared to men (b = .12, p = .033, 95% CI = [0.02; 0.48]).

SPSS Indirect Macro Analyses. To further test the study hypotheses and answer its research questions, a series on analyses using SPSS Indirect Macro which uses bootstrapping techniques for the standard errors were performed (Preacher and Hayes,

2008). The 95% confidence intervals for all effects used 10,000 bootstrapped samples. Specifically, Indirect Macro was used to: 1) test the direct effects of the upward CFT conditions (versus the downward CFT conditions) on self-efficacy, response efficacy, outcome expectancy, and behavioral intention; 2) test the indirect effects of the upward CFT conditions (versus the downward CFT conditions) on behavioral intention, through self-efficacy, response efficacy, and outcome expectancy; and 3) test the interaction between the upward CFT conditions (versus the downward CFT conditions) and regret on self-efficacy, response efficacy, outcome expectancy, and behavioral intention.

Stated upward CFT versus stated downward CFT. First, the stated upward CFT condition was compared to the stated downward CFT condition. Model 4 was used to explore direct and indirect effects (hypotheses 1 through 5; and research questions 1 and 2); then, model 1 was used to explore the interaction effects (hypotheses 6 and 7; and research questions 3 and 4); finally, model 8 was used to explore the existence of conditional indirect effects (hypothesis 8; and research questions 5 and 6).

Direct effects

Model 4 was used to test for direct and indirect effects. The independent variable was dummy coded such that the stated downward CFT condition served as the reference category. Self-efficacy, response efficacy, and outcome expectancy were entered as mediators and behavioral intention was entered as the dependent variable. Based on ANCOVA results, doctor-patient communication, gender, education, income, and risk for medication nonadherence were entered as covariates.

The model significantly predicted medication adherence behavioral intention (R^2 = .47, F (9, 97) = 9.42, p < .001). The experimental condition, however, did not have a

significant direct effect on intention (b = .17, p = .232, 95% CI = [-0.11; 0.45]). Hypothesis 1 was not supported.

The model significantly predicted self-efficacy (R^2 = .13, F (6, 97) = 2.35, p = .036). The experimental condition had a significant effect on self-efficacy, such that participants in the stated upward counterfactual thinking condition reported higher levels of self-efficacy compared to participants in the stated downward counterfactual thinking condition (b = .53, p = .001, 95% CI = [0.23; 0.83]). Hypothesis 2 was supported.

Response efficacy was also significantly predicted by the model (R^2 = .27, F (6, 97) = 5.90, p < .001). The experimental condition had a significant direct effect on response efficacy, such that participants in the stated upward counterfactual thinking condition reported higher levels of response efficacy compared to participants in the stated downward counterfactual thinking condition (b = .71, p < .001, 95% CI = [0.44; 0.99]). Hypothesis 3 was supported.

The model also significantly predicted outcome expectancy (R^2 = .26, F (6, 97) = 5.80, p < .001), however, mirroring ANCOVA results, the experimental condition did not significantly predict this variable (b = -.11, p = .74, 95% CI = [-0.75; 0.53]). The response to the first research question, then, is that individuals in the stated upward CFT condition do not differ from individuals in the stated downward CFT condition in terms of outcome expectancy.

Indirect effects

The indirect effect of the experimental condition on behavioral intention through self-efficacy was significant (b = .16; 95% CI = [0.06; 0.34]), such that individuals in the stated upward CFT condition, as opposed to those in the stated downward CFT condition,

reported higher levels of self-efficacy (b = .53, p = .0006, 95% CI = [0.23; 0.83]); and higher levels of self-efficacy were associated with increased medication adherence intention (b = .30; p = .009, 95% CI = [0.08; 0.52]). Hypothesis 4 was supported.

The indirect effect of the experimental condition on behavioral intention through response efficacy was also significant (b = .23; 95% CI = [0.06; 0.46]), such that individuals in the stated upward CFT condition, as opposed to those in the stated downward CFT condition, reported higher levels of response efficacy (b = .71, p < .001, 95% CI = [0.44; 0.99]); and higher levels of response efficacy were associated with increased medication adherence intention (b = .32; p = .008, 95% CI = [0.08; 0.56]). Hypothesis 5 was supported.

Finally, there was no indirect effect of the experimental condition on behavioral intention through outcome expectancy (b = -.01; 95% CI = [-0.07; 0.02]); nor was the association between outcome expectancy and behavioral intention significant (b = .06; p = .15, 95% CI = [-0.02; 0.14]). The response to the second research question, then, is that there is no indirect effect of experimental condition on medication adherence behavioral intention through outcome expectancy.

Interaction effects

Whether the experimental condition interacted with regret in predicting self-efficacy, response efficacy, outcome expectancy, and behavioral intention was tested using model 1. Regret was entered as a moderator; self-efficacy, response efficacy, outcome expectancy, and behavioral intention were entered as dependent variables (each in turn); and the same variables as in model 4 above were entered as covariates.

The interaction model significantly predicted self-efficacy (R^2 = .17, F (8, 97) = 2.47, p = .017) and the R^2 increase due to adding the interaction term to the model was also significant (R^2 change = .04, F (1, 97) = 4.52, p = .036). Regret significantly moderated the effect of the experimental condition on self-efficacy (b = -.33; p = .04; 95% CI = [-0.64; -0.02]). At one standard deviation below the mean and at the mean, the effect of the experimental condition (0 – downward CFT condition; 1 – upward CFT condition) on self-efficacy was significant and positive; while there was a decrease in the effect, the difference was not significant (at one standard deviation below the mean: regret = 2.35; b = .86; p = .0004; 95% CI = [0.39; 1.33]; at the mean: regret = 3.39; b = .52; p = .001; 95% CI = [0.21; 0.84]). At one standard deviation above the mean for regret, the effect of the experimental condition on self-efficacy became non-significant (regret = 4.44; b = .18; p = .409; 95% CI = [-0.25; 0.60]). Hypothesis 6 was supported.

The interaction model significantly predicted response efficacy (R^2 = .27, F (8, 97) = 4.41, p = .0001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .00, F (1, 97) = 0.06, p = .94). Regret did not moderate the effect of the experimental condition on response efficacy (b = -.01; p = .94; 95% CI = [-0.30; 0.28]). The response to research question 3, then, is that there is no interaction between the experimental condition and regret in predicting response efficacy.

Similarly, the interaction model significantly predicted outcome expectancy (R^2 = .27, F (8, 97) = 4.38, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .001, F (1, 97) = 0.13, p = .72). Regret did not moderate the effect of the experimental condition on outcome expectancy (b = -.12; p = .72; 95% CI = [-0.79; 0.55]). The response to research question 4, then, is that

there is no interaction between the experimental condition and regret on outcome expectancy.

Finally, the interaction model significantly predicted behavioral intention (R^2 = .25, F (8, 97) = 3.96, p = .0004); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .000, F (1, 97) = 0.0009, p = .98). Regret did not moderate the effect of the experimental condition on behavioral intention (b = -.01 p = .98; 95% CI = [-0.31; 0.31]). Hypothesis 7 was not supported.

Conditional indirect effects

In light of the results above, model 7 was also run to test for the existence of a moderated indirect effect of experimental condition on behavioral intention, through self-efficacy, with regret as a moderator of the relationship between experimental condition and self-efficacy. The index of moderated mediation (or, of a conditional indirect effect) was significant (b = -.16; 95% CI = [-.40; -.03]). Probing of this moderated mediation showed that, whereas at lower levels of regret (one standard deviation below the mean and at the mean), there was a positive indirect effect of the experimental condition on behavioral intention, through self-efficacy, at high levels of regret (one standard deviation above the mean), this effect became non-significant: at one standard deviation below the mean (regret = 2.35; b = .42; 95% CI = [0.22; 0.80]); at the mean (regret = 3.39; b = .25; 95% CI = [0.11; 0.48]); at one standard deviation above the mean (regret = 4.44; b = .09; 95% CI = [-0.14; 0.36]). Hypothesis 8 was supported.

Model 7 was also run with response efficacy and outcome expectancy as mediators, but, in line with findings from models 4 and 1, the moderated indirect effects were not significant in these models.

All models were run with the control condition as the reference category and results were largely the same, in line with ANCOVA results in which the stated downward CFT condition did not differ from the control condition on any of the dependent variables.

Self-generated outcomes upward CFT versus self-generated downward CFT. The same analyses as the ones above were repeated with the self-generated counterfactual thinking conditions. First, the self-generated upward CFT condition in which participants generated alternative outcomes given a different behavior (i.e., that of adhering to one's medication) was compared to the self-generated downward CFT condition.

Direct effects

The model significantly predicted medication adherence behavioral intention (R^2 = .39, F (9, 89) = 6.20, p < .001). The experimental condition had a significant positive direct effect on intention, such that individuals who generated alternative outcomes (given that the character had taken his medication as prescribed) reported higher intention to adhere to medication as prescribed than participants who generated downward CFT (b = .79, p < .001, 95% CI = [0.40; 1.19]). Hypothesis 1 was supported for self-generated alternative outcomes.

The model significantly predicted self-efficacy (R^2 = .21, F (6, 92) = 4.15, p = .001). The experimental condition had a significant effect on self-efficacy, such that participants who generated alternative outcomes reported higher levels of self-efficacy compared to participants who generated downward CFT (b = .77, p = .001, 95% CI = [0.35; 1.20]). Hypothesis 2 was supported with self-generated alternative outcomes.

Response efficacy was also significantly predicted by the model (R^2 = .18, F (6, 92) = 5.37, p = .005). The experimental condition had a significant effect on response efficacy, such that participants who generated alternative outcomes reported higher levels of response efficacy compared to participants who generated downward CFT (b = .74, p = .001, 95% CI = [0.30; 1.19]). Hypothesis 3 was supported with self-generated alternative outcomes.

The model significantly predicted outcome expectancy (R^2 = .16, F (6, 92) = 3.02, p = .01), however, mirroring ANCOVA results, the experimental condition did not significantly predict this variable (b = .38; p = .33, 95% CI = [-0.38; 1.13]). The response to the first research question, then, is that individuals who generate alternative outcomes do not differ from individuals who generate downward CFT in terms of outcome expectancy in a medication adherence context.

Indirect effects

The indirect effect of the experimental condition on behavioral intention through self-efficacy was not significant (b = .18; 95% CI = [-0.05; 0.56]); although the experimental condition had a significant effect on self-efficacy, such that individuals who generated alternative outcomes, as opposed to those who generated downward CFT, reported higher levels of self-efficacy (b = .77, p = .0005, 95% CI = [0.35; 1.20]); self-efficacy did not predict intention (b = .23; p = .18, 95% CI = [-0.11; 0.58]). Hypothesis 4 was not supported in this context.

The indirect effect of the experimental condition on behavioral intention through response efficacy was not significant either (b = .08; 95% CI = [-0.05; 0.56]); although individuals who generated alternative outcomes, as opposed to those who generated

downward CFT, reported higher levels of response efficacy (b = .74, p = .001, 95% CI = [0.30; 1.19]); response efficacy did not predict intention (b = .10; p = .54, 95% CI = [-0.23; 0.43]). Hypothesis 5 was not supported with self-generated alternative outcomes.

Finally, there was no indirect effect of the experimental condition on behavioral intention through outcome expectancy (b = .02; 95% CI = [-0.02; 0.14]); nor was the association between outcome expectancy and behavioral intention significant (b = .05; p = .34, 95% CI = [-0.05; 0.15]). The response to the second research question, then, is that there is no indirect effect of experimental condition on behavioral intention through outcome expectancy when comparing the self-generated alternative outcomes upward CFT condition with the self-generated downward CFT condition.

Interaction effects

The interaction model significantly predicted self-efficacy (R^2 = .33, F (8, 90) = 5.48, p < .001) and the R^2 increase due to adding the interaction term to the model was also significant (R^2 change = .07, F (1, 90) = 7.50, p = .007). Regret significantly moderated the effect of the experimental condition on self-efficacy (b = -.42; p = .007; 95% CI = [-0.73; -0.12]). At high levels of regret (one standard deviation above the mean), the effect of the experimental condition (0 – self-generated downward CFT condition; 1 – self-generated alternative outcomes upward CFT condition) on self-efficacy was not significant anymore: at one standard deviation below the mean (regret = 1.80; b = 1.31; p < .001; 95% CI = [0.74; 1.89]); at the mean (regret = 3.17; b = .73; p = .0004; 95% CI = [0.34; 1.13]); at one standard deviation above the mean (regret = 4.53; b = .16; p = .59; 95% CI = [-0.42; 0.74]). Hypothesis 6 was supported with self-generated alternative outcomes upward CFT.

The interaction model significantly predicted response efficacy (R^2 = .31, F (8, 90) = 5.00, p < .001) and the R^2 increase due to adding the interaction term to the model was also significant (R^2 change = .07, F (1, 90) = 9.71, p = .003). Regret moderated the effect of the experimental condition on response efficacy (b = -.50; p = .003; 95% CI = [-0.82; -0.18]). At high levels of regret (one standard deviation above the mean), the effect of the experimental condition on response efficacy was not significant anymore: at one standard deviation below the mean (regret = 1.80; b = 1.39; p < .001; 95% CI = [0.79; 1.99]); at the mean (regret = 3.17; b = .70; p = .001; 95% CI = [0.29; 1.12]); at one standard deviation above the mean (regret = 4.53; b = .01; p = .96; 95% CI = [-0.59; 0.62]). The response to research question 3, then, is that regret moderates the effect of the self-generated alternative outcomes upward CFT versus self-generated downward CFT on response efficacy.

Similarly, the interaction model significantly predicted outcome expectancy (R^2 = .23, F (8, 90) = 3.39, p = .002); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .002, F (1, 90) = 0.27, p = .60). Regret did not moderate the effect of the experimental condition on outcome expectancy (b = .15; p = .60; 95% CI = [-0.42; 0.72]). The response to research question 4, then, is that there is no interaction between the experimental condition and regret on outcome expectancy with self-generated alternative outcomes upward CFT.

Finally, the interaction model significantly predicted behavioral intention (R^2 = .31, F (8, 90) = 5.06, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .008, F (1, 90) = 1.15, p = .29). Regret did not moderate the effect of the experimental condition on behavioral intention (b = -

.16; p = .29; 95% CI = [-0.46; 0.14]). Hypothesis 7 was not supported with self-generated alternative outcomes upward CFT.

Conditional indirect effect

None of the conditional indirect effects were significant.

Self-generated behaviors upward CFT versus self-generated downward CFT. Second, the self-generated upward CFT condition in which participants generated alternative behaviors was compared to the self-generated downward CFT condition.

Direct effects

The model significantly predicted medication adherence behavioral intention (R^2 = .52, F (9, 85) = 10.62, p < .001). The experimental condition had a significant positive direct effect on intention, such that individuals who generated alternative behaviors reported higher intention to adhere to medication as prescribed than participants who generated downward CFT (b = .63, p = .002, 95% CI = [0.25; 1.01]). Hypothesis 1 was supported for self-generated alternative behaviors that could undo the outcome.

The model significantly predicted self-efficacy (R^2 = .24, F (6, 88) = 4.67, p = .0004). The experimental condition had a significant effect on self-efficacy, such that participants who generated alternative behaviors that undid the outcome reported higher levels of self-efficacy compared to participants in the self-generated downward counterfactual thinking condition (b = .91, p = .0001, 95% CI = [0.47; 1.35]). Hypothesis 2 was supported with self-generated alternative behaviors upward CFT, as well.

Response efficacy was also significantly predicted by the model (R^2 = .27, F (6, 88) = 5.41, p = .0001). The experimental condition had a significant effect on response efficacy, such that participants who generated alternative behaviors to undo the outcome

reported higher levels of response efficacy compared to participants who generated downward CFT (b = .98, p = .0001, 95% CI = [0.51; 1.44]). Hypothesis 3 was supported with self-generated alternative behaviors upward CFT.

The model did not significantly predict outcome expectancy (R^2 = .12, F (6, 88) = 2.05, p = .067), and, mirroring ANCOVA results, the experimental condition did not significantly predict this variable in these analyses either (b = .25; p = .54, 95% CI = [-0.54; 1.03]). The response to the first research question, then, is that individuals who generate alternative behaviors to undo a negative outcome do not differ from individuals who generate downward CFT in terms of outcome expectancy in a medication adherence context.

Indirect effects

The indirect effect of the experimental condition on behavioral intention through self-efficacy was not significant (b = .10; 95% CI = [-0.14; 0.43]); although the experimental condition had a significant effect on self-efficacy, such that individuals who generated alternative behaviors to undo the outcome, as opposed to those who generated downward CFT, reported higher levels of self-efficacy (b = .91, p = .0001, 95% CI = [0.47; 1.35]); self-efficacy did not predict intention (b = .11; p = .48, 95% CI = [-0.20; 0.42]). Hypothesis 4 was not supported in this context.

The indirect effect of the experimental condition on behavioral intention through response efficacy was significant (b = .43; 95% CI = [0.18; 0.81]), such that individuals who generated alternative behaviors upward CFT, as opposed to those who generated downward CFT, reported higher levels of response efficacy (b = .98, p = .0001, 95% CI =

[0.51; 1.44]); and higher levels of response efficacy were associated with increased intention (b = .44; p = .004, 95% CI = [0.14; 0.73]). Hypothesis 5 was supported.

Finally, there was no indirect effect of the experimental condition on behavioral intention through outcome expectancy (b = .0002; 95% CI = [-0.05; 0.06]); nor was the association between outcome expectancy and behavioral intention significant (b = .001; p = .99, 95% CI = [-0.10; 0.10]). The response to the second research question, then, is that there is no indirect effect of experimental condition on behavioral intention through outcome expectancy in this context.

Interaction effects

The interaction model significantly predicted self-efficacy (R^2 = .39, F (8, 86) = 7.15, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .008, F (1, 86) = 1.16, p = .28). Regret did not moderate the effect of the experimental condition on self-efficacy (b = -.15; p = .28; 95% CI = [-0.44; 0.13]).

The interaction model significantly predicted response efficacy (R^2 = .39, F (8, 86) = 6.97, p < .001); however, R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .02, F (1, 86) = 2.65, p = .11). Regret did not moderate the effect of the experimental condition on response efficacy (b = -.25; p = .11; 95% CI = [-0.55; 0.06]).

Similarly, the interaction model significantly predicted outcome expectancy (R^2 = .17, F (8, 86) = 2.19, p = .04); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .001, F (1, 86) = 0.12, p = .73). Regret did

not moderate the effect of the experimental condition on outcome expectancy (b = -.10; p = .73; 95% CI = [-0.64; 0.45]).

Finally, the interaction model significantly predicted behavioral intention (R^2 = .35, F (8, 86) = 5.70, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .000, F (1, 86) = 0.001, p = .98). Regret did not moderate the effect of the experimental condition on behavioral intention (b = -.004; p = .98; 95% CI = [-0.29; 0.29]).

Conditional indirect effect

None of the conditional indirect effects were significant.

Stated upward CFT versus self-generated outcomes upward CFT. One last set of analyses was run to compare the stated upward CFT condition to the self-generated upward CFT conditions. The stated upward CFT condition served as the reference category in these analyses. First, the stated upward CFT condition was compared to the condition in which participants generated alternative outcomes if a different behavior had been performed (i.e., that of adhering to one's medication).

Direct effects

The model significantly predicted medication adherence behavioral intention (R^2 = .30, F (9, 91) = 4.625, p < .001). The experimental condition had a significant positive direct effect on intention, such that individuals who generated alternative outcomes reported more intention to adhere to medication as prescribed than participants who were exposed to a stated upward CFT message (b = .36, p = .04, 95% CI = [0.02; 0.69]).

