The impact of self-affirmation on defensive processing of health messages: A meta-analysis

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Dedication

To my beloved parents and maternal grandparents,

for their unconditional love and support over the years.

Abstract

This meta-analysis studies the effects of self-affirmation on cognitive, affective, and behavioral responses to threatening health messages. It analyzes how the effects vary as a function of three moderators: self-affirmation domains, health topics, and self-relevance levels. In addition, this analysis examines the role of emotions in the self-affirmation process. Effect sizes for 11 outcome variables were extracted from 55 studies and analyzed (N = 10,611). I performed fixed-effect and random-effects models to examine the main effect and moderating effects. Both models indicated small but statistically significant positive effects of self-affirmation in increased perceived message effectiveness, perceived susceptibility, response efficacy, and behavior. The results lend empirical support to self-affirmation as an effective intervention strategy.

Moderator analyses with both fixed-effect and random-effects models revealed that self-affirmation was most effective (1) when we used the desirable traits self-affirmation domain; (2) when we exposed participants to messages of unhealthy behaviors cessation; and (3) among participants with low self-relevance. The two most commonly used self-affirmation domains (i.e., desirable traits and values), did not work equally well in reducing defensiveness. Moreover, these two domains were not effective in restoring self-integrity when applied to high-self-relevance populations, or to reducing defensive responses to messages of unhealthy behavior cessation.

Meta-analytic review of the role that emotions play in the self-affirmation process shows that self-affirmation was effective in reducing negative emotions aroused by

delivery of threatening health messages. However, the evidence of a mediating role of (positive) emotions in the self-affirmation process is scant.

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Chapter 1: Preface

Human behavior flows from three main sources: Desire, emotion, and knowledge.

(Plato, Greek Philosopher)

In each kind of Me, material, social, and spiritual, men distinguish between the immediate and actual, and the remote and potential, between the narrower and wider view, to the detriment of the former and the advantage of the latter.

William James (1968, pp.45).

This dissertation examines self-affirmation's impact on people's defensive processing of self-relevant threatening health messages. Maintaining good health and staying alive is the prerequisite for all other activities. Ever since Homo sapiens began roaming the Earth, staying healthy has been the first and foremost condition necessary to adapt to the environment. Gathering food, chopping wood to make fire, fighting off predators, and successfully procreating all required (and today require) one to be healthy. Having learned the necessity of staying healthy, human beings have devised a variety of strategies to protect against life-threatening or injurious situations.

Researchers and healthcare professionals provide vast resources to educate us about health protection and disease prevention. As biological and medical research advances, we are exposed to ever-increasing scientific evidence that we can use to guide our health behaviors. From this body of knowledge, we know that, although there are some unforeseeable or uncontrollable events that can harm our health, our lifestyle choices substantially influence our health (Saito T, Watanabe M, Nishida J, & et al., 2011; Sesso, Paffenbarger, & Lee, 2000). Healthcare professionals and industry media

communicate this scientific evidence to the public with the ultimate purpose of changing populations' unhealthy behaviors (Taylor, 1990).

A common strategy in health message design is to inform people that if they engage in a particular unhealthy behavior, they may very well experience harmful outcomes. The logic behind such a strategy is that awareness of personal relevance might motivate people to avoid harmful outcomes. Whether the health message promotes healthy behaviors, such as increasing physical activity and eating more fruits and vegetables, or discourages unhealthy behaviors, such as binge drinking and smoking, the goal is to increase awareness of an individual's personal relevance, and facilitate behavior modification accordingly. For instance, since the first anti-drinking health campaign (i.e., the temperament movement), public health professionals have designed numerous health messages to provide facts about harmful effects of excessive drinking and recommend responsible drinking or drinking cessation. The specific content of these messages differs. Some messages present scientific conclusions about diseases that are attributable to excessive alcohol consumption [e.g., "CDC Factsheets-Alcohol Use and Your Health" (http://www.cdc.gov/alcohol/fact-sheets/alcohol-use.htm)]. Other messages use emotional appeals (especially fear tactics) to emphasize possible negative health consequences [e.g., "Don't turn a night out into a nightmare" in the Australian anti-binge drinking campaign (http://www.drinkingnightmare.gov.au/internet/drinkingnightmare/publishing.nsf) or "Be there for your kids. Stop drinking. Drinking kills families" in the UK anti-binge drinking campaign (https://www.drinkaware.co.uk/)].