The model significantly predicted self-efficacy (R^2 = .13, F (6, 94) = 2.30, p = .04). The experimental condition had a significant effect on self-efficacy, such that

participants who generated alternative outcomes reported higher levels of self-efficacy compared to participants in the stated upward CFT message condition (b = .40, p = .007, 95% CI = [0.11; 0.69]).

Response efficacy was not significantly predicted by the model (R^2 = .08, F (6, 94) = 1.41, p = .22). The experimental condition had a significant effect on response efficacy, such that participants who generated alternative outcomes reported higher levels of response efficacy compared to participants exposed to a stated upward CFT; however, given that the regression model was not significant, this effect should be interpreted with caution (b = .27, p = .04, 95% CI = [0.02; 0.53]). Of note, none of the covariates in this model were significant predictors of response efficacy. Excluding the covariates from the analyses led to a significant regression model (R^2 = .05, F (1, 99) = 5.58, p = .02); in this model, as well, participants who generated alternative outcomes reported higher levels of response efficacy compared to participants exposed to a stated upward CFT (b = .29, p = .02, 95% CI = [0.05; 0.53]).

The model significantly predicted outcome expectancy (R^2 = .30, F (6, 94) = 6.67, p < .001), however, the effect of the experimental condition was not significant (b = .31; p = .32, 95% CI = [-0.30; 0.93]).

Indirect effects

The indirect effect of the experimental condition on behavioral intention through self-efficacy was not significant (b = .09; 95% CI = [-0.02; 0.29]); although the experimental condition had a significant effect on self-efficacy, such that individuals who generated alternative outcomes, as opposed to those who were exposed to a stated upward

CFT, reported higher levels of self-efficacy (b = .40, p = .007, 95% CI = [0.11; 0.69]); self-efficacy did not predict intention (b = .22; p = .20, 95% CI = [-0.12; 0.55]).

The indirect effect of the experimental condition on behavioral intention through response efficacy was not significant either (b = .09; 95% CI = [-0.02; 0.29]); although individuals who generated alternative outcomes, as opposed to those who were exposed to a stated upward CFT, reported higher levels of response efficacy (b = .27, p = .04, 95% CI = [0.02; 0.53]), higher levels of response efficacy were not associated with increased intention (b = -.17; p = .36, 95% CI = [-0.54; 0.19]).

Finally, there was no indirect effect of the experimental condition on behavioral intention through outcome expectancy (b = .009; 95% CI = [-0.02; 0.11]); nor was the association between outcome expectancy and behavioral intention significant (b = .03; p = .62, 95% CI = [-0.08; 0.14]).

Interaction effects

The interaction model did not significantly predict self-efficacy (R^2 = .14, F (8, 92) = 4.28, p = .06); the R^2 increase due to adding the interaction term to the model was also not significant (R^2 change = .003, F (1, 92) = 0.29, p = .59). Regret did not moderate the effect of the experimental condition on self-efficacy (b = .08; p = .59; 95% CI = [-0.21; 0.36]).

The interaction model did not significantly predict response efficacy either (R^2 = .11, F (8, 92) = 1.46, p = .18); the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .005, F (1, 92) = 0.49, p = .49). Regret did not moderate the effect of the experimental condition on response efficacy (b = -.09; p = .49; 95% CI = [-0.35; 0.17]).

Similarly, the interaction model significantly predicted outcome expectancy (R^2 = .33, F (8, 92) = 5.70, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .007, F (1, 92) = 0.92, p = .34). Regret did not moderate the effect of the experimental condition on outcome expectancy (b = .29; p = .34; 95% CI = [-0.31; 0.90]).

Finally, the interaction model significantly predicted behavioral intention (R^2 = .29, F (8, 92) = 4.76, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .01, F (1, 92) = 1.30, p = .26). Regret did not moderate the effect of the experimental condition on behavioral intention (b = -.18; p = .26; 95% CI = [-0.50; 0.14]).

Conditional indirect effect

None of the conditional indirect effects were significant.

Stated upward CFT versus self-generated behaviors upward CFT. Second, the stated upward CFT condition was compared to the condition in which participants generated alternative behaviors to undo the negative outcome. Here, as well, the stated upward CFT condition served as the reference category.

Direct effects

The model significantly predicted medication adherence behavioral intention (R^2 = .39, F (9, 87) = 6.20, p < .001). The experimental condition did not have a significant effect on intention (b = .22, p = .21, 95% CI = [-0.12; 0.57]).

The model significantly predicted self-efficacy (R^2 = .19, F (6, 90) = 3.49, p = .004). The experimental condition had a significant effect on self-efficacy, such that participants who generated alternative behaviors to undo the negative outcome in the

story reported higher levels of self-efficacy compared to participants in the stated CFT condition (b = .55, p = .001, 95% CI = [0.25; 0.85]).

Response efficacy was also significantly predicted by the model (R^2 = .25, F (6, 90) = 4.95, p < .001). The experimental condition had a significant effect on response efficacy, such that participants who generated alternative behaviors reported higher levels of response efficacy compared to participants exposed to a stated upward CFT (b = .46, p = .002, 95% CI = [0.18; 0.75]).

The model significantly predicted outcome expectancy (R^2 = .17, F (6, 90) = 3.16, p = .007), however, the effect of the experimental condition on outcome expectancy was not significant (b = .38; p = .26, 95% CI = [-0.28; 1.05]).

Indirect effects

The indirect effect of the experimental condition on behavioral intention through self-efficacy was not significant (b = .08; 95% CI = [-0.09; 0.29]); although the experimental condition had a significant effect on self-efficacy, such that individuals who generated alternative behaviors, as opposed to those who were exposed to a stated upward CFT, reported higher levels of self-efficacy (b = .55, p = .001, 95% CI = [0.25; 0.85]); self-efficacy did not predict intention (b = .15; p = .37, 95% CI = [-0.18; 0.47]).

The indirect effect of the experimental condition on behavioral intention through response efficacy was significant (b = .19; 95% CI = [0.04; 0.45]); individuals who generated alternative behaviors, as opposed to those who were exposed to a stated upward CFT, reported higher levels of response efficacy (b = .46, p = .002, 95% CI = [0.18; 0.75]), and higher levels of response efficacy were associated with increased intention (b = .41; p = .02, 95% CI = [0.06; 0.75]).

Finally, there was no indirect effect of the experimental condition on behavioral intention through outcome expectancy (b = .007; 95% CI = [-0.03; 0.11]); nor was the association between outcome expectancy and behavioral intention significant (b = .02; p = .70, 95% CI = [-0.08; 0.12]).

Interaction effects

The interaction model significantly predicted self-efficacy (R^2 = .28, F (8, 88) = 4.28, p < .001); the R^2 increase due to adding the interaction term to the model was also significant (R^2 change = .05, F (1, 88) = 5.80, p = .02). Regret moderated the effect of the experimental condition on self-efficacy (b = .33; p = .02; 95% CI = [0.06; 0.61]), such that, at low levels of regret (one standard deviation below the mean), the effect of the experimental condition (self-generated alternative behaviors versus stated upward CFT) on self-efficacy was not significant (regret = 2.49; b = 0.16; p = .49; 95% CI = [-0.29; 0.61]). However, at higher levels of regret, the experimental condition had a positive effect on self-efficacy, as follows: at the mean (regret = 3.70; b = .56; p < .001; 95% CI = [0.27; 0.85]); at one standard deviation above the mean (regret = 4.91; b = .97; p < .001; 95% CI = [0.53; 1.40]).

The interaction model significantly predicted response efficacy (R^2 = .29, F (8, 88) = 4.42, p < .001); however, R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .01, F (1, 88) = 1.27, p = .26). Regret did not moderate the effect of the experimental condition on response efficacy (b = .15; p = .26; 95% CI = [-0.12; 0.42]).

Similarly, the interaction model significantly predicted outcome expectancy (R^2 = .18, F (8, 88) = 2.45, p = .02); however, the R^2 increase due to adding the interaction term

to the model was not significant (R^2 change = .001, F (1, 88) = 0.15, p = .70). Regret did not moderate the effect of the experimental condition on outcome expectancy (b = .13; p = .70; 95% CI = [-0.52; 0.77]).

Finally, the interaction model significantly predicted behavioral intention (R^2 = .31, F (8, 88) = 4.90, p < .001); however, the R^2 increase due to adding the interaction term to the model was not significant (R^2 change = .001, F (1, 88) = 0.13, p = .72). Regret did not moderate the effect of the experimental condition on behavioral intention (b = .06; p = .72; 95% CI = [-0.27; 0.39]).

Conditional indirect effect

None of the conditional indirect effects were significant.

A summary of findings across hypotheses and research questions can be found in Table 15.

Experiment 3 Discussion

Experiment 3 was conducted to address some of the issues identified at the conclusion of experiments 1 and 2 and to provide an additional test of the persuasiveness of counterfactual thinking-based messages in a medication adherence context. Specifically, the counterfactual thinking manipulation was strengthened in experiment 3 by including two counterfactual thinking statements. Furthermore, to facilitate participant engagement, the messages were created in audio format. Also, to assist with engagement throughout the survey, several strategic attention checks were added to separate participants who carefully considered the survey from those who paid less attention. Finally, the two incidental counterfactual thinking conditions from experiment 1 and 2 were replaced with three integral self-generated counterfactual thinking conditions, in

light of past research that has found effects of self-generated counterfactuals on efficacy perceptions and behavioral intentions. In a sample of individuals who self-identified as having been diagnosed with type 2 diabetes, findings showed a robust persuasive effect of messages including upward counterfactual thoughts (either stated or generated by participants) on perceptions of self- and response efficacy, and on behavioral intention to take one's medication as prescribed. Each of the results is discussed in detail below.

Counterfactual thinking and self-efficacy

In line with prior research, both self-generated and stated upward counterfactual thinking messages, relative to downward counterfactual thinking messages and control, increased perceptions of self-efficacy about taking one's medication as prescribed (Tal-Or, Boninger, & Gleicher, 2004). This finding extends prior research that has found a positive effect of counterfactual thinking on self-efficacy in an educational context to a health context (medication adherence). Moreover, whereas Tal-Or and colleagues (2004) studied the effects of counterfactual thinking in a performance context (i.e., an exam), the findings here suggest that counterfactual thinking is effective as a persuasive health message strategy, as well, when the goal is to increase individuals' perceptions of self-efficacy. The results provide additional support for Roese's (1997) theorizing that upward counterfactual thinking, by providing explicit information about what behaviors should be performed in the future to avoid negative outcomes, reinforces individuals' confidence in their abilities to engage in those behaviors at a future time.

Downward counterfactual thinking, relative to the control condition, did not change self-efficacy. This finding is different from Tal-Or et al.'s (2004), who found that, when participants engaged in downward counterfactual thinking in response to an exam

grade, their perceptions of self-efficacy that they would do better on a future exam decreased (Experiment 1). Tal-Or and colleagues explained that imagining how things could have been worse (i.e., downward counterfactual thinking) likely undermines perceptions of self-efficacy. However, their explanation lacks information on *why* imagining how things could have been worse reduces self-efficacy. Whereas it is true that downward counterfactual thinking does not inform on how one can improve their outcomes in the future (and, therefore, should not reinforce self-efficacy), downward counterfactual thinking does not equate negative feedback either; it does not tell people they are not able to do something, to the contrary, it suggests what happened is not the worst-case scenario.

Tal-Or and colleagues' findings, then, may be explained by something else, specifically, their stimuli. Participants in the downward counterfactual condition were told that their decision to change some of the exam answers they were unsure of was the right one and that their grade improved as a result; they were then told that if they had stayed with their initial answers, they would have done much worse. Participants in the upward counterfactual thinking condition, on the other hand, were told that their decision to change their exam answers was the wrong one and that their grade was worse as a result; they were then told that if they had stayed with their initial answers, they would have done much better. Participants in the control condition received no feedback, only their exam grade, which was the same across conditions. The feedback in the downward counterfactual thinking condition suggested to students that their better grade was due to luck or chance; such a suggestion, then, likely reduced one's confidence in their ability to do well on a future exam. It is possible that, had the downward and upward

counterfactual thinking conditions included the same feedback (i.e., that changing exam answers was the wrong decision), a negative effect of downward counterfactual thinking on self-efficacy would not have been observed. The stimuli used in the present study were identical across conditions and they only differed in terms of the concluding counterfactual thinking statements.

The present study also included two upward self-generated counterfactual thinking conditions. In the first such condition, after hearing the vignette, participants were instructed to fill in sentences with alternative outcomes given that the character in the vignette had taken his medication as prescribed. In the second such condition, participants were instructed to fill in sentences with alternative behaviors that would undo the negative outcome in the vignette (i.e., the character's health condition worsening). In prior work, participants were typically asked to do the latter and fill in statements with alternative behaviors (e.g., Baek, Shen, & Reid, 2013; Nan, 2008; Page & Colby, 2003). However, in these studies, counterfactual thinking was not used as a persuasive message design component. As a result, the behaviors that participants generated were likely not of great importance. Here, however, counterfactual thinking was tested as a persuasion strategy; thus, it was important to ensure that participants focused on the key behavior promoted, that of medication adherence, and this is why a condition in which participants generated alternative outcomes if the key behavior had been performed was of interest.

Both conditions led to increased perceptions of self-efficacy, compared to the downward counterfactual thinking conditions, the stated upward counterfactual condition, and the control condition. These results are in line with prior research on self-generated counterfactual thinking and self-efficacy (Tal-Or et al., 2004, Experiment 2). The

findings also expand prior work by showing that generating alternative outcomes versus alternative actions (which has been the norm in past research) are both effective ways to increase self-efficacy. This finding is particularly important for persuasion research and practice because it suggests that, as long as individuals engage in upward counterfactual thinking, their self-efficacy receives a boost.

However, it is also possible that this finding is specific to this context and, more importantly, to the stimulus used. Specifically, given the vignette participants listened to in this study, it is possible that their generation of alternative actions was constrained to behaviors related to one's medication adherence. Indeed, an examination of the alternative behaviors that participants typed in shows that the great majority focused on medication adherence: "not stopped the pills"; "taken his pills"; "took his doctor's advice"; "taken medicines properly"; "listen to his doctor". However, this focus on the key behavior may not happen when perhaps other behaviors are plausible, as well. For instance, in a car accident scenario in which not speeding is the behavior of interest, participants may generate alternative behaviors that focus on the other driver or the road conditions, rather than on a character's speeding. To conclude, then, whereas self-generated upward counterfactual thinking that focuses on undoing behaviors or outcomes matters in a persuasion context should be further tested.

Finally, that self-generated upward counterfactual thinking outperformed stated upward counterfactual thinking in increasing perceptions of self-efficacy is a new and important finding. In the one study that compared the two methods of engaging participants in counterfactual thinking, Tal-Or, Boninger, Poran, and Gleicher (2004) found no difference between self-generated upward (generating alternative actions to

undo an outcome) and stated upward counterfactual thinking (Experiment 2). In their study, participants viewed a three-minute film in which a woman in a wheelchair shared how she became paralyzed from waist down after a collision at an intersection due to failure to heed a yield sign. Whether participants had to create their own upward counterfactual thoughts following instructions or listened to upward counterfactuals as uttered by the character in the story, their attitudes toward traffic safety regulations were not significantly different. One explanation as to why a difference was not observed was perhaps lack of power; Tal-Or et al.'s sample was 61 for a two-condition design.

Another explanation may reside in the content of the counterfactual thoughts that participants generated themselves. It is possible that the thoughts participants generated were very diverse (i.e., less congruent with the message) and, thus, overall, their effect on attitudes was weaker compared to a situation in which the thoughts would have been more focused, as in the present study. Yet, Tal-Or and colleagues (2004) ran a second, more stringent analysis in which only participants who generated the right counterfactuals were compared to those who were given a stated counterfactual; the effect of the two conditions on attitudes was not distinct (the sample for this analysis, however, included only 11 cases, suggesting, again, that low power may have underlined the findings). Perhaps, then, self-generated versus stated upward counterfactuals have a distinct effect on perceptions of self-efficacy, but not on attitudes.

That self-generated counterfactuals were more effective than stated counterfactuals in increasing self-efficacy is not that surprising. Prior research does suggest that conclusions drawn by people themselves compared to conclusions given to them in a persuasion message are more persuasive (Sawyer, 1988), as long as people are

motivated and able to generate their own conclusions (McGuire, 1969). Yet, in a meta-analysis, O'Keefe (1997) found that persuasive messages that include an explicit conclusion are more effective. O'Keefe explains that, when a conclusion is omitted, assimilation and contrast effects are likely, such that receivers of the persuasive message infer the position of the message to be aligned with their own or more discrepant from their own than it actually is. Both these types of inferences reduce message persuasiveness because they either reduce the perceived change advocated by the message (in the case of assimilation effects) or they create the perception that the message is advocating an unacceptable view (in the case of contrast effects) (O'Keefe, 2002).

In the present study (and in research on counterfactual thinking overall), however, a conclusion was not fully absent in that participants were guided to generate their own conclusions. The keyword here is "guided": individuals' inferences are constrained to counterfactual thinking and participants are given instructions on what kind of thoughts to generate, which might explain why persuasion still occurs. Moreover, as noted above, participants' level of involvement is also an important factor. At least in the present study, there is reason to believe that participants, who had diabetes themselves, were likely involved with the content of the message; hence, their generation of conclusions to the message had a higher persuasive effect than when a conclusion was spoon-fed to them (McGuire, 1969).

Counterfactual thinking and response efficacy

As with self-efficacy, all upward counterfactual thinking conditions significantly increased response efficacy, relative to the downward counterfactual thinking and control

conditions. This finding is a new one in the persuasion and counterfactual thinking literature and it signifies that upward counterfactual thinking is effective at increasing both people's confidence in their ability to perform a behavior and their confidence that said behavior will help them avoid or alleviate a threat. In other words, this finding suggests that upward counterfactual thinking is a powerful persuasive strategy because when both response and self-efficacy are high, behavioral change is more likely to occur (Witte, 1992).

Theoretically, that upward counterfactual thinking increases response efficacy suggests that the causal information between the behavior and the outcome contained in the counterfactual (i.e., not taking the medication led to his health condition to worsen) triggers an expectation of the consequences of that behavior in the future (i.e., not taking one's medication again will result in poorer health) (Roese & Olson, 1995, p. 171). A corollary of that expectation is a response efficacy statement: if medication is taken as it should be, one's health will not be affected. It appears, then, that participants engaged in a similar thought process.

The effect of upward counterfactual thinking on response efficacy can also be explained drawing from research on message repetition. Specifically, repeated exposure to messages about preventing melanoma led to increased response efficacy regarding several actions to protect oneself against melanoma (Shi & Smith, 2015). An upward counterfactual thought functions as a repetition of the information in that message. The story in this study described a person with diabetes who decided to stop taking their medication and ends up in the hospital. The upward counterfactual thought at the end of the message repeated this information, albeit in a different format, resulting in increased

response efficacy compared to the downward counterfactual thinking and control conditions in which the information was not repeated ("it could have been worse" is not a repetition of the information in the message).

That self-generated counterfactual thinking, compared to stated counterfactual thinking, led to higher levels of response efficacy is likely explained by the superior persuasive effect of participants generating their own conclusions versus being exposed to a message with an explicit conclusion, as stated earlier (McGuire, 1969; Sawyer, 1988).

Finally, both self-generated upward counterfactual thinking conditions, relative to the downward counterfactual thinking and control conditions, increased response efficacy, suggesting again that whether participants undo actions or outcomes does not seem to make a difference in this context.