However, research in health communication and psychology reveals that health information that threatens audiences often risks being counterproductive. Empirical evidence shows that threatening health information is not well received, and message recipients demonstrate defensive reactions to threatening health information (De Hoog, Stroebe & Wit, 2007). The purpose of making personal relevance salient is to motivate the message recipient to take actions recommended by the health messages. However, boomerang effects often occur. Health information induces a negative emotional state (e.g., fear, anger, guilt) among message recipients (Lang, 2009; Liberman & Chaiken, 1992; Yzer, Southwell, & Stephenson, 2013). To reduce the negative emotional state, message recipients tend to deny that the message applies to them, personally, so they dismiss the health recommendations. It seems to be an intractable problem that message recipients with high self-relevance are most likely to become defensive about, and be least persuaded by, threatening health messages (Croyle, Sun & Hart, 1997; Ditto & Lopez, 1992; Kunda, 1987; Liberman & Chaiken, 1992).

Defensive processing has been examined in a variety of health behaviors. For example, people (1.) derogate smoking cessation messages and show little intention to quit smoking (Freeman, Hennessy, & Marzullo, 2001); (2.) counter-argue mammography examination messages and tend not to cognitively rehearse the messages afterwards (McQueen, Kreuter, Kalesan, & Alcaraz, 2011); (3.) avoid, blunt, suppress, and counter-argue colorectal cancer screening messages (McQueen, Vernon, & Swank, 2013); and (4.) deny personal relevance to the message about increasing fruit and vegetable consumption,

and show little intention to follow behavioral recommendations (Dijkstra, Rothman, & Pietersma, 2011).

To understand why message recipients process self-relevant threatening health messages in a biased and self-serving manner, psychology and communication researchers developed a number of theories. Two of the most influential theoretical perspectives are cognitive dissonance (Festinger, 1957; Festinger, Riecken, & Schachter, 1956) and self-involved (or motivational) information processing (Aronson, 1968; Aronson & Carlsmith, 1962; Kunda, 1990). Cognitive dissonance posits that the inconsistency between health recommendations and message recipients' prior beliefs motivates the recipients to defensively process heath messages (Festinger, 1957; Zimbardo, 1960). Self-involved information processing argues that the conflict between message recipients' needs to preserve positive self-perceptions and the negative implications health messages cast on their positive self-perceptions is the root of defensiveness (Baumeister, 1996; Jemmott, Ditto, & Croyle, 1986).

The second theoretical approach provides a framework that explains why message recipients tend to discount health information detailing detrimental consequences that are relevant to them, but may objectively process health information that is not relevant to them even when the message presents some knowledge that is inconsistent with their prior beliefs. For instance, a health message linking coffee drinking to increased risks of fibrocystic disease presents knowledge that is inconsistent with heavy coffee drinkers' (both male and female) beliefs (e.g., drinking coffee does no harm to my health) and behavior (e.g., continuing to drink coffee heavily). However, the same health message

instigates defensive processing in only female coffee drinkers but not in male coffee drinkers, because the health risk (i.e., fibrocystic disease) is not relevant to male coffee drinkers (Kunda, 1987). People want to have positive self-perception such as being competent and worthy. Crucially, self-relevant threatening health information (e.g., health messages linking coffee consumption to fibrocystic disease) challenges individuals' self-perception as competent and worthy. This occurs because individuals (e.g., female coffee drinkers) link the health behavior that is important to them (e.g., drinking coffee) to the threat to their positive self-perception (e.g., being able to make rational health choices and being responsible for their own health). Instead of facilitating behavior, self-relevant threatening health messages lead to the activation of self-system and the instigation of a need to protect positive self-perception. Defensive processing is one way to restore threatened self-perceptions.