Counterfactual thinking and outcome expectancy

Counterfactual thinking had no effects on outcome expectancy, measured here as an individual's expectancy about family and friends' reactions to their taking the medication recommended by the doctor. There are a few potential explanations for this lack of effect. First, the messages were focused on the self and did not make any reference to families or friends and perhaps participants failed to make that connection themselves. Second, participants in this study may simply not think that their medication adherence should have any implications for their families and friends, supported by the finding that outcome expectancy was not significantly associated with behavioral intention. This idea is particularly viable if participants in the study did not regularly interact with family and friends, were estranged from family members, did not live in

close proximity to who they consider as family and friends, or did not have family and friends. Because these variables were not measured, however, this explanation is tentative and future research can help shed light on this issue.

In retrospect, the items used to measure expectations about friends and family may have lacked specificity. For example, one item read "I believe that if I take my medication as prescribed by my doctor, my family and friends will trust me more". Perhaps participants did not know how to interpret what "family" meant in this case and, as a result, they each had different family members in mind when answering (e.g., grandparents, parents, children, a spouse). Or, they may have thought that their family members would have trusted them more, but not their friends, and, thus, averaged these expectations in answering the question. Using better, more specific measures in future studies may show different results.

Finally, more than half of participants in the study reported having been diagnosed with diabetes less than one year ago (and more than six months ago, given that individuals who reported having been diagnosed less than six months ago were not eligible for participation). Potentially this amount of time of having lived with type 2 diabetes was not enough for individuals to fully understand the implications of their illness for their family and friends and, thus, they may not have considered adhering to medication to have an effect on friends and family.

Counterfactual thinking and behavioral intention

Past research has found a positive effect of upward counterfactual thinking, relative to downward counterfactual thinking, on behavioral intentions (Roese, 1994; Roese & Olson, 1995), including related to smoking intentions (Page & Colby, 2003;).

Whereas such an effect was observed in this study, as well, the effect of counterfactual thinking on behavior was largely direct for self-generated counterfactuals (with one exception, noted below) and indirect for stated counterfactuals. Concretely, the message including stated upward counterfactual thinking statements, compared to the message including stated downward counterfactual thinking statements, had an indirect positive effect on behavioral intentions to adherence to one's medication as prescribed, through self- and response efficacy; whereas the messages in which participants were instructed to generate their own counterfactuals that undo either actions or outcomes, relative to the message in which participants were instructed to generate downward counterfactuals, had a direct effect on behavioral intentions and no indirect effect through self- or response efficacy.

The lack of indirect effects in the self-generated counterfactual thinking conditions was due to self- and response efficacy not being significant predictors of behavior, after accounting for experimental condition. Thus, it appears that the experimental conditions (and the covariates included in the model) explained all the variance there was to explain in behavioral intention and, therefore, self- and response efficacy were not significant predictors anymore.

This post-hoc rationalization was tested in a regression model in which self-efficacy, response efficacy, and covariates (i.e., doctor-patient communication, gender, education) were entered in the first block and experimental condition (self-generated upward counterfactual thinking vs. downward counterfactual thinking) was entered in the second block. For the self-generated upward counterfactual thinking condition in which participants typed in alternative outcomes, only self-efficacy was a significant predictor

of behavior in the first regression block ($p_{self\text{-}efficacy}$= .03; $p_{response\ efficacy}$ = .59); but fell below significance once the experimental condition was controlled for in the second block ($p_{self\text{-}efficacy}$= .10; $p_{response\ efficacy}$ = .70).

For the self-generated upward counterfactual thinking condition in which participants typed in alternative behaviors, only response efficacy was a significant predictor of behavior in the first block ($p_{self\text{-}efficacy}$= .25; $p_{response\ efficacy}$ = .001) and the second block ($p_{self\text{-}efficacy}$= .37; $p_{response\ efficacy}$ = .003). Of note, that response efficacy was a significant predictor of behavior in this situation is in agreement with the finding that messages in which participants generated alternative behaviors, compared to those in which they generated downward counterfactuals, did have an indirect effect on behavioral intention, through response efficacy.

The results were different for the stated upward counterfactual thinking message (versus stated downward counterfactual thinking message), such that both self- and response efficacy significantly predicted intention in both the first ($p_{self\text{-}efficacy}$= .009; $p_{response\ efficacy}$ = .001) and in the second regression block ($p_{self\text{-}efficacy}$= .01; $p_{response\ efficacy}$ = .008); while experimental condition was not a significant predictor of behavioral intention (p = .25). Overall, then, these findings support the idea that self-generated upward counterfactual thinking, relative to self-generated downward counterfactual thinking, is a powerful predictor of behavioral intention and its effect on intention is not mediated by self- or response efficacy. Whether other variables mediate the effect of self-generated CFT on behavioral intention remains a question for future research.

When comparing effects on behavioral condition of the upward self-generated counterfactual thinking conditions versus the upward stated counterfactual thinking

condition, results are ambiguous. When participants were asked to come up with alternative outcomes to a given medication adherence behavior, their behavioral intention to adhere to medication was higher than that of participants who listened to a message in which upward counterfactual thinking statements were explicit. This finding follows the results on self-efficacy, suggesting that participants prefer generating their own conclusions and are, therefore, more persuaded when they do so (i.e., they report higher behavioral intentions to engage in a key behavior). Of note, the outcomes that participants generated were similar to the ones given in the stated upward counterfactual thinking statements (i.e., my condition wouldn't have worsened; I would not be in the hospital right now): "gotten sick"; "had to go to the ER"; "not ended up in the ER"; "made his diabetes worse"; "felt sick".

However, when participants were asked to come up with alternative behaviors that would lead to a better outcome than the one in the story, their behavioral intention to adhere to medication was not different from that of participants who listened to a message in which upward counterfactual thinking statements were explicit. This finding is in line with Tal-Or and colleagues' (2004) findings that self-generated versus stated upward CFTs do not have a distinct effect on attitudes toward traffic safety regulations. However, this result is somewhat surprising, given that, as mentioned previously, individuals in the present study by and large typed in behaviors focused on medication adherence, as opposed to irrelevant behaviors. So why did not generating one's own conclusions in the form of alternative behaviors (versus being spoon-fed conclusions) increase behavioral intentions, as well? The answer is unclear, but it is possible that participants who generated alternative behaviors that could lead to a better outcome than

the one in the story found it easier to feel more confident that they were able to perform those behaviors (i.e., adhere to medication), but not necessarily more inclined to do so. Future research can investigate this issue further.

Counterfactual thinking and regret

Regret only moderated the effects of messages including upward stated and self-generated alternative outcomes CFT (versus downward counterfactual thinking) on self-efficacy; at high levels of regret, the effect of the condition on self-efficacy failed to reach significance. These findings are congruent with those of Arora et al. (2013) who found a negative association between regret and self-efficacy in a counterfactual thinking context. Relatedly, Sanna (1997) found that experimentally manipulated lower levels of self-efficacy reduced the effect of upward CFT on negative affect.

Regret is an emotion experienced after one has made a bad decision (Zeelenberg et al., 1988). Regret is associated with appraisals of personal responsibility and a belief that the negative outcome can be rectified through one's actions (Roseman et al., 1994). That regret reduced the effect of upward counterfactual thinking on self-efficacy may be an indication that, at high levels of regret, individuals may have also experienced a feeling similar to helplessness which, in turn, made them feel less confident in their abilities to adhere to medication. In other words, the feeling that they could be responsible for aggravating their own illness due to a clearly poor decision (i.e., stopping to take one's pills) may have been so demotivating/demoralizing that their self-efficacy took a hit. In Roseman et al.'s study (1994), participants who recalled a past experience that has caused them to feel regret, also reported feeling "a sinking feeling", although regret also motivated them to correct their mistake.

Furthermore, research also finds that individuals who experience negative emotions have an inclination to remember past events that were also negative or that led to a negative outcome (LeBlanc, McConnell, & Monteiro, 2015; Maher, 2007). What this means is that the regret experienced by participants in this study may have fostered remembrance of similar events from their past, to the extent that such events took place (of note, about half of the sample reported having experienced health complications due to nonadherence, however, participants may have recalled negative medication-related experiences other than their own). The recollection of past negative events in addition to the negative content of the stimulus participants were exposed to may have been overwhelming, creating a feeling of helplessness which hampered the positive effect of upward counterfactual thinking on self-efficacy. A more thorough investigation into what appraisals associated with regret impact self-efficacy could be pursued in future research.

That regret only moderated the effect of stated counterfactuals and that of self-generated outcomes (and not self-generated behaviors) on self-efficacy is intriguing. Both of these conditions clearly stated the bad decision that led to the negative outcome, i.e., the character not taking his medication as prescribed. In the stated upward counterfactual thinking condition, the message ended with statements such as "I couldn't help but think that if only I had taken my medication as prescribed, I would have been fine! If only I had taken my medication as prescribed, my condition wouldn't have worsened". Similarly, in the self-generated outcomes condition, the sentences that participants were asked to fill in with outcomes other than the ones in the story they listened to, began as follows: "if only the character had taken the medication, he wouldn't have _____". The self-generated behaviors condition, however, instructed participants to fill in sentences in

which this bad decision was, of course, omitted: “If only the character had _____, his illness wouldn’t have gotten worse”. Although the majority of participants in this condition wrote in behaviors related to taking one’s medication, it seems that the effects of the regret experienced were different; regret moderated the effect of the experimental condition on self-efficacy only when the bad decision was explicitly given to participants. Yet, although this observation explains why effects were observed with the stated and self-generated outcomes conditions, it does not explain why such effects occurred and, as mentioned above, further investigations are needed to understand the phenomenon.

Although rooted in theory, the prediction that regret would enhance the effects of upward counterfactual thinking messages (versus downward counterfactual thinking messages) on behavioral intention was not supported by data in this research. Studies on regret have found that experiencing this emotion motivates behavior that corrects or alleviates the negative outcome that caused the feeling of regret (Roseman et al., 1994).

Indeed, regret was significantly and positively correlated with behavioral intention, albeit that correlation was modest (*Pearson’s r* = .195, $p < .001$). However, regret did not predict behavioral intention ($p = .26$ for the stated upward counterfactual thinking versus downward counterfactual thinking conditions; $p = .07$ for the self-generated outcomes versus self-generated downward counterfactual thinking conditions; $p = .05$ for the self-generated actions versus self-generated downward counterfactual thinking conditions, yet the 95% confidence interval was very close to including zero, [.002; .41]). It is not clear why, but perhaps these findings are context-specific and regret simply does not predict medication adherence behavioral intention.

It is also possible that higher levels of regret are necessary to motivate behavior (i.e., activate action tendencies). The average levels of regret across upward counterfactual thinking conditions were below 3.8 on a scale from 1 to 7 (i.e., 3.78 for the stated upward counterfactual thinking condition; 3.17 for the self-generated alternative outcomes condition; and 3.57 for the self-generated alternative behaviors condition). Perhaps participants were not too uncomfortable at these levels of regret and did not need to consider engaging in reparatory actions; for regret, such actions would involve taking one's medication as prescribed to correct the negative outcome that occurred due to not taking one's medication as prescribed.

Regarding why experienced regret was not higher, it is possible that the vignettes were not as effective as expected. It is also possible that asking participants to rate their experience of regret lowered its levels, as there is research to suggest that linguistic processing of emotions (i.e., labeling) reduces emotional reactivity (Lieberman, Eisenberger, Crockett, Tom, Pfeifer, & Way, 2007). Utilizing other methods for measuring the experience of regret (e.g., the use of a dial that participants can turn up and down depending on the level of regret experienced) could circumvent this issue and lead to different findings than the ones reported here.

Overall, then, experiment 3 provides support for the effectiveness of counterfactual thinking-based persuasive messages in the context of medication adherence.

Chapter 8: General Discussion

This final chapter discusses the findings across experiments 1, 2, and 3. First, the discussion of findings from experiments 1, 2, and 3 is briefly reiterated. Second, the differences observed among the three experiments is discussed. Finally, the chapter concludes with a summary of theoretical and practical implications derived from the findings, limitations of the current research, and directions for future research.

Experiments 1 and 2

Experiments 1 and 2 failed to find an effect of counterfactual thinking on efficacy perceptions and behavioral intentions to take one's medication as prescribed for patients with type 2 diabetes and hypertension. None of the counterfactual thinking conditions (stated integral or incidental) led to different efficacy perceptions and behavioral intention when compared to the control condition or when compared with one another. It is possible that counterfactual thinking is not an efficient persuasive message design strategy in the context of medication adherence.

It is also possible that self-generated, as opposed to stated counterfactual thinking, is more effective at changing efficacy perceptions and behavioral intentions. Prior studies that have investigated the persuasive role of counterfactual thinking in health contexts (Baek et al., 2013; Nan, 2008; Page & Colby, 2003; Tal-Or et al., 2004) and have found persuasive effects of counterfactual thinking used primarily self-generated counterfactual thinking or a combination of integral stated and self-generated counterfactual thinking. The persuasion literature notes that individuals are more persuaded by conclusions that

they draw themselves (so, similar to generating a counterfactual thought) compared to conclusions given to them in a persuasion message (Sawyer, 1988), thus, suggesting that self-generated counterfactual thoughts, as opposed to stated ones, could be more persuasive. However, findings from experiment 3, discussed below, suggest that both stated and self-generated upward CFTs are persuasive, relative to downward CFT or no CFT, although self-generated upward CFTs seem to have a persuasive advantage over stated CFT.

It is also possible that factors other than the consequences of not taking one's medication/ the importance of taking one's medication and one's ability to take medication as prescribed are more efficient at increasing medication adherence. Such factors include fear of side effects, misperception of side effects, lack of interest in managing one's illness perhaps due to depression, or medication cost (Garcia-Perez, Alvarez, Dilla, Gil-Guillen, & Beltran, 2013; Gazmararian, Kripalani, Miller, Echt, Ren, & Rask, 2006; Kreps et al., 2011; Mann, Ponieman, Leventhal, & Halm, 2007). In other words, other counterfactual thinking-based message contents that address some of these factors may be more effective at increasing medication adherence.

Another potential reason for the non-significant findings in experiments 1 and 2 may have been the counterfactual thinking manipulation itself. Specifically, the messages used in the studies included only one counterfactual thinking statement and it is possible that participants failed to notice and, thus, process it. Prior studies included multiple counterfactual thinking statements (i.e., asked participants to generated multiple counterfactual thoughts: Baek et al., 2013; Nan, 2008; Page & Colby, 2003; included one counterfactual thinking statement in the message and then asked participants to generate

an additional counterfactual thought after message exposure: Tal-Or et al., 2004). Thus, designing messages that include more than one counterfactual thought, either by asking participants to generate their own counterfactual thoughts or by stating multiple such thoughts as part of the message, may be a more powerful manipulation, as shown in experiment 3.

The sample recruited for experiments 1 and 2 may also underlie the lack of significant findings. Specifically, participants self-reported their risk for nonadherence and were, perhaps, dishonest. If participants were not at risk for nonadherence, the messages they were exposed to could do little to change their already positive efficacy perceptions and behavioral intentions (as evidenced by the high average ratings for all dependent variables). Medication adherent individuals may have approached the messages from a disinterested perspective and thought that the messages were applicable to others rather than themselves. As a result, the messages had no differential effect on their efficacy perceptions and behavioral intentions.

Finally, it is also argued that participants may not have engaged with the message content due to the format of the message (i.e., text). Given that the two experiments were conducted online, participants may have easily chosen to skip reading the messages or quickly skim through, undermining any potential persuasive effect from manifesting. Utilizing formats other than text (e.g., audio or video) may foster information processing and persuasive effects of counterfactual thinking may be observed, as shown in experiment 3.

Experiment 3

The purpose of experiment 3 was to provide an additional test of the effect of counterfactual thinking on medication adherence. This experiment was designed in light of the issues identified with experiments 1 and 2. Specifically, experiment 3 incorporated a stronger manipulation in the form of two counterfactual thinking statements at the end of each message (as opposed to just one such statement which may easily be overlooked by participants); a manipulation check to verify if the messages (i.e., counterfactual thoughts) were perceived as intended; several attention checks to verify participant engagement; and three self-generated counterfactual thinking conditions (given that prior research finding strong effects of counterfactual thinking on persuasion-related outcomes almost exclusively looked at self-generated counterfactual thoughts). Finally, messages in experiment 3 were in audio format to facilitate information processing (Stanczyk et al., 2016). By strengthening the experimental design in this manner, if the results again failed to show an effect of counterfactual thinking on medication adherence-related factors, the conclusion that counterfactual thinking does not have a persuasive effect in this health context would be stronger.

Several of the hypothesized findings in experiment 3 were significant. These results tentatively rule out the conclusion that counterfactual thinking is not an effective persuasive strategy when the goal is to increase chronic illness patients' intention to take their medication as prescribed and their self- and response efficacy related to medication adherence.

The effects observed were rather robust across experimental conditions, such that, messages including upward counterfactual thinking (self-generated and stated) were

clearly more persuasive than messages including downward counterfactual thinking (self-generated and stated) or control messages (no counterfactual thinking). Specifically, messages including upward counterfactual thinking led to increased intentions to take one's medication as prescribed, increased self-efficacy, and increased response efficacy; counterfactual thinking had no effect on outcome expectancy (measured as an individual's expectations about his/her family's and friends' reactions to his/her taking their medication as prescribed). The indirect effects of counterfactual thinking on intention through self- and response efficacy were less homogeneous across experimental conditions; likewise, the moderating effects of regret on the relationship between the experimental condition and self-efficacy, response efficacy and behavioral intention were not consistent across conditions.

Experiment 3 versus Experiments 1 and 2

Sample characteristics

One could argue that the significant results observed in experiment 3 may be sample specific, given that findings for experiments 1 and 2 were largely non-significant. However, quite a few relevant participant characteristics were controlled for in the analyses, meaning that differences in such characteristics between the sample recruited for experiment 3 versus the samples in experiments 1 and 2 do not account for the different findings. Furthermore, the individuals with type 2 diabetes who participated in experiment 1 and experiment 3 were overall demographically similar. All participants were recruited using the same platform, Amazon Mechanical Turk, and were screened for participation using the same screener survey; participants were, on average, around 37

years old ($M_{experiment1}$ = 36.65 years old; $M_{experiment3}$ = 37.43 years old); predominantly women (57.8% in experiment 1; 52.5% in experiment 3) and white (69.3% in experiment 1; 68.0% in experiment 3). In both experiments, around 75% of participants reported having some college education or being college graduates (75.6% in experiment 1; 74.9% in experiment 3). Income levels were also similar, although a larger percentage of participants in experiment 3 reported income levels between $65,001 and $100,000 (19.5% compared to 17.9% in experiment 1) and over $100.000 (9.6% compared to 5.9% in experiment 1).

The largest difference between the two samples was that more participants in experiment 1 reported having been diagnosed with diabetes longer compared to experiment 3; specifically, only 28.8% of participants in experiment 1 reported having been diagnosed with diabetes less than a year ago, whereas 57.8% of participants in experiment 3 reported having been diagnosed with diabetes less than a year ago. However, this variable was controlled for in the analyses. Relatedly, fewer participants in experiment 3, compared to participants in experiment 1, said they experienced health complications (49.5% compared to 65.4% in experiment 1) or had been hospitalized due to nonadherence (15.9% versus 30.4% in experiment 1). It is possible, then, that participants in experiment 3 were more receptive to messages depicting health complications and hospitalization, whereas participants in experiment 1 who have lived through these events may have dismissed them as not that terrifying. Again, though, these variables were also controlled for in the analyses, so they should not underlie the findings.

Study design

A more plausible explanation of the difference of effects in experiment 1 versus experiment 3, then, lies in the study design modifications. Specifically, experiment 3 incorporated audio messages; two rather than one counterfactual thinking statements at the end of each message (with the exception of the control); manipulation checks to ensure the messages were perceived as intended; and several strategic attention checks to help identify participants who may not have engaged with the study content. Of note, the manipulation check questions were asked after measuring the dependent variables in the study, therefore, they should not have affected how participants rated the dependent variables. Yet, because these changes were not incremental, it is hard to tell which one in particular led to the experimental manipulation being successful. However, each of these changes has important implications that deserve consideration.

Audio versus text messages. Research on whether text versus audio messages are more engaging is scarce. As previously mentioned, existing evidence does suggest an advantage of audio messages over text (Stanczyk, De Vries, Candel, Muris, & Bolman, 2016) and even audio-video (Muller & Cameron, 2014). Yet, whether the differences observed in the cited studies are robust across contexts is a question for future research. The present study adds to this body of literature and raises the question of whether text-based communication efforts to raise medication adherence, such as mHealth or text messaging, should be compared to interventions in which medication adherence information is transmitted in different formats, such as audio or video. Existing systematic analyses of mobile messaging interventions primarily focus on comparing between different messaging strategies (e.g., more or less frequent texts, tailored versus

generic content (Finitsis, Pellowski, & Johnson, 2014); or reminders versus motivational content (Park, Howie-Esquivel, & Dracup, 2014)) rather than comparing between different formats such as audio versus text.

Of note, individuals participating in mHealth interventions likely self-select into these efforts. For example, patients who desire to be reminded to refill their prescriptions by CVS pharmacy opt into this service, it is not imposed on them (m.cvs.com). Perhaps choosing to be part of a service that helps maintain one's medication adherence means that individuals are more motivated to engage with the content sent to them via text than if they had not chosen to be part of that service. Yet, the fact that one opts into these services may also mean that only individuals who are already aware about the importance of medication adherence and are motivated to follow their doctor's advice self-select into this task, but this is an empirical question, as well.

Number of counterfactual thinking statements. Multiple counterfactual thinking statements (given to or generated by participants) may be necessary to observe an effect of counterfactual thinking on perceptions and behavioral intention. This idea, although not explicitly tested in prior research, does find support in other studies in which researchers included multiple counterfactual thinking statements in their messages (Tal-Or et al., 2004). Why this may be the case is unclear. It is possible that in experimental designs in which participants are prompted to read or listen to a message, they need more time and context to process counterfactual thinking compared to an everyday life situation in which they naturally engage in such thinking and one counterfactual thought may suffice. Relatedly, research on message repetition finds that repeated exposure to health risk messages is needed to observe increases in self-efficacy (Shi & Smith, 2015).

Therefore, the use of multiple CFT statements in persuasive messages may be more effective than including just one such statement.

Attention checks. Goodman, Cryder, and Cheema (2013) found that attention checks are particularly useful when conducting studies on the MTurk platform. Their results suggested that MTurk participants are not as motivated as other samples (e.g., student samples) to engage in cognitive processing. They recommend that for studies, that require participants to pay careful attention to materials and instructions, researchers use attention checks to improve statistical power and reduce Type II error. Goodman and colleagues do not discuss how such attentions checks should look like, but do suggest that attention checks placed at the end of the survey may be missed due to fatigue rather than inattentiveness and that attention questions that require factual answers might prompt internet searches among participants.

The attention checks in the current study were positioned early on in the survey (before its midpoint) and required that participants answered using either information from the stimuli or by following instructions. Therefore, it is quite possible that these attention checks were successful in screening out participants who did not engage with the information or who rushed through the survey without paying attention and, as a result, in increasing statistical power. Future research could compare online experiments in which attention checks are and are not used, as well as types of attention checks and positioning within the experiment. Findings from such studies would help researchers understand how to best use platforms such as MTurk in conducting experimental work.

Research Contributions

Theoretical implications

This research makes several important theoretical contributions to both the counterfactual thinking literature and the field of health communication. First, this research is one of the few to combine persuasion and counterfactual thinking. Although a heavily studied matter in some domains of the social sciences (e.g., psychology, political sciences, decision making), counterfactual thinking has received less attention in the communication discipline. Given counterfactuals' influence on a variety of processes and factors of relevance to persuasion, research in this area represents an opportunity to expand our knowledge.

Using a controlled experimental design, this research provides evidence that messages including upward counterfactual thinking, relative to messages including downward counterfactual thinking and no counterfactual thinking (control), are an effective persuasive strategy to increase medication adherence self- and response efficacy, and behavioral intention to take one's medication as prescribed. Persuasive effects are observed with both stated and self-generated counterfactual thinking messages, with a slight persuasive advantage of the latter over the former. Findings also suggest that more than one counterfactual thinking statement may be necessary to persuade individuals.

Furthermore, although not explicitly measured in the studies presented here, that persuasive effects of counterfactual thinking were observed only with audio versus text messages suggests that facilitating cognitive processing of the messages by the recipients may be critical to observe any persuasive effects of counterfactual thinking. This issue

might be more relevant for stated rather than self-generated counterfactual thinking, given that cognitive engagement can likely be assumed with self-generated counterfactual thoughts and future research can test this possibility.

This research is also the first to provide evidence for an effect of messages including counterfactual thinking on response efficacy, an important persuasive message-related variable (Witte, 1992). Third, this research is also one of the few to compare stated with self-generated counterfactual thinking as a message design strategy (the only other study in which the two types of CFT were compared is Tal-Or et al.'s (2004)); in doing so, a new method of generating counterfactual thoughts was introduced in experiment 3 (i.e., by undoing outcomes versus behaviors). Findings showed that both methods were overall superior to the stated counterfactual thinking condition in directly increasing self-efficacy and response efficacy; and that the self-generated alternative outcomes upward CFT condition increased behavioral intentions more than did the upward CFT condition.

This research extends prior work that has found a positive effect of counterfactual thinking on self-efficacy in an educational context to a health context (medication adherence). Finally, this research also shows that regret limits the persuasive effect of both stated and self-generated upward counterfactual thinking on self-efficacy.

Practical implications

From a practical perspective, this research adds to the thin body of literature on effective message design for increasing medication adherence; it proposes and formally tests a theory-grounded model of counterfactual thinking-based persuasive communication for improving medication adherence. That counterfactual thinking

increased motivation to take one's medication as prescribed is a valuable finding, given that, for a significant number of patients, medication nonadherence is a lack of motivation issue, above everything else. Prior research provides little insight into how to motivate people to take their medication (with a few notable exceptions, Krebs et al., 2015; Kreps et al., 2011; and Zhao et al., 2012). This study provides an additional theory grounded message design strategy that can be incorporated in more complex health interventions as a tool for improving people's motivation to adhere to their medication therapy.

Counterfactual thinking can also be employed by health care providers in their conversations with patients. For example, health care providers could use upward counterfactual thinking statements when explaining the importance of treatment adherence to their patients or they could invite patients to engage in such thinking themselves given that self-generated counterfactual thinking statements appear to be more effective. A similar strategy can be used by pharmacists, as well, when they dispense medicine to patients. Moreover, some pharmacies initiate reminder phone calls/voice messages when a patient's medication is due for a refill. Such call could easily include counterfactual thinking statements to motivate patients to go get their medication refill.

Of note, it is possible that counterfactual thinking-based persuasive communication is effective at increasing adherence to certain types of medications versus others. For example, CFT messages may backfire if targeting adherence to medications associated with stigma, such as antidepressants or PrEP (HIV medicines taken daily to lower the chances of getting infected for very high-risk individuals). CFT messages may

be perceived as blaming the individuals for their condition and, thus, lead to the experience of guilt, shame, or anger among these already stigmatized individuals. Such feelings, together with the perception of being blamed, might reduce willingness to adhere to treatment further. Future research could explore how CFT messages work across various types of medicines.

Research Limitations

This research is not without limitations. This research could be improved by collecting data at multiple points in time. That way, the long-term effect of counterfactual thinking-based persuasive messages could be assessed. Also, the impact and generalizability of the proposed model would be more rigorously assessed if tested with other chronic illnesses; this is particularly relevant, given that experiment 3 only included type 2 diabetes patients.

Regarding sampling, although a screener was used to recruit participants, it is possible that some individuals were dishonest in order to qualify for the study and receive the incentive, given that completing studies on Amazon Mechanical Turk serves as a job for some. Replicating this study using a different recruitment strategy that more rigorously assesses one's illness status (i.e., a diabetes clinic database) and risk for nonadherence (e.g., pill counts, pharmacy databases) would be useful.

This research also has a few design-related limitations. Experiments administered over the internet have been criticized for lacking control and precision (Ferrer, Grenen, & Taber, 2015; Skitka & Sargis, 2006). When experiments are conducted online versus in a laboratory, researchers cannot ensure that all participants are completing the tasks under the same environmental conditions (e.g., same level of noise, without interacting with

other people) or that they are fully engaged with the experiment content and understand instructions (Ferrer, Grenen, & Taber, 2015). However, there is research to suggest that online experiments have results similar to laboratory-based experiments (Berinsky, Huber, & Lenz, 2012). Yet, replicating the present study using a laboratory-based experiment would increase confidence in the results.

With regard to experiment 3, the design changes (i.e., message format, number of counterfactual thinking statements, attention checks) were not incorporated incrementally, making it hard to establish what modification was responsible for the findings as compared to experiments 1 and 2. Also, the messages in experiment 3 were narrated by a man and it is possible that participants may have reacted differently to a woman's voice or if the voice narrating the message would have been matched to each participant's gender. Future research can explore this possibility.

Actual medication adherence behavior was not measured in this research. Therefore, whether the behavioral intention increase due to counterfactual thinking observed translates into actual behavior is uncertain. Future studies, particularly if designed longitudinally, could assess actual behavior instead.

Another limitation of the studies reported here is that involuntary medication nonadherence was not measured. Specifically, the study measures did not include items about medication cost, access to healthcare, or forgetting to take one's medication. It is possible that participants in the study, in addition to lacking motivation to take one's medication (i.e., voluntary nonadherence), also encountered cost-, healthcare access-, or memory-related barriers. Regarding cost, participants' income was measured and used as a covariate in the analyses; however, one's income does not necessarily mean that

adequate funds can be allocated for purchasing medication, as individuals may have additional expenses that they prioritize over their treatment.

Finally, participants in this research were not asked about other chronic illnesses they may have had. Given that 42 percent of Americans had more than one chronic condition in 2014 (Buttorff, Ruder, & Bauman, 2017), it is likely that participants in any of the three experiments reported here may have been dealing with more than just type 2 diabetes or hypertension. If that were the case, the complexity of their overall medication regimen may have affected their adherence intentions and efficacy perceptions.

Future Research

In addition to the future research directions already mentioned in the limitations and discussion of findings sections above, subsequent studies should apply this model to other health contexts (e.g., smoking, exercising, eating habits). That way, the generalizability of the persuasive message design strategy proposed here is tested across health domains.

Also, future research could directly compare text, audio, and video messages, as well as the underlying mechanisms responsible for potential differential effects (e.g., information processing type – heuristic or systematic; identification with the character in the message; message perceived vividness or credibility).

Comparing various message contents that conclude with a related counterfactual thought would also be useful. As already mentioned, in addition to beliefs about medication adherence and one's ability to take the medication as prescribed, barriers such as fear of side effects or perceived side effects are common. Messages that address such barriers, while incorporating counterfactual thinking, may be more effective in

motivating adherence for some individuals. Specifically, matching the message content to individuals' stated reasons for nonadherence may increase persuasiveness. There is research to suggest that matching message content to individuals' characteristics increases persuasiveness (e.g., Carpenter, 2012; Latimer et al., 2008). In the present research, although participants reported on a series of items measuring risk for nonadherence, the messages they were exposed to were not tailored to those items that were rated the highest by a particular individual. Rather, all messages addressed the negative consequences of not taking one's medication as prescribed, and, through that, underlined the importance of taking one's medication as prescribed.

Related to different message contents, testing the interaction between counterfactual thinking and emotions other than regret is also a direction for future research. Specifically, persuasion scholars note that, when one's behavior may harm other people and that behavior is under one's control, guilt appeals are an efficient strategy to elicit change (Turner, 2012). For example, not taking one's medication could affect other people such as loved ones if an individual's condition worsens as a result of nonadherence and results in financial or psychological burden for one's family. A message depicting this scenario would likely lead to the experience of guilt. Research on counterfactual thinking and guilt finds that individuals experiencing guilt are prone to generating counterfactuals that undo actions (e.g., if only I had taken my medication) (Niedenthal et al., 1994), suggesting that a guilt appeal followed by such a counterfactual could be a strong persuasive strategy. However, guilt appeals can also lead to high reactance among some populations, such as adolescents, suggesting that understanding

the audience prior to using guilt-based messages is necessary (Bessarabova, Turner, Fink, & Blustein, 2015).

Finally, counterfactual thinking-based messages should be incorporated in a multicomponent intervention aimed at increasing medication adherence. Whereas effective persuasive communication is important for persuading and motivating people to take their drugs, medication nonadherence is a complex issue that necessitates a multidimensional solution.

Appendices

Appendix A. Proposed stimuli for experiments 1 and 2

Integral upward counterfactual condition

I have been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication that I took for a while and then decided that I didn't need it. So I stopped taking it, thinking that I will be alright. But today I stated feeling really bad and I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that if only I had taken my medication as prescribed, I wouldn't be in the emergency room!

Integral downward counterfactual condition

I have been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication that I took for a while and then decided that I didn't need it. So I stopped taking it, thinking that I will be alright. But today I stated feeling really bad and I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that at least I didn't die!

Incidental upward counterfactual condition

I have been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication that I took for a while and then decided that I didn't need it. So I stopped taking it, thinking that I will be alright. But today I stated feeling really bad and I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that if only I had my dog with me, I wouldn't feel so bored!

Incidental downward counterfactual condition

I have been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication that I took for a while and then decided that I didn't need it. So I stopped taking it, thinking that I will be alright. But today I stated feeling really bad and I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that at least now I have a reason not to attend that dreadful work meeting tomorrow!

Control condition

I have been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication that I took for a while and then decided that I didn't need it. So I stopped taking it, thinking that I will be alright. But today I stated feeling really bad and I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Appendix B. Revised Stimuli for experiments 1 and 2

Integral upward counterfactual condition

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that if only I had taken my medication as prescribed, my condition wouldn't have worsened!

Integral downward counterfactual condition

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Now here I am, lying on a hospital bed, thinking that at least I didn't die!

Incidental upward counterfactual condition

A few months ago, I bought a laptop. I decided to go for a cheaper one and save some money. But the laptop I ended up buying is very slow, it often freezes and then I need to restart it. If only I had bought a more expensive laptop, I wouldn't have these issues now!

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Incidental downward counterfactual condition

A few months ago, I bought a laptop. I decided to go for a cheaper one and save some money. But the laptop I ended up buying is very slow, it often freezes and then I need to restart it. Oh well, at least I have a laptop to use for my work!

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Control condition

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Appendix C. Institutional Review Board Application Materials for Experiments 1 and 2

Initial Application Part

1. Abstract:

Chronic illnesses among the most common, costly, and preventable of all health problems in the United States. After an individual has been diagnosed with a chronic illness, he/she must follow a doctor-recommended course of treatment in order to manage their condition and avoid medical complications. Adherence to treatment, however, is low and understanding how to effectively communicate to patients about the importance of treatment is important. This study tries to understand how individuals with type 2 diabetes or hypertension, two major chronic illnesses that have low treatment adherence, process and react to information about treatment adherence. The goal of this study is to offer advice on how to effectively communicate with patients about treatment adherence in order to maximize their willingness to follow said treatment.

2. Subject Selection:

a. **Recruitment:** Participants for this study will be recruited via Amazon Mechanical Turk.

b. **Eligibility Criteria:** In order to be eligible for this study, individuals must 1) be at least 18 years of age; 2) have been diagnosed with either type 2 diabetes or hypertension in the past 6 months; 3) not be pregnant or 3 months postpartum (for female participants); and 4) be at risk for treatment nonadherence.

c. **Rationale:** This study focuses on effective communication about treatment adherence for type 2 diabetes and hypertension. Thus, individuals who participate in the study must have one of these 2 conditions. The 6 month cutoff has been chosen based on the literature which suggests that individuals give up treatment starting 6 months after they have been diagnosed with a chronic condition. Pregnant women or women within 3 months from having given birth are excluded because it is common for these patients to not take chronic illness medication during this time period due to its potential negative effects on the fetus/on the baby through breastfeeding. Finally, this study focuses on individuals who are at risk for not adhering to their treatment; therefore, following recommendations from prior literature, it is necessary that only individuals who present such risks are included in our study in order to determine the effectiveness of the communications tested. Including individuals who are not at risk for nonadherence might inflate the effectiveness of the communications tested.

d. **Enrollment Numbers:** A total of 100 participants will be recruited for the pilot study and a total of 1000 participants will be recruited for the main study.

e. **Rationale for Enrollment Numbers**: The aim of the pilot study is to make sure that the communications tested in the main study are readable, easy to understand, relevant to this group of patients. The pilot study will also be used to estimate how much time on average is needed to read the communications tested. Thus, given the descriptive nature of the pilot study, 100 participants represents an appropriate number.

   For the main study, the number of participants has been established based on statistical power calculations. 1000 participants ensures enough statistical power to make accurate inferences. By setting a maximum number of participants, the survey software used (Qualtrics) will automatically stop collecting data once 1000 respondents have taken the survey.

3. Procedures:

A quasi-experiment will be conducted online to test the hypotheses. In the Amazon Mechanical Turk participant recruitment system, the study will be introduced as a study that investigates patients' reactions to communications discussing adherence to treatment for chronic illnesses. Once participants identify themselves as eligible and agree to participate, they will be redirected to an online survey webpage hosted by Qualtrics.

The research presents no risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context. The study will be conducted using Qualtics survey software. Participants will be able to complete the study from their personal computers.

After signing the consent form, participants will report if they have type 2 diabetes or hypertension and will be assigned to the corresponding health condition group. Within each of these two groups, participants will be randomly assigned to one of the five experimental conditions. The five experimental conditions are the same, with the exception of a concluding statement. They will all describe the story of a patient who has decided not to take their medication as prescribed because he/she thought that the medication wasn't necessary. As a result, the patient finds himself/herself in the emergency room. There, the doctor tells him/her that their chronic illness has worsened significantly. Depending upon the experimental condition, the story will end with one of the following statements: 1) If only I had taken my medication, I wouldn't be here right now.; 2) At least I didn't die!; 3) If only I had my dog with me here, I wouldn't feel so bored.; 4) At least now I have a reason not to attend that dreadful work meeting tomorrow!; 5) no statement.

Each of these communications will be showed to participants as black text on a white screen. After reading one of these communications depending on their assigned

experimental condition, participants will respond a battery of questions, as described below.

Pilot Study
Participants in the pilot study will report demographic information. After that, they will rate the message they read in terms of readability, comprehension, relevance, effectiveness. They will also provide qualitative feedback about what should be changed about the message in order to make it more relevant and easy to understand for other patients like them. The pilot study should take no more than 10 minutes to complete. Following Amazon Mechanical Turk guidelines, participants in the pilot study will received 50 cents for their participation. The compensation will be handled through the Amazon Mechanical Turk system. An amendment application will be submitted to revise the messages (if necessary) based on the results of the pilot study.