Consistent with the reasoning that cognitions and behaviors are motivated by the need to maintain positive self-perceptions, self-affirmation provides an alternative approach to maintaining and restoring positive self-perceptions while reducing the need for defensive processing (Aronson, Cohen, & Nail, 1999; Steele, 1988). Self-affirmation theory predicts that to protect people's overall positive self-perception, one can draw on resources from an aspect of self that is not related to the health threat, such as an important value (e.g., Steele, 1988). Although the general proposition that self-affirmation can reduce defensive processing of self-relevant threatening health messages has received much empirical support (Epton et al., 2014; Sweeney & Moyer, 2014; McQueen & Klein, 2006), evidence addressing conditions under which self-affirmation is

more effective in facilitating objective processing and behavior is still mixed. In addition, the mechanism of the self-affirmation process is largely unknown. This dissertation meta-analyzes published studies on self-affirmation in the area of health communication to examine the aforementioned questions.

In Chapter 2 I review theoretical roots and empirical evidence of defensive (including negative) emotions induced by defensive processing. Then I elaborate on the theoretical roots and tenets of self-affirmation, followed by a discussion of the current research on self-affirmation in communication, with an emphasis on the role of emotions in the self-affirmation process. The chapter ends with a brief description of the present meta-analysis.

Chapter 2: Literature Review

Defensive Processing

The Theoretical Roots of Defensive Processing

Defensive processing of information refers to a variety of cognitive, emotional, and behavioral responses to that information by rejecting an undesirable conclusion about oneself while defending a desirable one. Cognitive defensive responses include message derogation, defensive avoidance, denial of perceived severity of--and personal susceptibility to--a risk, etc. (e.g., Good & Abraham, 2007). Emotional defensive responses include a variety of negative emotions such as fear, anxiety, worry, and anger (e.g., Bradley, Codispoti, Cuthbert, & Lang, 2001). “Behavioral defensive response” is refusing to perform a recommended behavior (e.g., continuing to perform unhealthy behaviors after exposure to health messages).

For instance, smokers who are familiar with anti-smoking messages may completely avoid the message in order to avoid the threat to their views about themselves as individuals who can make healthy lifestyle choices. These same smokers avoid the message to also prevent experiencing negative emotions (e.g., anger and fear) associated with the threat (Dillard & Seo, 2012; Fry & Prentice-Dunn, 2005; Holton & Pyszczynski, 1989). The smokers may derogate the message quality, minimize the severity of the health risk (e.g., lung cancer), refuse personal susceptibility to the health risk (Block, Lauren, & Patti, 2002; Luce & Kahn, 1999), demonstrate lower perceived self-efficacy in quitting smoking (Bandura, 1997; Glanz, Rimer, & Viswanath, 2008; Hagger, Chatzisarantis, & Biddle, 2002; Maddux, & Rogers, 1983; Vries, Dijkstra, & Kuhlman,

1988), and demonstrate lower perceived response efficacy of smoking cessation in reducing health risks (e.g., Armitage, Harris, Hepton, & Napper, 2008; Harris, Mayle, Mabbott, & Napper, 2007). In addition, these smokers' attitudes (Barkoukis, Lazarus, & Harris, 2014; Cooke, Trebaczyk, Harris, & Wright, 2014) and perceived norms (Epton et al., 2014) are less likely to be formed in support of the behavioral recommendations. Eventually, the smokers may have lower intentions (Pavey & Sparks, 2012; Sherman, Nelson, & Steele, 2000) and be less likely to quit smoking (De Hoog et al., 2007; Pietersma & Dijkstra, 2011).

There are two major lines of research examining why people defensively process (health) information. The first line of research posits that cognitive dissonance is the reason people defensively process messages. Cognitive dissonance researchers propose that because health information presents cognitions that are inconsistent with people's existing knowledge and beliefs about a certain health behavior, people defensively process the health message in order to reduce these inconsistencies. The second line of research posits that self-inconsistency [the threat posed to people's positive views about themselves by the (health) information] is the reason people defensively process messages. In the following sections, I elaborate on the two theoretical perspectives and explain why self-inconsistency is the preferred theoretical argument for the cause of defensive processing.

Cognitive dissonance

Some researchers reason that cognitive dissonance causes defensive processing of information. "Cognitive dissonance" refers to a state of discomfort caused by two

relevant but inconsistent elements of knowledge (Festinger, 1957; Festinger et al., 1956). In Festinger's original definition, disruption of the logical relationship between two cognitive elements is the reason why cognitive dissonance occurs: "Two elements are in a dissonant relation if, considering these two alone, the obverse of one element would follow from the other." (Fesinger, 1957, p.13). For example, "If a person were standing in the rain and yet could see no evidence that he was getting wet, these two cognitions would be dissonant with one another." (Festinger, 1957, p. 14). Once the cognitive dissonance occurs, people perceive a discomfort, and they are pressured to reduce or eliminate the discomfort associated with the dissonance (Festinger et al., 1956).