Main Study
Participants in the main study will report demographic information. After that, participants will report on the emotions they felt while reading the story, their self-efficacy to take their medication as prescribed, their beliefs that the recommendation to take their medication is effective in managing their illness, and their intentions to take their medication as prescribed at the time of the study and in the future. Participants will also answer questions regarding the length of their disease, their communication with their health care provider, the side effects of their medications, and others. The main study should take approximately 25 minutes to complete. Following Amazon Mechanical Turk guidelines, participants in the main study will receive $1 for their participation. The compensation will be handled through the Amazon Mechanical Turk system.

4. Risks:

There are no known risks from participating in this research study.

5. Benefits:

There are no direct benefits to participants. We are hoping that this study will add knowledge to how to effectively communicate to chronic illness patients about the necessity to adhere to their treatment.

6. Confidentiality:

The researchers will not have any direct way of linking participants' responses to their identity, so the information they provide will be confidential. If the online survey system returns IP addresses or other identifying information, it will be immediately deleted. Only approved researchers will have access to the data collected. Data collected will be stored in a password-protected computer in a limited access space. The data will be retained for at least 5 years.

7. Consent Process:

The probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life.

Participants will be presented an online consent form after they click the link of the survey via the Amazon Mechanical Turk system.

This study needs a waiver of physical signed consent. Participants' rights and welfare will not be violated by the waiver of consent.

Participants will give their consent online by clicking a button saying, "I agree to participate in this study". Participants will have the ability to print a copy of the consent form for their records.

Because the study involves an online survey, it could not have been conducted without the alteration of consent.

Participation in the study will be voluntary. If they withdraw or decline participation, they will not be penalized or lose benefits or services unrelated to the study. If they decide to participate, they may decline to answer any question and may choose to withdraw at any time.
If participants have any questions or concerns about the study, participants may contact the principal investigator whose name and email address will be specified on the Amazon Mechanical Turk system and the consent form.

8. Conflict of Interest:

No conflict of interest.

9. HIPAA Compliance:

Not applicable.

10. Research Outside of the United States:

Not applicable.

11. Research Involving Prisoners:

Not applicable.

12. <u>SUPPORTING DOCUMENTS</u>

Your Initial Application must include a **completed Initial Application Part 1 (On-Line Document),** the information required in items 1-11 above, and all relevant supporting documents including: consent forms, letters sent to recruit participants, questionnaires completed by participants, and any other material that will be presented, viewed or read to human subject participants.

For funded research, a copy of the Awarded Grant Application (minus the budgetary information) must be uploaded. If the Grant has not been awarded at the time of submission of this Initial Application, a statement must be added to the Abstract Section stating that an Addendum will be submitted to include the Grant Application once it has been awarded.

THE IRB OFFICE WILL NO LONGER STAMP CONSENT FORMS. THE CONSENT FORMS IN YOUR APPROVED IRBNET PACKET MUST BE USED. THESE ARE YOUR APPROVED CONSENT FORMS.

Consent form pilot study

Project Title	Communicating about treatment adherence for chronic illness.
Purpose of the Study	*This research is being conducted by **Irina Iles and Xiaoli Nan** at the University of Maryland, College Park. We are inviting you to participate in this research project because you have a chronic illness. The purpose of this research project is to understand how individuals with chronic illness process and react to information about treatment adherence.*
Procedures	*The procedures involve a 10 minutes computer-based study. You will read a short story about a person who has the same chronic illness you have and who decides not to take their medication. Then, you will provide basic demographic information and answer a few questions that assess your reactions to the story you read. Sample questions include:* The story I just read grasped my attention immediately. The story I just read was easy to understand. *You will be compensated with 50 cents for your participation. The compensation will be provided to you via the Amazon Mechanical Turk System.*
Potential Risks and Discomforts	*There may be some risks from participating in this research study. Specifically, the story you will read might make you feel some discomfort because it will depict a person who shares your chronic illness.*
Potential Benefits	*There are no direct benefits from participating in this research. However, we hope that, in the future, other people might benefit from this study through improved understanding of how to best communicate about chronic illness and treatment for chronic illnesses.*

Confidentiality	*Any potential loss of confidentiality will be minimized by* ***storing data in a password protected computer in a locked office. Hard copy materials will be stored in a locked office. For an online survey, we will immediately delete any identifying information like IP address after the data have been collected.*** *Only approved researchers will have access to the data you provide.* *If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
Compensation	*You will receive 50 cents. You will be responsible for any taxes assessed on the compensation.* *If you will earn $100 or more as a research participant in this study, you must provide your name, address and SSN to receive compensation.* *If you do not earn over $100 only your name and address will be collected to receive compensation.*
Right to Withdraw and Questions	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.* *If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:* ***Irina Iles*** ***Department of Communication*** ***University of Maryland*** ***0107 Skinner Building*** ***College Park, MD 20742-7635*** ***(301) 405-0775***

	iirina@umd.edu
Participant Rights	*If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:* **University of Maryland College Park** **Institutional Review Board Office** **1204 Marie Mount Hall** **College Park, Maryland, 20742** **E-mail:** irb@umd.edu **Telephone: 301-405-0678** *This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.*
Statement of Consent	*Your online consent by clicking the radio button below indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this consent form.* *If you agree to participate, please choose the radio button "I agree to participate in this study" below.*

Consent form experiments 1 and 2

Project Title	Communicating about treatment adherence for chronic illness.
Purpose of the Study	*This research is being conducted by **Irina Iles and Xiaoli Nan** at the University of Maryland, College Park. We are inviting you to participate in this research project because you have a chronic illness. The purpose of this research project is to understand how individuals with chronic illness process and react to information about treatment adherence.*
Procedures	*The procedures involve a 25 minutes computer-based study. You will read a short story about a person who has a chronic illness like you and who decides not to take their medication. Then, you will provide basic demographic information and answer a few questions that assess your reactions to the story you read. Sample questions include:* I believe that taking my medication as prescribed by my doctor will help me stay healthy. How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you feel you do not need it? *You will be compensated with $1 for your participation. The compensation will be provided to you via the Amazon Mechanical Turk System.*
Potential Risks and Discomforts	*There may be some risks from participating in this research study. Specifically, the story you will read might make you feel some discomfort because it will depict a person who shares your chronic illness.*
Potential Benefits	*There are no direct benefits from participating in this research. However, we hope that, in the future, other people might benefit from this study through improved understanding of how to best communicate about chronic illness and treatment for chronic illnesses.*

Confidentiality	*Any potential loss of confidentiality will be minimized by* ***storing data in a password protected computer in a locked office. Hard copy materials will be stored in a locked office. For an online survey, we will immediately delete any identifying information like IP address after the data have been collected.*** *Only approved researchers will have access to the data you provide.* *If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
Compensation	*You will receive $1. You will be responsible for any taxes assessed on the compensation.* *If you will earn $100 or more as a research participant in this study, you must provide your name, address and SSN to receive compensation.* *If you do not earn over $100 only your name and address will be collected to receive compensation.*
Right to Withdraw and Questions	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.* *If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:* ***Irina Iles*** ***Department of Communication*** ***University of Maryland*** ***0107 Skinner Building*** ***College Park, MD 20742-7635*** ***(301) 405-0775***

	iirina@umd.edu
Participant Rights	*If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:* **University of Maryland College Park** **Institutional Review Board Office** **1204 Marie Mount Hall** **College Park, Maryland, 20742** **E-mail:** irb@umd.edu **Telephone: 301-405-0678** *This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.*
Statement of Consent	*Your online consent by clicking the radio button below indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this consent form.* *If you agree to participate, please choose the radio button "I agree to participate in this study" below.*

Participant recruiting and screening

The same text will be used for both the pilot and the main study.
This text will appear on Amazon Mechanical Turk:

In this study, we are interested in what individuals who have a chronic illness think about a brief story in which the importance of medical treatment is discussed. We are only looking for people who meet certain criteria. Please check to see if you qualify before accepting this HIT by clicking the link below.

[the link will redirect to a short screener hosted by Qualtrics]

Qualtrics Screener:

1. Are you at least 18 years of age? Yes/no
   If no, terminate
2. Are you pregnant? Yes/no
   If yes, terminate
3. If you are a woman, are you 3 months postpartum? Yes/no
   If yes, terminate
4. Have you been diagnosed with either hypertension or type 2 diabetes in the past 6 months?
   - Yes, with type 2 diabetes [jump to Questions 5-10]
   - Yes, with hypertension [jump to Questions 11-16]
   - No

   If no, terminate
5. Are you currently taking type 2 diabetes medication? Yes/no
   If no, terminate
6. Do you perceive the severity of your illness to be low? Yes/no
   If yes, participant is eligible -> redirect to main study survey
7. Are you concerned that you will gain weight if you take your medication? Yes/no
   If yes, participant is eligible -> redirect to main study survey
8. Are you concerned that your risk for cardiovascular illness might increase if you take your medication? Yes/no
   If yes, participant is eligible -> redirect to main study survey
9. Do you believe that your medication is not effective? Yes/no
   If yes, participant is eligible -> redirect to main study survey
10. Do you believe that your medication is not necessary? Yes/no
    If yes, participant is eligible -> redirect to main study survey
    [if participant answers no to all questions above, terminate]

11. Are you currently taking blood pressure lowering medication? Yes/no
    If no, terminate
12. Do you perceive the severity of your illness to be low?
    If yes, participant is eligible -> redirect to main study survey

13. Do you believe that your medication is not effective?
    If yes, participant is eligible -> redirect to main study survey
14. Do you believe that your medication is not necessary?
    If yes, participant is eligible -> redirect to main study survey
15. Are you concerned that your medication may cause side effects?
    If yes, participant is eligible -> redirect to main study survey
16. Is your hypertension condition asymptomatic, meaning that you are experiencing no symptoms because of your illness?
    If yes, participant is eligible -> redirect to main study survey

[if participant answers no to all questions above, terminate]

Message to appear on screen if "terminate": We're sorry, but you do not meet the requirements of this study. Thank you for participating.
Qualified participants are redirected to the study Qualtrics page.

Survey instrument pilot study

Consent form
[as detailed in the attached Consent Form document]

Chronic condition assignment:
Do you have:
1) Diabetes – if yes, assign to diabetes group
2) Hypertension – if yes, assign to hypertension group

Experimental manipulation for both the diabetes and the hypertension groups

A short story will now appear on the screen. Please read it carefully and pay attention to details. Imagine that what is being described in the story actually happened to you. Take as much time as you need to read the story. When you are done, click the "Next" button in the bottom right corner in the screen. You will then respond to a few questions about your reactions to the story.
[insert stimulus]

Study Measures
Now, please answer the questions that follow. Keep in mind that this is a survey designed to measure what you are thinking at this moment. This is not a test and there are no right or wrong answers. Please answer the questions based on what you really think and have experienced.

Remember that this is an anonymous survey and that your answers will not be connected to your name or contact information.

All of your answers are very important. We want to hear YOUR thoughts and opinions.

Please make sure to read every question. If you don't find an answer that fits exactly, use the one that comes closest.

Note that there will be no back button throughout the survey because we want to know your first impressions.

1. **Relevance.** 1 – strongly disagree to 7 – strongly agree
- The story I just read said something highly relevant to me.

2. **Believability.** 1 – strongly disagree to 7 – strongly agree
- The story I just read was believable.

3. **Comprehension** 1- strongly disagree to 7 – strongly agree

- The story I just read was easy to understand.
- I had no difficulty in understanding the story I just read.

4. **Interest in the message** 1 – strongly disagree to 7 – strongly agree
    - The story I just read grasped my attention immediately.

5. **Message derogation** 1- strongly disagree to 7 – strongly agree
   To what extent do you think the story you just read was:
    - Exaggerated
    - Distorted
    - Overblown

6. **Identification with the message** 1 – strongly disagree to 7 – strongly agree
    - I could easily relate to what happened in the story.
    - I think that the events I just read could happen to me in real life.

7. **Qualitative feedback**
   In the space provided below, please mention any thoughts you might have about the story you just read. Please focus on what aspects (words, ideas) in the story should be changed to make it more relevant and easier to understand by people like you.

Survey experiments 1 and 2

Consent form
[as detailed in the attached Consent Form document]

Chronic condition assignment:
Do you have:
3) Diabetes – if yes, assign to diabetes group
4) Hypertension – if yes, assign to hypertension group

Experimental manipulation for both the diabetes and the hypertension groups

A short story will now appear on the screen. Please read it carefully and pay attention to details. Imagine that what is being described in the story actually happened to you. You will have X minutes [X to be estimated in the pilot study] to read the story. After X minutes, the story will disappear from the screen and you will be asked a few questions about your reactions to the story.
[insert stimulus]

Study Measures
Now, please answer the questions that follow. Keep in mind that this is a survey designed to measure what you are thinking at this moment. This is not a test and there are no right or wrong answers. Please answer the questions based on what you really think and have experienced.

Remember that this is an anonymous survey and that your answers will not be connected to your name or contact information.

All of your answers are very important. We want to hear YOUR thoughts and opinions.

Please make sure to read every question. If you don't find an answer that fits exactly, use the one that comes closest.

Note that there will be no back button throughout the survey because we want to know your first impressions.

1. **Emotions**

   What were your feelings while reading the story?

   1 – did not experience that emotion at all; 7 – experienced the emotion more strongly than ever before

- Regret
- Remorse
- repentance

2. **Self-efficacy**
    - How confident are you that you can follow the medication treatment that your doctor prescribed to you for your chronic condition?
    - How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you experience side effects?
    - How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you feel you do not need it?
    - How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you do not have symptoms?
    - How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you are feeling well?
    - How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you are afraid of becoming dependent on them?
    - How confident are you that you can make taking medication part of your routine?

    1 – not at all confident to 7 – very confident.

3. **Response Efficacy** 1 – strongly disagree; 7 – strongly agree

- I believe that taking my medication as prescribed by my doctor will help me stay healthy
- I believe that taking my medication as prescribed by my doctor will improve the quality of my life
- I believe that taking my medication as prescribed by my doctor will improve my ability to function in day to day life
- I believe that taking my medication as prescribed by my doctor will allow me to have a long life
- I believe that taking my medication as prescribed by my doctor will allow me to lead a normal life
- I believe that taking my medication as prescribed by my doctor will decrease my chronic illness-related symptoms

- I believe that taking my medication as prescribed by my doctor will prevent hospitalization
- I believe that taking my medication as prescribed by my doctor will allow me to enjoy life.

4. **Behavioral intentions** 1 – not strong at all to 7 – very strong

    - Think about this moment. How strong is your intention to take your medication as advised by your doctor right now?
    - Think about tomorrow. How strong do you think your intention to take your medication as advised by your doctor will be tomorrow?
    - Think about one week from today. How strong do you think your intention to take your medication as advised by your doctor will be one week from today?

5. **Covariates**
    a. **History of medical complications**
    - Have you ever experienced health complications, such as chronic illness symptom aggravation, due to not taking your medications? (yes, one time; yes, more than once; no, never)
    - Have you ever been hospitalized because you did not take your medications? (yes, one time; yes, more than once; no, never).

    b. **Experience of medication side effects** 1-not at all; 7 – very much
    - How much do you fear that your chronic illness medication will cause side effects
    - Have you experienced any side effects caused by your chronic illness medication?

    c. **Depressive symptoms**
    In the past 2 weeks, how much did you experience any of the following: 1- not at all; 7 – very much
    - Little interest or pleasure in doing things
    - Feeling down, depressed, or hopeless
    - Feeling nervous, anxious, or on edge
    - Not being able to stop or control worrying

    d. **Doctor-patient communication** 1 – strongly disagree; 7 – strongly agree
    - The physician gave me detailed information about the available treatment options.

- The physician and I made all treatment decisions together.
- The physician's explanations were easy to understand.
- The physician spoke to me in detail about the risks and side effects of the proposed treatment.
- The doctor asked about how my illness affects my everyday life.
- The doctor gave me enough time to talk about all my problems.
- The physician respects that I may have a different opinion regarding treatment. The physician gave me detailed information about my illness.

e. <u>Length of illness</u>

For how long have you diagnosed with diabetes/hypertension?
Less than a year

- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- more than 6 years

6. <u>Demographic information.</u> Participants will be asked to report their gender, race/ethnicity, and age.

a. **Age**: _____
b. **Sex**: ☐ Female ☐ Male
c. **Race/Ethnicity**:

☐ African-American/Black ☐ Asian or Pacific Islander
☐ Latino/Hispanic ☐ Native-American
☐ White /Caucasian ☐ Unknown / Other _____

Appendix D. Stimuli used in Experiment 3

Condition 1: Stated upward counterfactual condition

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

I couldn't help but think that if only I had taken my medication as prescribed, I would have been fine! If only I had taken my medication as prescribed, my condition wouldn't have worsened and I would not be in the hospital right now!

Condition 2: Stated downward counterfactual condition

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

I couldn't help but think that it could have been worse and I could have died!

Condition 3: Spontaneous upward counterfactual condition version 1

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that

I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

After listening to the text above, participants read the following instructions [the bold text appeared in the survey, as well]:

People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "If only I had looked down the street a second time, **I wouldn't have been hit!"**

Think about the story you just listened to. Then think about **how things could have been better if the character had taken their medication as prescribed**. Please fill in the following statements with your thoughts.

If only the character had taken the medication, he wouldn't have _____

If only the character had taken the medication, he wouldn't have _____

Condition 4: Spontaneous upward counterfactual condition version 2

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that

I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

After listening to the text above, participants read the following instructions [the bold text appeared in the survey, as well]:

People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better **if they had done things differently**. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "**If only I had looked down the street a second time**, I wouldn't have been hit!"

Think about the story you just listened to. Then think what the character in the story **could have done differently to prevent his illness from getting worse**. Please fill in the following statements with your thoughts.

If only the character had _____, his illness wouldn't have gotten worse.
If only the character had _____, his illness wouldn't have gotten worse.

<u>Condition 5: Spontaneous downward counterfactual condition</u>

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side

effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

After listening to the text above, participants read the following instructions [the bold text appeared in the survey, as well]:

People often have thoughts like "it could have been worse and I could have…" after negative events, in that they can see how things may have turned out even worse. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "it could have been worse and I could have died!"

Think about the story you just listened to. Then think about how the character's situation could have been worse than it currently is. Please fill in the statements below with your thoughts.

The character could have ____

The character could have ____

Condition 6: Control condition (no counterfactual)

I've been diagnosed with type 2 diabetes/hypertension. My doctor prescribed me medication. I took the medication for a while and it was causing uncomfortable side effects, so I wanted to see if it was really necessary. So I stopped taking it, thinking that

I'll be alright. After about a week of not taking my pills, I started feeling really bad, I felt very dizzy, I could barely walk or talk, so I had to go to the emergency room. The doctors there told me that my diabetes/hypertension got worse.

Appendix E. Institutional Review Board Application Materials for Experiment 3

Initial Application Part 2

13. Abstract:

Chronic illnesses among the most common, costly, and preventable of all health problems in the United States. After an individual has been diagnosed with a chronic illness, he/she must follow a doctor-recommended course of treatment in order to manage their condition and avoid medical complications. Adherence to treatment, however, is low and understanding how to effectively communicate to patients about the importance of treatment is important. This study tries to understand how individuals with type 2 diabetes, a major chronic illness that has low treatment adherence, process and react to information about treatment adherence. The goal of this study is to offer advice on how to effectively communicate with patients about treatment adherence in order to maximize their willingness to follow said treatment.

14. Subject Selection:

f. **Recruitment:** Participants for this study will be recruited via Amazon Mechanical Turk.

g. **Eligibility Criteria:** In order to be eligible for this study, individuals must 1) be at least 18 years of age; 2) have been diagnosed with type 2 diabetes in the past 6 months; 3) not be pregnant or 3 months postpartum; and 4) be at risk for treatment nonadherence.

h. **Rationale:** This study focuses on effective communication about treatment adherence for type 2 diabetes. Thus, individuals who participate in the study must this condition. The 6 month cutoff has been chosen based on the literature which suggests that individuals give up treatment starting 6 months after they have been diagnosed with a chronic condition. Pregnant individuals or individuals within 3 months from having given birth are excluded because it is common for these patients to not take chronic illness medication during this time period due to its potential negative effects on the fetus/on the baby through breastfeeding. Finally, this study focuses on individuals who are at risk for not adhering to their treatment; therefore, following recommendations from prior literature, it is necessary that only individuals who present such risks are included in our study in order to determine the effectiveness of the communications tested. Including individuals who are not at risk for nonadherence might inflate the effectiveness of the communications tested.

i. **Enrollment Numbers:** A total of up to 500 participants will be recruited for the study.

j. **Rationale for Enrollment Numbers**: The number of participants has been established based on statistical power calculations. 500 participants ensure enough statistical power to make accurate inferences. By setting a maximum number of participants, the survey software used (Qualtrics) will automatically stop collecting data once 500 respondents have taken the survey.

15. Procedures:

A quasi-experiment will be conducted online to test the hypotheses. In the Amazon Mechanical Turk participant recruitment system, the study will be introduced as a study that investigates patients' reactions to communications discussing adherence to treatment for chronic illnesses. Once participants identify themselves as eligible and agree to participate, they will be redirected to an online survey webpage hosted by Qualtrics. The screening of participants will include questions about 1) their diagnosis with diabetes; 2) their currently taking medication to treat the illness; 3) their concerns with side effects of the medication; 4) their concerns with the necessity and effectiveness of the medication. Participants who have diabetes, are taking medication, and express some concern regarding side effects or medication necessity or medication effectiveness will be included in the study.

The research presents no risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context. The study will be conducted using Qualtrics survey software. Participants will be able to complete the study from their personal computers.

If agreeing to participate in the study, participants will report if they have type 2 diabetes. Participants will first engage in a brief exercise to ensure that they can properly hear the messages of interest and that they are paying attention.

For this exercise, participants will listen to a brief introduction narrated by a person named Robert. After that, participants will answer a question about what Robert has said. If participants answer this question wrong, they are reminded to pay attention and listen carefully and cautioned that if they miss any other attention checks they will be terminated from the study without compensation.

Participants will be then randomly assigned to one of the study's six experimental conditions. The six experimental conditions consist of an audio message; they are all the same, with the exception of their ending statement. They will all describe the story of a

patient who has decided not to take their medication as prescribed because he/she thought that the medication wasn't necessary. As a result, the patient finds himself/herself in the emergency room. There, the doctor tells him/her that their chronic illness has worsened significantly. Depending upon the experimental condition, the story will end with one of the following statements: 1) I couldn't help but think that if only I had taken my medication as prescribed, my condition wouldn't have worsened! If only I had taken my medication as prescribed, my condition wouldn't have worsened and I would not be in the hospital right now!; 2) I couldn't help but think that it could have been worse and I could have died!; 3) 4), & 5) instructions to generate their own statements (see details below); 6) no statement (control condition).

3) Instructions for condition 3: People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "If only I had looked down the street a second time, I wouldn't have been hit!"

Think about the story you just listened to. Then think about how things could have been better if the character had taken their medication as prescribed. Please fill in the following statements with your thoughts.

If only the character had taken the medication, he wouldn't have _____
If only the character had taken the medication, he wouldn't have _____

4) Instructions for condition 4: People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better if they had done things differently. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "If only I had looked down the street a second time, I wouldn't have been hit!"

Think about the story you just listened to. Then think what the character in the story could have done differently to prevent his illness from getting worse. Please fill in the following statements with your thoughts.

If only the character had _____, his illness wouldn't have gotten worse.
If only the character had _____, his illness wouldn't have gotten worse.

5) Instructions for condition 5: People often have thoughts like "it could have been worse and I could have…" after negative events, in that they can see how things may have turned out even worse. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "it could have been worse and I could have died!"

Think about the story you just listened to. Then think about how the character's situation could have been worse than it currently is. Please fill in the statements below with your thoughts.

The character could have ____
The character could have ____

Participants will be randomly assigned to listen to one these stories. After listening to one of these communications depending on their assigned experimental condition, participants will respond a battery of questions, as described below.

Participants will report on the emotions they felt while reading the story, their self-efficacy to take their medication as prescribed, their beliefs that the recommendation to take their medication is effective in managing their illness, and their intentions to take their medication as prescribed at the time of the study and in the future. Participants will also answer questions regarding the length of their disease, beliefs about their illness (e.g., illness severity, effectiveness of medication to manage their illness), their communication with their health care provider, the side effects of their medications, and demographic information. The study should take approximately 15 minutes to complete.

Following Amazon Mechanical Turk guidelines, participants will receive $1 for their participation. The compensation will be handled through the Amazon Mechanical Turk system.

Because participants on Mturk often do not pay attention to survey items, researchers include accuracy questions/attention checks to ensure that they obtain quality data. We have 3 such accuracy questions/attention checks:
1) in the exercise in the beginning of the study (described above)
2) after listening to the messages

When did the character in the story start feeling sick after not taking their medication?

a) immediately
b) after about one week [correct answer]
c) after about one month
d) the character didn't feel sick

3) when measuring self-efficacy [the following item will be inserted among the self-efficacy measures]:

How confident are you that you are paying attention? Please select option '5', this is
an attention check.

If participants miss the first attention check, they are given a free pass, cautioned to pay more attention, and allowed to continue. If participants miss the 2nd or the 3rd attention check, they are terminated from the survey immediately and the data collected up that point is automatically deleted by the survey software. Compensation is not provided in this case. Participants will be informed about this in the consent form. The attention checks/accuracy questions are positioned in the beginning of the survey, immediately after the study manipulation, and at about the mid-point of the survey (for the self-efficacy item) to avoid terminating a participant from the study once the survey is almost completed. The 2nd and 3rd attention checks are strategically positioned to ensure that 1)

participants have carefully listened to the main message in the study (failure to do so would render the study invalid); and 2) participants carefully answer the main variables in the study (failure to do so would also render the study invalid).

16. Risks:

There are no known risks from participating in this research study. However, participants might feel some discomfort due to reading a story about a person who shares their chronic illness. At the end of the survey, resources regarding the treatment of diabetes will be provided so that participants can learn more about the role of treatment for their condition.

17. Benefits:

There are no direct benefits to participants. We are hoping that this study will add knowledge to how to effectively communicate to chronic illness patients about the necessity to adhere to their treatment.

18. Confidentiality:

The researchers will not have any direct way of linking participants' responses to their identity, so the information they provide will be confidential. If the online survey system returns IP addresses or other identifying information, it will be immediately deleted. Only approved researchers will have access to the data collected. Data collected will be stored in a password-protected computer in a limited access space. The data will be retained for at least 5 years.

19. Consent Process:

The probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life.

Participants will be presented an online consent form after they click the link of the survey via the Amazon Mechanical Turk system.

This study needs a waiver of physical signed consent. Participants' rights and welfare will not be violated by the waiver of consent.

Participants will give their consent online by clicking a button saying, "I agree to participate in this study". Participants will have the ability to print a copy of the consent form for their records.

Because the study involves an online survey, it could not have been conducted without

the alteration of consent.

Participation in the study will be voluntary. If they withdraw or decline participation, they will not be penalized or lose benefits or services unrelated to the study. If they decide to participate, they may decline to answer any question and may choose to withdraw at any time.
If participants have any questions or concerns about the study, participants may contact the principal investigator whose name and email address will be specified on the Amazon Mechanical Turk system and the consent form.

20. Conflict of Interest:

No conflict of interest.

21. HIPAA Compliance:

Not applicable.

22. Research Outside of the United States:

Not applicable.

23. Research Involving Prisoners:

Not applicable.

24. <u>SUPPORTING DOCUMENTS</u>

Your Initial Application must include a **completed Initial Application Part 1 (On-Line Document),** the information required in items 1-11 above, and all relevant supporting documents including: consent forms, letters sent to recruit participants, questionnaires completed by participants, and any other material that will be presented, viewed or read to human subject participants.

For funded research, a copy of the Awarded Grant Application (minus the budgetary information) must be uploaded. If the Grant has not been awarded at the time of submission of this Initial Application, a statement must be added to the Abstract Section stating that an Addendum will be submitted to include the Grant Application once it has been awarded.

THE IRB OFFICE WILL NO LONGER STAMP CONSENT FORMS. THE CONSENT FORMS IN YOUR APPROVED

<u>IRBNET PACKET</u> MUST BE USED. THESE ARE YOUR APPROVED CONSENT FORMS.

Consent Form

Project Title	Communicating about treatment adherence for chronic illness.
Purpose of the Study	*This research is being conducted by **Irina Iles and Xiaoli Nan** at the University of Maryland, College Park. We are inviting you to participate in this research project because you have a chronic illness. The purpose of this research project is to understand how individuals with chronic illness process and react to information about their illness.*
Procedures	*The procedures involve a 15 minutes computer-based study. You will listen to a short story about a person who has a chronic illness like you. Then, you will provide basic demographic information and answer a few questions or rate items that assess your reactions to the story you heard. Sample questions/items include:* • How confident are you that you can take the medication that the doctor prescribed to you for your chronic condition when you feel you do not need it? • I am concerned that I will gain weight if I take my medication. *You will be compensated with $1 for your participation. The compensation will be provided to you via the Amazon Mechanical Turk System.* *Please note that there will be attention checks/accuracy questions throughout the survey to ensure that you have listened to the story carefully and that you pay attention to all the questions/items in the survey. If any of the attention checks/accuracy questions are missed, the survey software will immediately terminate your participation in the survey and the data you have provided up to the point you are terminated from the survey will automatically be deleted by the survey software. Compensation will not be provided in this situation.*
Potential Risks and Discomforts	*There may be some risks from participating in this research study. Specifically, the story you will read might make you feel some discomfort because it will depict a person who shares your chronic illness. At the end of the survey, a link where you can find more information about the information in the story will be provided.*
Potential Benefits	*There are no direct benefits from participating in this research. However, we hope that, in the future, other people might benefit from this study through improved understanding of how to best communicate about chronic illness and treatment for chronic illnesses.*

Confidentiality	*Any potential loss of confidentiality will be minimized by* ***storing data in a password protected computer in a locked office. Hard copy materials will be stored in a locked office. For an online survey, we will immediately delete any identifying information like IP address after the data have been collected.*** *Only approved researchers will have access to the data you provide.* *If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
Compensation	*You will receive $1. You will be responsible for any taxes assessed on the compensation.*
Right to Withdraw and Questions	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.* *If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:* ***Irina Iles*** ***Department of Communication*** ***University of Maryland*** ***0107 Skinner Building*** ***College Park, MD 20742-7635*** ***(301) 405-0775*** ***iirina@umd.edu***
Participant Rights	*If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:* **University of Maryland College Park** **Institutional Review Board Office** **1204 Marie Mount Hall** **College Park, Maryland, 20742** **E-mail: irb@umd.edu** **Telephone: 301-405-0678** *This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.*

Statement of Consent	*Your online consent by clicking the radio button below indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study.* *You may print a copy of this consent form for your records.* *If you agree to participate, please choose the radio button "I agree to participate in this study" below.*

Survey

Exercise to ensure participants can hear the messages

Trial before exposure to experimental condition

In this study, you will listen to a brief story and then answer a few questions about that story. Please make sure the audio volume on your computer is working and turned on at an adequate volume. We'll start with a test message to ensure that you can hear our messages properly. Please listen to the following test message carefully. You will be asked questions about it and you must answer them correctly to continue with the study!

Click "play" to listen to the message.

> Hi! My name is Robert and I love sports. My favorite sport is tennis. I like playing tennis on Sunday afternoons with my brother. I also love wild animals. My favorite animal is the tiger. Have a nice day!

Accuracy question:

What is Robert's favorite animal?

- Cats
- Snakes
- **Tigers [correct answer]**
- Kangaroos

If the participant answers this question wrong, the following message appears:

Your answer is incorrect. Please make sure your audio is on and at an adequate volume and that you pay attention to the information you listen to. If you miss other accuracy questions asked throughout the survey, you will be terminated from the survey without compensation.

We will move on to the main study. Please listen to the following story. The remaining questions in this study will relate to this story so it is important that you pay attention to it. Click "play" to begin the story.

If the participant answers correctly, the following message appears:

You did great! Now that we made sure you can hear our messages properly, we will move on to the main study. Please listen to the following story. The remaining questions in this study will relate to this story so it is important that you pay attention to it. Click "play" to begin the story.

Pre-exposure behavior

Are you currently taking your diabetes/hypertension medication consistently as prescribed by your doctor?

- No, I stopped taking my medication
- I take my medication inconsistently, most of the days I don't take it
- I take my medication inconsistently, but I do take it most days
- Yes, I take my medication as prescribed every day.

Risk for medication nonadherence

Now please rate the following items on a scale from 1 -strongly disagree to 7 – strongly agree.

- I think the severity of my diabetes is low.
- I am concerned that I will gain weight if I take my diabetes medication.
- I am concerned that my risk for cardiovascular illness my increase if I take my diabetes medication.
- I think my diabetes medication is not effective.
- I think that my diabetes medication is not necessary.
- I don't think it's such a big deal if I don't take my diabetes medication every day.

Experimental manipulation

[insert stimulus]

Accuracy question about the message:

When did the character in the story start feeling sick after not taking their medication?

a) immediately
b) **after about one week [correct answer]**
c) after about one month
d) the character didn't feel sick

[if participant answers wrongly, he/she is exited from the survey]

Study Measures

Now, think about the story you just listened to as you answer the questions that follow. Please answer the questions based on what you really think and have experienced.

Remember that this is an anonymous survey and that your answers will not be connected to your name or contact information.

All of your answers are very important. We want to hear YOUR thoughts and opinions.

Please make sure to read every question. The questions are distinct, even if they may initially appear as the same, so it is important that you read all of them.

Note that there will be no back button throughout the survey because we want to know your first impressions.

1. **Regret**

What were your feelings while listening to the story?

1 – did not experience that emotion at all; 7 – experienced the emotion more strongly than ever before

- Regret
- Remorse
- Repentance

2. **Self-efficacy**

Think about the story you just listened to and rate your level of agreement or disagreement with each of items below. The items are distinct, so make sure you read each of them carefully.
1 – not at all confident to 7 – very confident.

After listening to this story, how confident are you that….

- you can follow the medication treatment that your doctor prescribed to you for your chronic condition?
- you can take the medication that the doctor prescribed to you for your chronic condition when you experience side effects?
- you can take the medication that the doctor prescribed to you for your chronic condition when you feel you do not need it?
- you are paying attention? Please select option '5', this is an attention check.
  [if any option other than 5 is selected, the participant is terminated from the survey]
- you can take the medication that the doctor prescribed to you for your chronic condition when you do not have symptoms?
- you can take the medication that the doctor prescribed to you for your chronic condition when you are feeling well?
- you can take the medication that the doctor prescribed to you for your chronic condition when you are afraid of becoming dependent on them?
- you can make taking medication part of your routine?

3. <u>Response Efficacy and Outcome Expectations</u>

1 – strongly disagree; 7 – strongly agree

- I believe that taking my medication as prescribed by my doctor will:
  - help me stay healthy
  - improve the quality of my life
  - improve my ability to function in day to day life
  - allow me to have a long life
  - allow me to lead a normal life
  - decrease my chronic illness-related symptoms
  - prevent hospitalization
  - allow me to enjoy life.
  - allow me to engage in activities that I enjoy.
  - allow me to live the life that I want.
  - make my family and friends happy.
- I believe that if I take my medication as prescribed by my doctor, my family and friends will support me.
- I believe that if I take my medication as prescribed by my doctor, my family and friends will like me more.
- I believe that if I take my medication as prescribed by my doctor, my family and friends will trust me more.

4. <u>Behavioral intentions</u>

1 – not strong at all to 7 – very strong

- Think about this moment. How strong is your intention to take your medication as advised by your doctor right now?
- Think about tomorrow. How strong do you think your intention to take your medication as advised by your doctor will be tomorrow?
- Think about one week from today. How strong do you think your intention to take your medication as advised by your doctor will be one week from today?
- How strong do you think your intention to take your medication as prescribed by your doctor even if you experience side effects is?
- How strong do you think your intention to take your medication as prescribed by your doctor even if you have no symptoms is?

5. Manipulation check (for the stated CFT conditions + control)

Think about the story you just listened to and rate the statements below on a scale from 1 – strongly disagree to 7 – strongly agree.

- The character in the story specifically mentioned what he could have done to avoid the negative situation he is now in.
- The character in the story specifically mentioned how his situation could have been worse.

6. Covariates

a. History of medical complications

- Have you ever experienced health complications, such as chronic illness symptom aggravation, due to not taking your medications? (yes, one time; yes, more than once; no, never)
- Have you ever been hospitalized because you did not take your medications? (yes, one time; yes, more than once; no, never).

b. Experience of medication side effects

1-not at all; 7 – very much

- How much do you fear that your chronic illness medication will cause side effects?
- Have you experienced any side effects caused by your chronic illness medication?

c. Depressive symptoms

In the past 2 weeks, how much did you experience any of the following:

2- not at all; 7 – very much

- Little interest or pleasure in doing things
- Feeling down, depressed, or hopeless
- Feeling nervous, anxious, or on edge
- Not being able to stop or control worrying

d. **Doctor-patient communication**

Think about your experience when you visit the doctor for your diabetes and rate your level of agreement or disagreement with the following statements.

1 – strongly disagree; 7 – strongly agree

- The physician gave me detailed information about the available treatment options.
- The physician and I made all treatment decisions together.
- The physician's explanations were easy to understand.
- The physician spoke to me in detail about the risks and side effects of the proposed treatment.
- The doctor asked about how my illness affects my everyday life.
- The doctor gave me enough time to talk about all my problems.
- The physician respects that I may have a different opinion regarding treatment.
- The physician gave me detailed information about my illness.

e. <u>Length of illness</u>

For how long have you been diagnosed with diabetes/hypertension?

- less than a year
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- more than 6 years

7. <u>Demographic information.</u> Participants will be asked to report their gender, race/ethnicity, and age.

a. **Age**: _____
b. **Gender**: ☐ Female ☐ Male ☐ Gender fluid
c. **Race/Ethnicity**:

☐ African-American/Black ☐ Asian or Pacific Islander
☐ Latino/Hispanic ☐ Native-American
☐ White /Caucasian ☐ Unknown / Other _____

d. What is the highest level of school you completed?

- Less than high school
- Some high school

- High school graduate
- Some college
- College graduate
- Post-college

e. What is your household yearly income?