People can reduce cognitive dissonance by employing three tactics. "The person may try to change one or more of the beliefs, opinions, or behaviors involved in the dissonance; to acquire new information or beliefs that will increase the existing consonance and thus cause the total dissonance to be reduced; or to forget or reduce the importance of those cognitions that are in a dissonant relationship" (Festinger et al., 1956, pp. 25-26). According to Festinger, dissonance reduction seems to be an unbiased process. Festinger (1956) formulated dissonance reduction process in terms of the ratio of cognitive dissonance as D/(D+C), in which D is the sum of cognitions that are dissonant with a particular cognition, while C is the sum of cognitions that are consonant with that particular cognition. This ratio indicates the magnitude of cognitive dissonance. To reduce cognitive dissonance, one can either reduce the number or importance of dissonant cognitions while holding the number and importance of consonant cognitions constant; or one can increase the number or importance of consonant cognitions while

holding the number and importance of dissonant cognitions constant. Festinger (1957) provides an example of how smokers process anti-smoking messages to illustrate how cognitive dissonance can be reduced or removed. An anti-smoking message presents information that is dissonant with a smoker's cognitions about smoking. To reduce cognitive dissonance, the smoker can either stop smoking or consider the health risks of smoking as negligible. This proposition is supported by subsequent studies (e.g., Aronson, Turner, & Carlsmith, 1963; Zimbardo, 1960).

However, cognitive dissonance theory provides limited predictive power in revealing the motivational bases on which dissonance reduction occurs. Specifically, why discomfort arises from the cognitive dissonance, what the nature of this discomfort is, and why this discomfort can motivate people to take actions to reduce cognitive dissonance are not clear under the framework of original cognitive dissonance theory. The original cognitive dissonance theory seems to neglect a pivotal component in dissonance reduction: the self. In the smoker example cited above, the smoker sometimes chooses to continue smoking, despite health recommendations. This probably occurs because health recommendations no longer are about scientific facts, but are becoming ego-involved issues. That is, smokers exposed to health recommendations perceive the discrepancy between their behavior (i.e., smoking) and the health recommendation (i.e., smoking cessation) and this discrepancy has negative implications on smokers' personal views that they have the ability to make good lifestyle choices. The explanation of the above phenomena goes well beyond the framework of the original cognitive dissonance theory.

Researchers thus modified the original cognitive dissonance theory by recruiting self-concept to explain why dissonance motivates people to engage in dissonance reduction (Aronson, 1968; Aronson & Carlsmith, 1962). In the following section, I elaborate on the role of "self" in explaining why people defensively process threatening (health) information.

The self.

As the aforementioned review indicates, researchers who revised the original cognitive dissonance theory focused on the motivational bases of dissonance and dissonance reduction. Researchers further clarified that it is not the inconsistencies between two different cognitions but the inconsistencies between the self-concept and cognition (so called "self-consistency," Aronson, 1968; 1992) that generate dissonance. An aversive state ensues from self-inconsistencies and this aversive state motivates people to engage in dissonance reduction (Bem, 1967; Cooper, Zanna, & Taves, 1978; Harmon-Jones & Mills, 1999; Kunda, 1990). What motivates people to engage in dissonance reduction is the primary goal of achieving "consistency or internal coherence of one's explanatory system" to "develop and maintain a positive self-concept" (Briñol & Petty, 2005; Steele, 1988) instead of achieving consistency between two dissonant cognitions.

Self-concept.

"Self-concept" refers to how people think about themselves and their definitions of themselves as objects in society (Gergen, 1971). This idea refers to the "empirical self"

(James, 1890), self-schema (Markus, 1977), self-system (Steele, 1988), or self-knowledge (Baumeister, 1998). Self-concept is derived from individuals' interactions with their environment (Mead, 1934; Shrauger & Schoeneman, 1979). Specifically, it comes from repeated evaluations of oneself through a variety of life experiences (Markus, 1980). Ultimately, the self-concept indicates the definitions of individuals in terms of who individuals are and what the relationship between the individuals and their environments is (Higgins, 1996; McGuire & Padawer-Singer, 1976).