- Less than $15,000
- $15,000-25,000
- $25,001-45,000
- $45,001-65,000
- $65,001-100,000
- More than $100,000
- I don't know

For more information about diabetes and its treatment, please access this page: http://www.diabetes.org/living-with-diabetes/treatment-and-care/

Tables

Table 1. Diabetes Message Evaluations Pilot Study

Condition	Relevance	Believability	Interest	Comprehension	Identification	Derogation
Integral Upward CFT	5.33 (1.41)	5.67 (1.66)	5.78 (1.20)	6.06 (1.16)	5.83 (1.00)	3.11 (1.87)
Integral Downward CFT	5.63 (1.06)	5.38 (1.60)	5.63 (1.06)	6.13 (1.16)	5.56 (1.29)	2.92 (1.14)
Incidental Upward CFT	3.38 (2.26)	3.00 (2.00)	3.63 (2.50)	4.25 (1.77)	3.13 (1.79)	3.71 (2.05)
Incidental Downward CFT	5.38 (1.85)	5.63 (1.60)	5.25 (2.44)	6.44 (0.82)	5.31 (1.58)	4.42 (2.01)
Control (no CFT)	6.25 (0.71)	6.13 (0.84)	5.88 (1.13)	6.31 (0.65)	5.88 (0.92)	3.00 (2.15)
Total	5.20 (1.76)	5.17 (1.87)	5.24 (1.88)	5.84 (1.38)	5.16 (1.64)	3.42 (1.87)

Note: Means (Standard Deviation)

Table 2. Hypertension Message Evaluations Pilot Study

Condition	**Relevance**	**Believability**	**Interest**	**Comprehension**	**Identification**	**Derogation**
Integral Upward CFT	5.75 (1.14)	5.83 (1.27)	5.67 (1.23)	6.42 (1.00)	5.25 (1.37)	2.81 (1.62)
Integral Downward CFT	5.54 (1.27)	6.15 (1.28)	6.00 (1.16)	6.38 (1.02)	5.38 (1.54)	2.79 (1.42)
Incidental Upward CFT	4.83 (1.03)	4.92 (1.17)	4.92 (1.17)	5.50 (1.28)	4.92 (1.22)	2.92 (1.19)
Incidental Downward CFT	4.67 (1.61)	5.50 (1.45)	5.25 (1.06)	6.04 (1.39)	4.54 (1.29)	3.03 (1.18)
Control (no CFT)	5.25 (1.14)	5.92 (1.00)	5.58 (1.00)	6.29 (0.94)	5.83 (0.86)	2.33 (1.08)
Total	5.21 (1.28)	5.67 (1.27)	5.49 (1.15)	6.13 (1.15)	5.19 (1.31)	3.78 (1.29)

Note: Means (Standard Deviation)

Table 3. Type 2 Diabetes sample characteristics

Characteristic	# participants	Percentage
Type 2 Diabetes		
Gender		
Woman	207	57.8
Man	147	41.1
Gender fluid	4	1.1
Race		
White	248	69.3
Black/African American	43	12.0
Latino/Hispanic	22	6.1
Asian/Pacific Islander	23	6.4
Native American	10	2.8
Mixed	12	3.4
Education		
Some high school	6	1.7
High school graduate	46	12.9
Some college	135	37.8
College graduate	135	37.8
Post-college graduate	35	9.8
Income		
Less than $15,000	31	8.7
$15,001 - $25,000	44	12.3
$25,001 - $45,000	97	27.1
$45,001 - $65,000	98	27.4
$65,001 - $100,000	64	17.9
>$100,000	21	5.9
Illness length		
Less than one year	103	28.8
One year	58	16.2
Two years	70	19.6
Three years	51	14.2
Four years	17	4.7
Five years	19	5.3
Six years	6	1.7
More than six years	34	9.5

Table 4. Hypertension sample characteristics

Characteristic	# participants	Percentage
Hypertension		
Gender		
Woman	238	61.0
Man	149	38.2
Gender fluid	3	0.8
Race		
White	288	73.8
Black/African American	44	11.3
Latino/Hispanic	31	7.9
Asian/Pacific Islander	16	4.1
Native American	7	1.8
Mixed	4	1.0
Education		
Some high school	3	0.8
High school graduate	46	11.8
Some college	123	31.5
College graduate	153	39.2
Post-college graduate	65	16.7
Income		
Less than $15,000	32	8.2
$15,001 - $25,000	52	13.3
$25,001 - $45,000	113	29.0
$45,001 - $65,000	81	20.8
$65,001 - $100,000	71	18.2
>$100,000	36	9.2
Illness length		
Less than one year	100	25.6
One year	44	11.3
Two years	58	14.9
Three years	56	14.4
Four years	32	8.2
Five years	29	7.4
Six years	5	1.3
More than six years	66	16.9

Table 5. Summary of measures for experiments 1 and 2

Variable	Number of items	Cronbach's alpha (Pearson's r)	Mean (SD)	Skewness (standard error)	Kurtosis (standard error)	Skewness transformed variable	Kurtosis transformed variable
Type 2 diabetes							
Regret	3	.89	3.84 (1.81)	-0.16 (.13)	-1.09 (.26)		
Self-efficacy	7	.92	5.31 (1.28)	-0.47 (.13)	-0.55 (.26)		
Response efficacy	10	.96	5.51 (1.20)	-0.66 (.13)	-0.31 (.26)		
Outcome expectancy	4	.74	4.76 (1.31)	-0.25 (.13)	-0.38 (.26)		
*Behavioral intention**	3	.93	5.87 (1.28)	-1.00 (.13)	0.17 (.26)	-0.63 (.13)	-0.88 (.26)
Depressive symptoms	4	.92	3.55 (1.70)	0.09 (.13)	-0.88 (.26)		
*Side effects***	2	.56	4.59 (1.50)	-0.39 (.13)	-0.32 (.26)		
Doctor-patient comm	8	.93	5.05 (1.41)	-0.60 (.13)	-0.24 (.26)		
Hypertension							
Regret	3	.86	3.46 (1.69)	0.07 (.12)	-1.03 (.25)		
Self-efficacy	7	.91	5.45 (1.27)	-0.83 (.12)	0.56 (.25)		
*Response efficacy**	10	.96	5.61 (1.24)	-1.15 (.12)	1.61 (.25)	-0.44 (.12)	-0.64 (.25)
Outcome expectancy	4	.79	4.55 (1.41)	-0.26 (.12)	-0.18 (.25)		
*Behavioral intention**	3	.94	5.99 (1.32)	-1.68 (.12)	2.76 (.25)	-0.84 (.12)	0.15 (.25)

Depressive symptoms	4	.91	3.56 (1.86)	0.12 (.12)	-0.90 (.25)
*Side effects***	2	.63	4.22 (1.65)	-0.21 (.12)	-0.85 (.25)
Doctor-patient comm	8	.93	4.93 (1.51)	-0.67 (.12)	-0.34 (.25)

Note: * This variable was squared. Means are specified for the untransformed variable.

** Pearson's r is reported.

Table 6. Bivariate correlations among continuous measures in experiments 1 and 2

Variable	1	2	3	4	5	6	7	8
Type 2 diabetes								
1. Regret	1	.062	.115*	.234**	.058	.203**	.144**	.064
2. Self-efficacy		1	.738**	.299**	.736**	-.031**	-.189**	.472**
3. Response efficacy			1	.480**	.771**	-.083	-.243**	.606**
4. Outcome expectancy				1	.310**	.074	-.047	.370**
5. Behavioral intention					1	-.016	-.174**	.488**
6. Side effects						1	.318**	-.015
7. Depressive symptoms							1	-.229**
8. Doctor-patient comm								1
Hypertension								
1. Regret	1	-.008	.074	.233**	.015	.113*	.172**	.145**
2. Self-efficacy		1	.676**	.271**	.738**	-.272**	-.248**	.424**
3. Response efficacy			1	.480**	.716**	-.318**	-.268**	.448**
4. Outcome expectancy				1	.302**	-.071	-.111*	.342**
5. Behavioral intention					1	-.236**	-.254**	.439**
6. Side effects						1	.298**	-.145**
7. Depressive symptoms							1	-.138**
8. Doctor-patient comm								1

Note: * correlation is significant at the 0.05 level
** correlation is significant at the 0.01 level

Table 7. Type 2 Diabetes sample experiments for experiment 3

Characteristic	# participants	Percentage
Type 2 Diabetes (experiment 3)		
Gender		
Woman	159	52.5
Man	144	47.5
Gender fluid	0	0
Race		
White	206	68
Black/African American	41	13.5
Latino/Hispanic	24	7.9
Asian/Pacific Islander	17	5.6
Native American	9	3.0
Mixed	5	1.7
Education		
Some high school	9	3.0
High school graduate	35	11.6
Some college	100	33.0
College graduate	127	41.9
Post-college graduate	32	10.6
Income		
Less than $15,000	23	7.6
$15,001 - $25,000	37	12.2
$25,001 - $45,000	68	22.4
$45,001 - $65,000	84	27.7
$65,001 - $100,000	59	19.5
>$100,000	29	9.6

Illness length		
Less than one year	175	57.8
Two years	49	16.2
Three years	27	8.9
Four years	19	6.3
Five years	13	4.3
Six years	2	0.7
More than six years	18	5.9

Table 8. Summary of measures for experiment 3

Variable	Number of items	Cronbach's alpha (Pearson's r)	Mean (SD)	Skewness (standard error)	Kurtosis (standard error)
Regret	3	.90	3.30 (1.28)	0.11 (.14)	-0.05 (.28)
Self-efficacy	7	.93	4.91 (0.98)	0.11 (.14)	0.15 (.28)
Response efficacy	10	.94	4.91 (1.00)	0.10 (.14)	-0.09 (.28)
*Outcome expectancy**	2	.87	4.32 (1.86)	-0.37 (.14)	-0.77 (.28)
Behavioral intention	5	.92	4.68 (1.01)	0.29 (.14)	0.29 (.28)
Depressive symptoms	4	.92	3.12 (1.76)	0.33 (.14)	-0.99 (.28)
*Side effects**	2	.52	3.95 (1.54)	-0.18 (.14)	-0.60 (.28)
Doctor-patient comm	8	.97	5.16 (1.38)	-0.48 (.14)	-0.37 (.28)
Nonadherence risk	3	.78	3.06 (1.32)	0.21 (.14)	-.66 (.28)

Note: *Pearson's r is reported.

Table 9. Bivariate correlations among continuous measures in experiment 3

Variable	1	2	3	4	5	6	7	8	9
Type 2 diabetes									
1. Regret	1	.228**	.117**	.170**	.195**	.148**	.085*	-.012	.150**
2. Self-efficacy		1	.824**	.137*	.574**	.001	-.121*	.191**	-.092
3. Response efficacy			1	.144*	.585**	.011	-.111*	.229**	-.094
4. Outcome expectancy				1	.164**	.016	.051	.256**	.112
5. Behavioral intention					1	.045	-.104	.160**	-.038
6. Side effects						1	.461**	-.319**	.453**
7. Depressive symptoms							1	-.359**	.374**
8. Doctor-patient comm								1	-.359**
9. Nonadherence risk									1

Note: * correlation is significant at the 0.05 level
** correlation is significant at the 0.01 level

Table 10. Summary of effects for stated upward CFT condition versus stated downward CFT condition

Direct effects						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.53	.15	3.53	.001	0.23	0.83
Condition > response efficacy	.71	.14	5.10	.000	0.44	0.99
Condition > outcome expectancy	-.11	.32	-0.34	.74	-0.75	0.53
Condition > intention	.17	.14	1.20	.23	-0.11	0.45
Self-efficacy > intention	.30	.11	2.67	.009	0.08	0.52
Response efficacy > intention	.32	.12	2.69	.008	0.08	0.56
Outcome expectancy > intention	.06	.04	1.45	.15	-0.02	0.14
Indirect effects of experimental condition on behavioral intention						
	Coefficient	*Bootstrapping standard error*	*LLCI*		*ULCI*	
Through self-efficacy	.16	.07	0.06		0.34	
Through response efficacy	.23	.10	0.06		0.46	
Through outcome expectancy	-.01	.02	-0.07		0.02	
Moderation effects (regret)						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	-.33	.15	-2.13	.036	-0.64	-0.02
Condition > response efficacy	-.01	.15	-0.07	.94	-0.30	0.28
Condition > outcome expectancy	-.12	.34	-0.53	.72	-0.79	0.55
Condition > intention	-.01	.16	-0.03	.98	-0.31	0.31

Table 11. Summary of effects for self-generated outcomes upward CFT condition versus self-generated downward CFT condition

Direct effects						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.77	.21	3.63	.001	0.35	1.20
Condition > response efficacy	.74	.22	3.30	.001	0.30	1.19
Condition > outcome expectancy	.38	.38	0.98	.33	-0.38	1.13
Condition > intention	.79	.19	3.98	.000	0.40	1.19
Self-efficacy > intention	.23	.17	1.34	.18	-0.11	0.58
Response efficacy > intention	.10	.17	0.62	.54	-0.23	0.43
Outcome expectancy > intention	.05	.05	0.96	.34	-0.05	0.15
Indirect effects of experimental condition on behavioral intention						
	Coefficient	*Bootstrapping standard error*	*LLCI*		*ULCI*	
Through self-efficacy	.18	.15	-0.05		0.56	
Through response efficacy	.08	.12	-0.14		0.34	
Through outcome expectancy	.02	.03	-0.02		0.14	
Moderation effects (regret)						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	-.42	.15	-2.74	.007	-0.73	-0.12
Condition > response efficacy	-.50	.16	3.012	.003	-0.82	-0.18
Condition > outcome expectancy	.15	.29	0.52	.60	-0.42	0.72
Condition > intention	-.16	.15	-1.07	.29	-0.46	0.14

Table 12. Summary of effects for self-generated behaviors upward CFT condition versus self-generated downward CFT condition

Direct effects						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.91	.22	4.09	.000	0.47	1.35
Condition > response efficacy	.98	.23	4.17	.000	0.51	1.44
Condition > outcome expectancy	.25	.39	0.62	.54	-0.54	1.03
Condition > intention	.63	.19	3.27	.002	0.25	1.01
Self-efficacy > intention	.11	.16	0.71	.48	-0.20	0.42
Response efficacy > intention	.44	.15	2.97	.004	0.14	0.73
Outcome expectancy > intention	.000	.05	0.02	.99	-0.10	0.10
Indirect effects of experimental condition on behavioral intention						
	Coefficient	*Bootstrapping standard error*	*LLCI*		*ULCI*	
Through self-efficacy	.10	.14	-0.14		0.43	
Through response efficacy	.43	.16	0.18		0.81	
Through outcome expectancy	.000	.03	-0.05		0.06	
Moderation effects (regret)						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	-.15	.14	-1.08	.28	-0.44	0.13
Condition > response efficacy	-.25	.15	-1.63	.11	-0.55	0.06
Condition > outcome expectancy	-.10	.28	-0.35	.73	-0.64	0.45
Condition > intention	-.004	.15	-0.02	.98	-0.29	0.29

Table 13. Summary of effects for self-generated outcomes upward CFT condition versus stated upward CFT condition

Direct effects						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.40	.14	2.77	.007	0.11	0.69
Condition > response efficacy (with covariates)	.27	.13	2.11	.037	0.02	0.53
Condition > response efficacy (w/o covariates)	.29	.12	2.36	.02	0.05	0.53
Condition > outcome expectancy	.31	.31	1.01	.31	-0.30	0.93
Condition > intention	.36	.17	2.08	.04	0.02	0.69
Self-efficacy > intention	.22	.17	1.29	.20	-0.12	0.55
Response efficacy > intention	-.17	.18	-0.92	.36	-0.54	0.20
Outcome expectancy > intention	.03	.05	0.51	.61	-0.08	0.14
Indirect effects of experimental condition on behavioral intention						
	Coefficient	*Bootstrapping standard error*		*LLCI*		*ULCI*
Through self-efficacy	.09	.08		-0.02		0.29
Through response efficacy	-.05	.06		-0.22		0.03
Through outcome expectancy	.01	.02		-0.02		0.11
Moderation effects (regret)						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.08	.14	0.54	.59	-0.21	0.36
Condition > response efficacy	-.09	.13	-0.70	.49	-0.35	0.17
Condition > outcome expectancy	.29	.31	0.96	.34	-0.31	0.90
Condition > intention	-.18	.16	-1.14	.26	-0.50	0.14

Table 14. Summary of effects for self-generated behaviors upward CFT condition versus stated upward CFT condition

Direct effects						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.55	.15	3.60	.001	0.25	0.85
Condition > response efficacy	.46	.14	3.23	.002	0.18	0.75
Condition > outcome expectancy	.38	.33	1.15	.26	-0.28	1.05
Condition > intention	.22	.18	1.25	.21	-0.13	0.57
Self-efficacy > intention	.15	.16	0.90	.37	-0.18	0.47
Response efficacy > intention	.41	.17	2.36	.02	0.06	0.75
Outcome expectancy > intention	.02	.05	0.39	.70	-0.08	0.12
Indirect effects of experimental condition on behavioral intention						
	Coefficient	*Bootstrapping standard error*	*LLCI*		*ULCI*	
Through self-efficacy	.08	.09	-0.09		0.29	
Through response efficacy	.19	.10	0.04		0.45	
Through outcome expectancy	.01	.03	-0.03		0.11	
Moderation effects (regret)						
	Coefficient	*Standard error*	*t*	*p*	*LLCI*	*ULCI*
Condition > self-efficacy	.33	.14	2.41	.02	0.06	0.61
Condition > response efficacy	.15	.14	1.13	.26	-0.12	0.42
Condition > outcome expectancy	.13	.32	0.39	.70	-0.52	0.77
Condition > intention	.06	.17	0.36	.72	-0.27	0.39

Table 15. Summary of findings across hypotheses and research questions in Experiment 3

Comparison	Direct effects				Indirect effects			Interaction effects				Conditional indirect effect		
	H1	H2	H3	RQ1	H4	H5	RQ2	H6	RQ3	RQ4	H7	H8	RQ5	RQ6
Stated upward vs. stated downward	ns	*	*	no	*	*	no	*	no	no	ns	*	no	No
Self-generated upward 1 vs. self-generated downward	*	*	*	no	Ns	ns	no	*	yes	no	ns	ns	no	No
Self-generated upward 2 vs. self-generated downward	*	*	*	no	Ns	*	no	ns	no	no	no	ns	no	No
Self-generated upward 1 vs. stated upward	*	*	*	no	Ns	ns	no	ns	no	no	no	ns	no	No
Self-generated upward 2 vs. stated upward	ns	*	*	no	Ns	*	no	*	no	no	no	ns	no	No

Note: * - hypothesis was supported; *ns* - hypothesis was not supported; *yes, no* - answers to research questions. Shaded areas denote significant results.

Figures

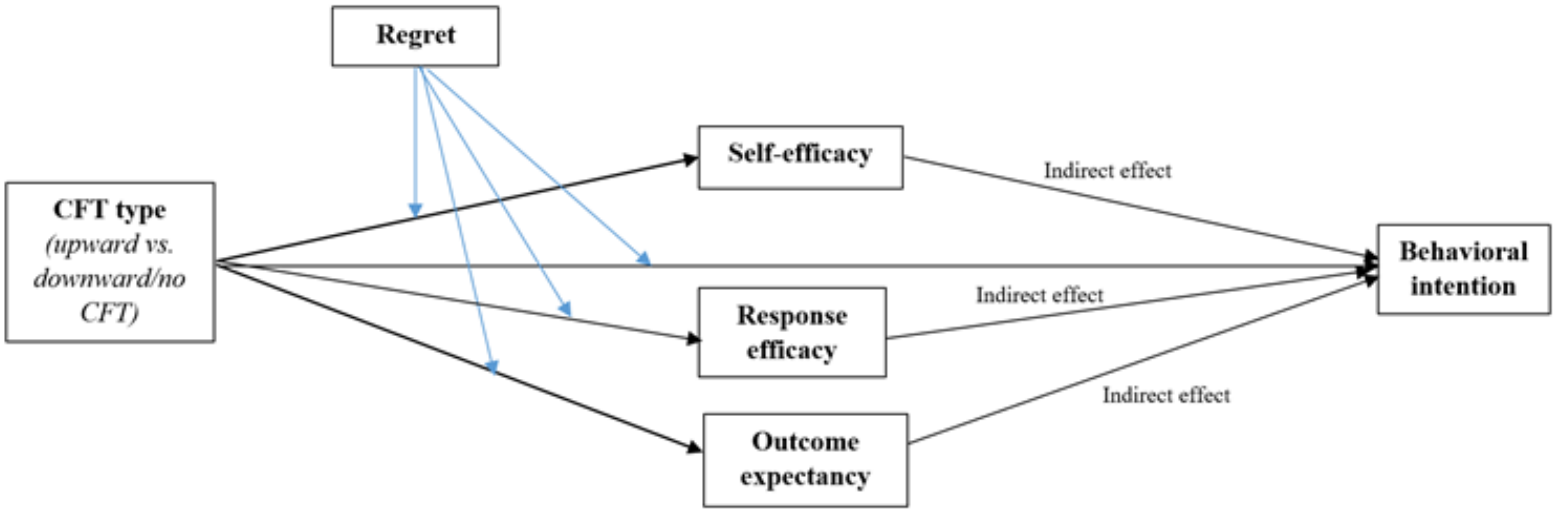

Figure 1. Proposed model

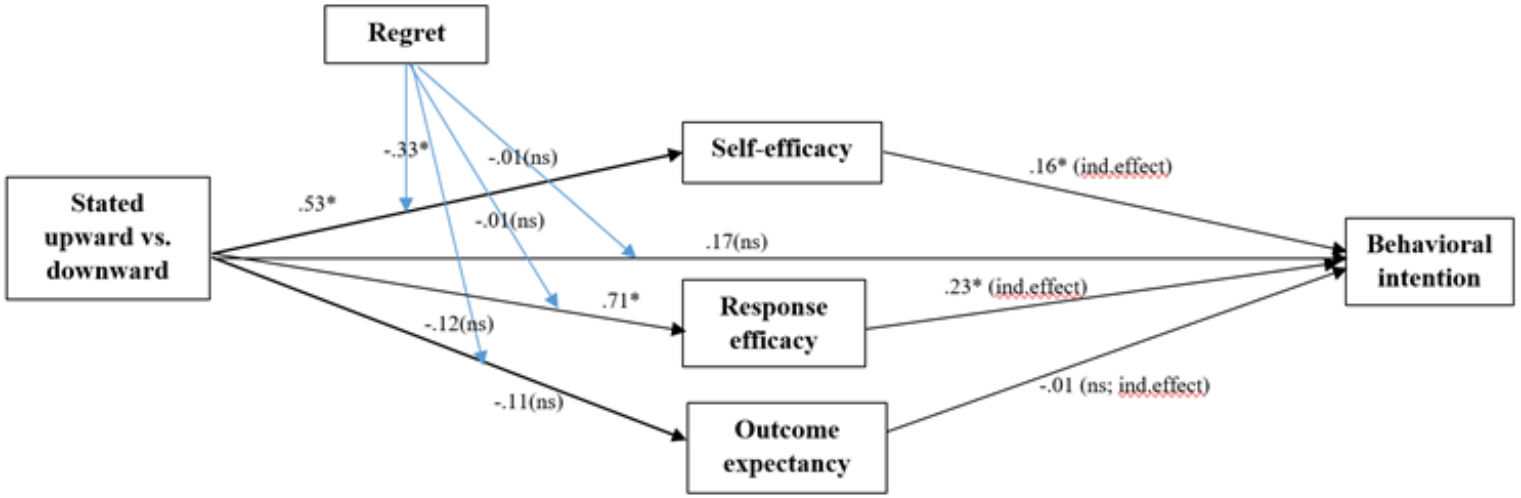

Figure 2. Comparison between stated upward CFT and stated downward CFT

Note: * - coefficient is statistically significant; ns – coefficient is not statistically significant

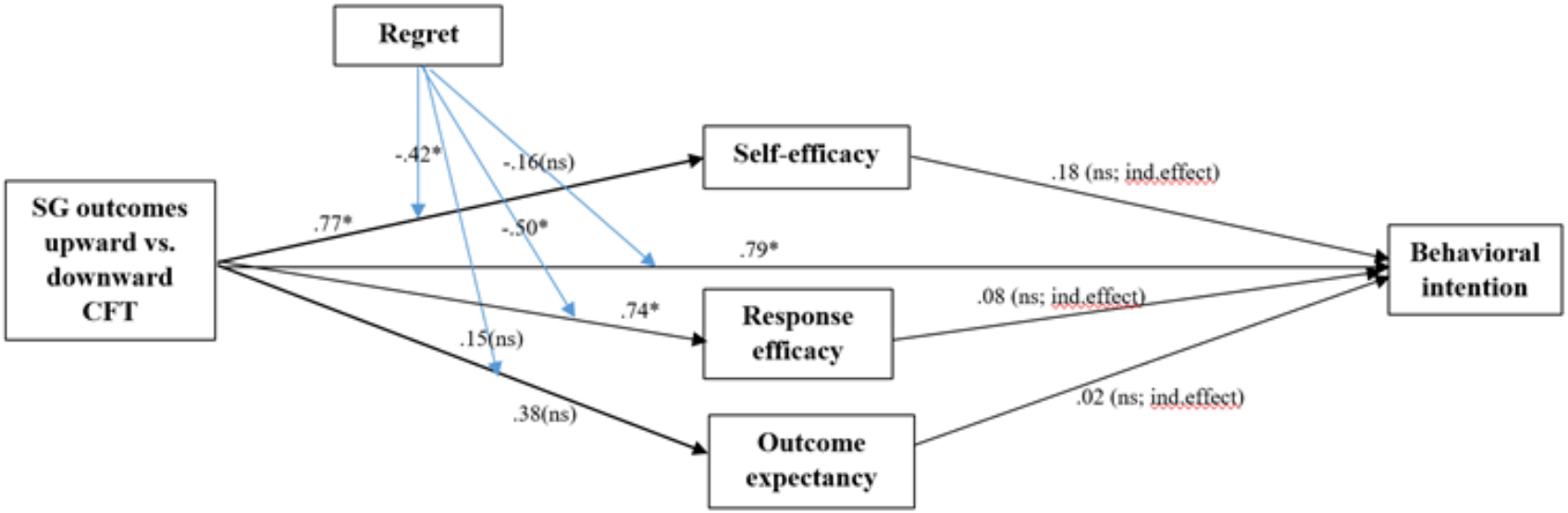

Figure 3. Comparison between self-generated outcomes upward CFT and self-generated downward CFT

Note: * - coefficient is statistically significant; ns – coefficient is not statistically significant

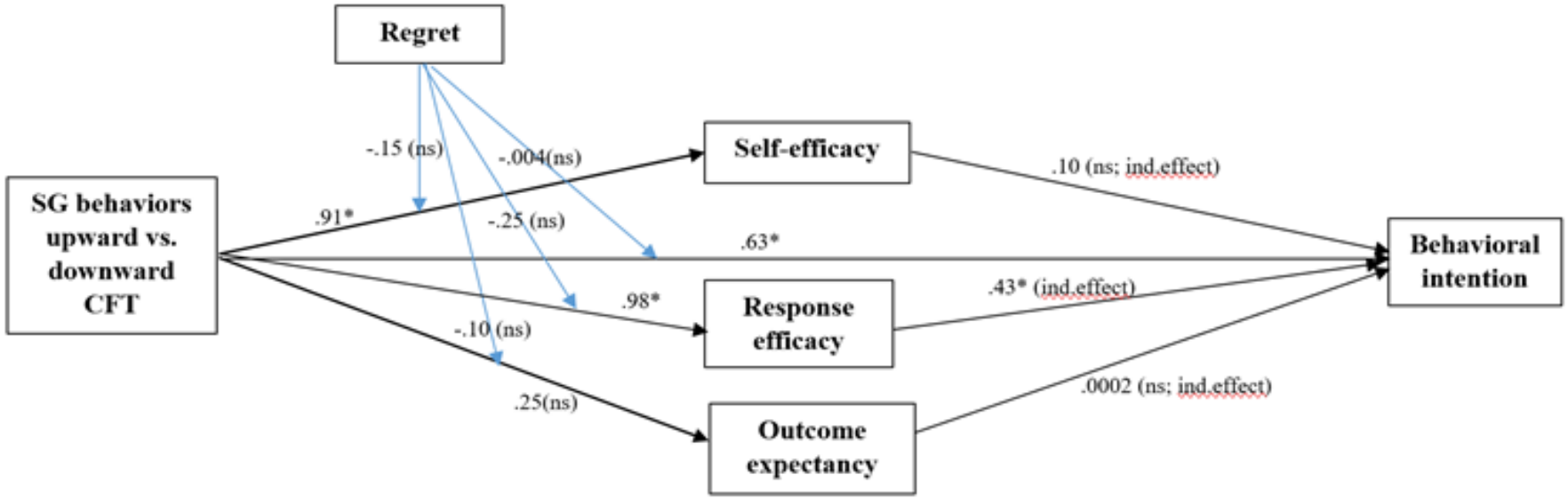

Figure 4. Comparison between self-generated behaviors upward CFT and self-generated downward CFT

Note: * - coefficient is statistically significant; ns – coefficient is not statistically significant

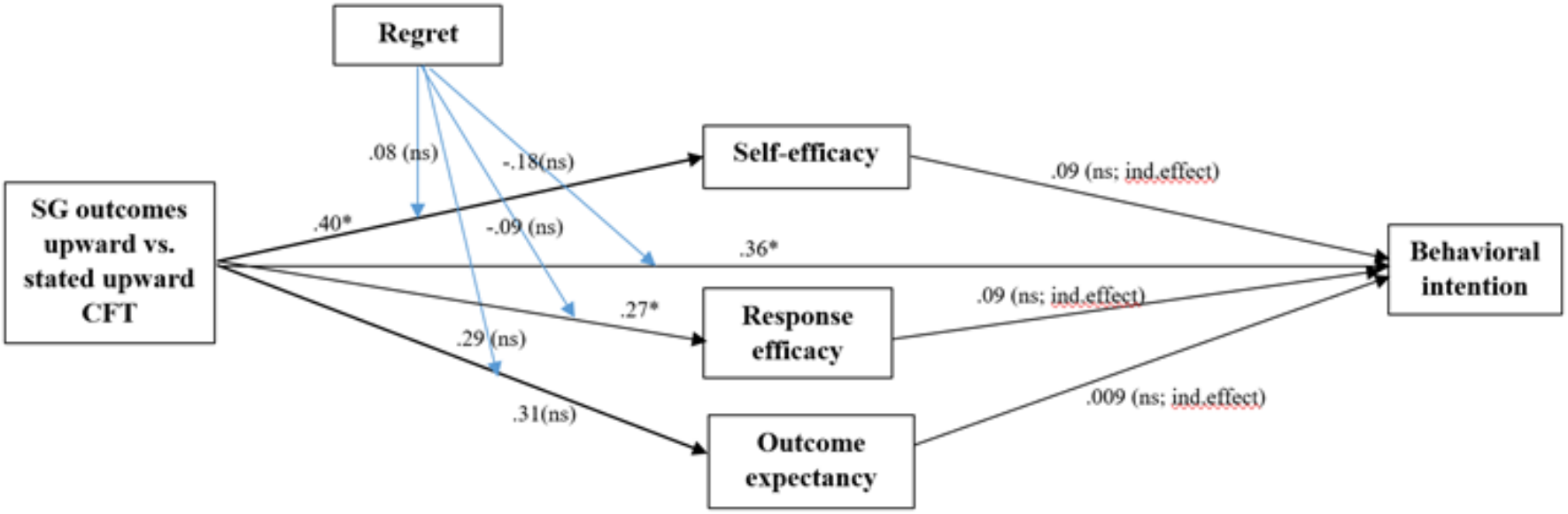

Figure 5. Comparison between self-generated outcomes upward CFT and stated upward CFT.

Note: * - coefficient is statistically significant; ns – coefficient is not statistically significant

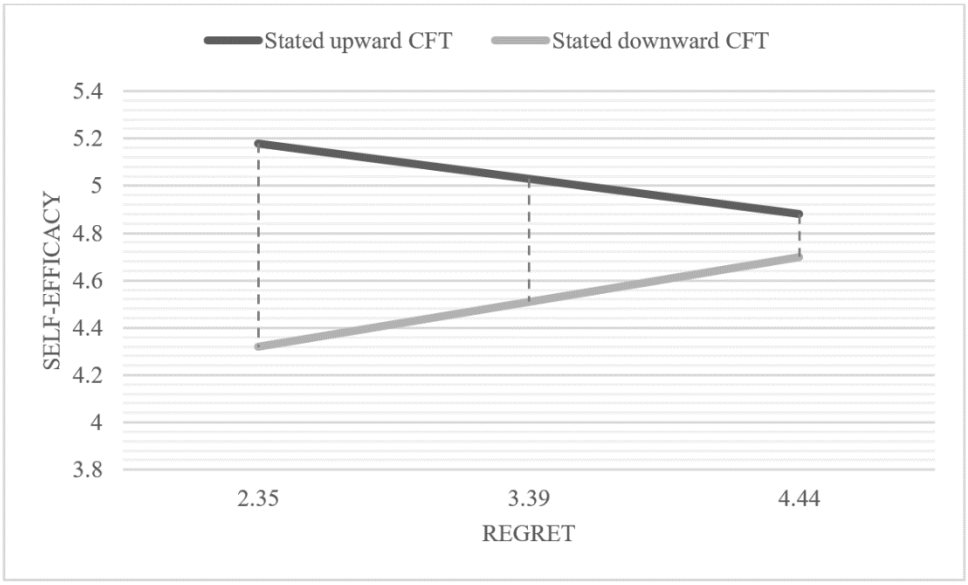

Figure 6. Regret moderates the effect of stated upward (vs downward) CFT on self-efficacy

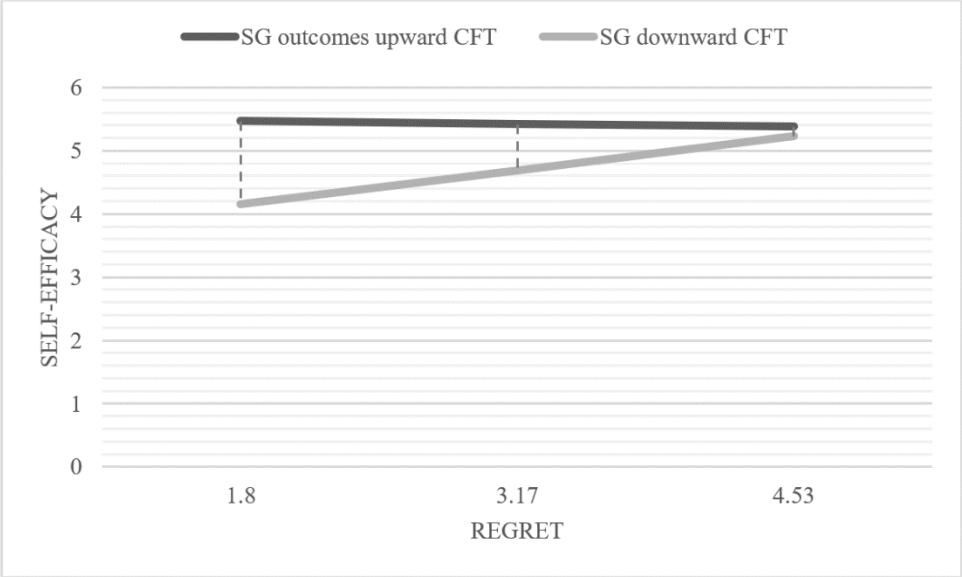

Figure 7. Regret moderates the effect of self-generated outcomes upward (versus downward) CFT on self-efficacy

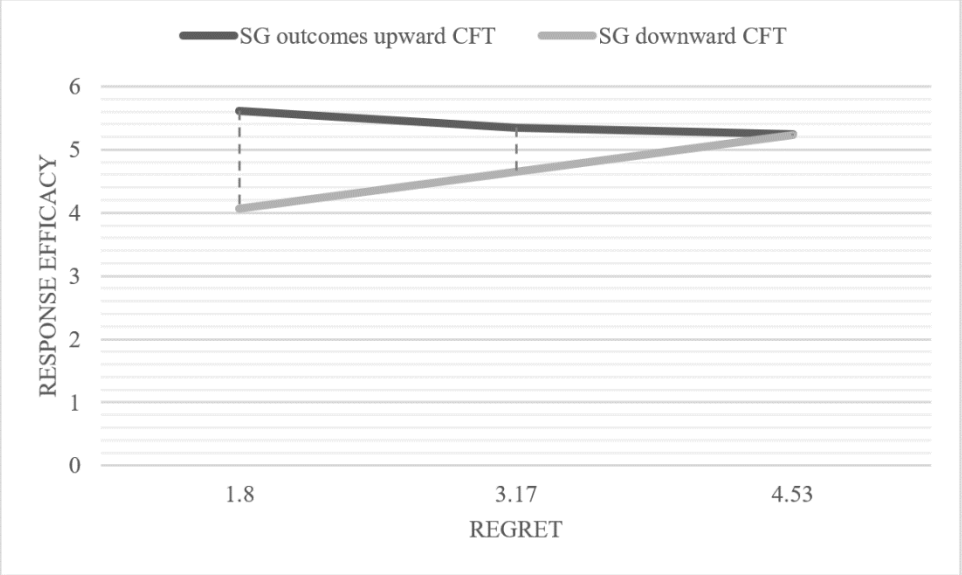

Figure 8. Regret moderates the effect of self-generated outcomes upward (versus downward) CFT on response efficacy

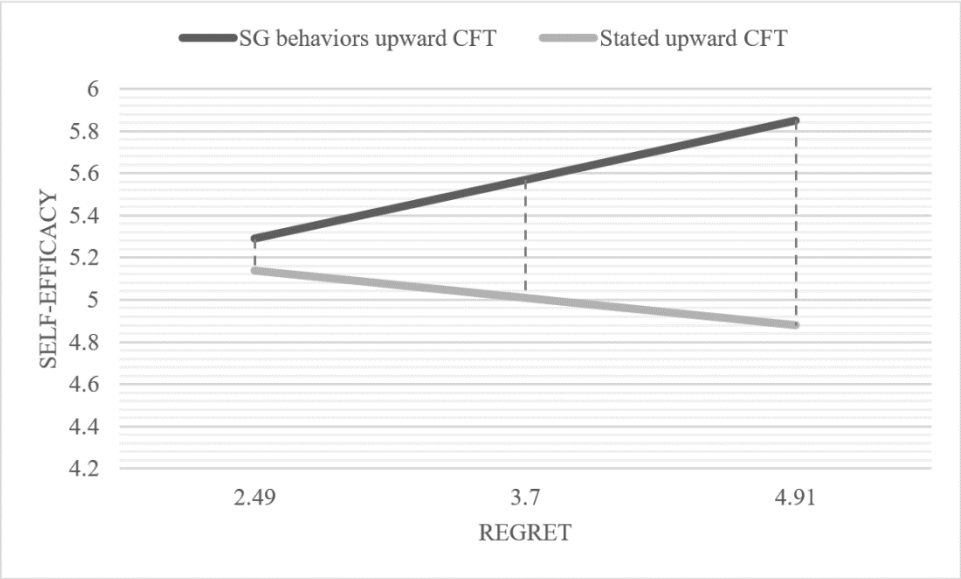

Figure 9. Regret moderates the effect of self-generated behaviors upward (versus stated upward) CFT on self-efficacy

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