The self-concept is multi-faceted. To James (1890), self-concept is composed of three categories: the material self (i.e., the physical existence and extracorporeal possessions), the social self (i.e., social identities), and the spiritual self (i.e., perceived psychological faculties or dispositions). James' categorization of self-concept has been revised and expanded (Gordon, 1968; Rosenberg, 1979). Gordon (1968) expands James' three categories to eight major categories (i.e., ascribed identities, roles and memberships, interest and activities, material possessions, major senses of self, personal characteristics, and external references) and 30 subcategories. Eagly (2007) proposes that the self is composed of identities such as ethnic or gender identity, values such as political or religious ideologies, and personal attribute such as intelligence, healthfulness, and generosity. An individual can be a caring mother, hard-working employee, loyal friend, dedicated runner, and amenable person who effectively organizes church activities. All of these identities, roles, values, personal characteristics, activities and other aspects of her self-concept comprise her whole self-concept. That self-concept, in turn, describes or defines who she is and what her relationship with her social environment is.

This multifaceted nature of self-concept implies that when one aspect of self-concept has been threatened, individuals can evaluate themselves from other equally important aspects of their self-concepts. In the example above, if the individual receives a suboptimal annual performance review from her manager, she probably feels bad about herself. But these temporary and specific "failures" do not indicate that she fails as a morally and adaptively adequate person, considering she is still doing well in other domains of her life. However, in reality, individuals often focus on the aspect(s) of self-concept that is (are) being threatened and make justifications of their behaviors instead of viewing themselves from a broader perspective. As Aronson, Blanton, and Cooper (1995) reasoned that after people received threatening information, they not only attempted to justify their behaviors, but also integrated these justifications to form or enhance a "working self-concept" (Markus & Kunda, 1986; Markus & Wulf, 1987), "present me" (James, 1890) or actual self (Higgins, 1996), with the purpose of solidifying overall self-concept. For example, after receiving the suboptimal job performance review, the individual probably engages in justifying her job performance and considers the review as unfair instead of thinking about other aspects of her self-concept.

The self-concept is both stable and malleable (Markus & Kunda, 1986). It is relatively stable when it refers to the overall self-concept (e.g., morally and adaptively adequate). The self-concept is relatively malleable when it refers to the working self-concept that is the direct and contextualized self (being kind or generous can be a demonstration of moral adequacy and staying healthy or diligent can be a demonstration of adaptive adequacy) (Baumeister, 1998; Markus & Kunda, 1986). For example, being

morally and adaptively adequate is the overall positive self-concept, while being a hard-working employee in the example above is positive working self-concept.

When working self-concept is threatened, individuals may feel that their overall self-concept is threatened when, in fact, their overall self-concept is relatively stable. In this situation, if individuals can be reminded that their overall self-concept is stable and not shaken by the specific threat to one of their working self-concepts, they may not ruminate over the threatened working self-concept and the negative implications on overall self-concept (Critcher & Dunning, 2015). In the example above, when the individual receives a bad job performance review, one of her working self-concepts (i.e., the ability of staying competitive in the job market) is called into question. Meanwhile, she may feel that her overall self-concept (i.e., being adaptively adequate) also is called into question. The more central the working self-concept is to the overall self-concept (e.g., the more important staying competitive in the job market is to the her), the bigger the threat to the her overall self-concept (e.g., being adaptively adequate) is. I will discuss this point in detail in the following section about self-relevance. If the employee in the example is reminded that she is still a morally and adaptively adequate individual (e.g., a caring mom, a contributing community activity organizer, and a loyal friend, etc.), she will not need to narrowly focus on her threatened self-concept and to defend her job performance.

Self-integrity.

While individuals try to do well in a variety of aspects of life and expect, accordingly, to get positive evaluations in these aspects of self-concept, the ultimate goal

is to maintain an overall positive self-concept. The overall positive self-concept serves as an indicator of individuals' capabilities of being "adaptively and morally adequate, that is as competent, good, coherent, unitary, stable, and capable of free choice, capable of controlling important outcomes, and so on" (Steele, 1988, p.262), which is referred to as "overall self-integrity."

"Self-integrity," sometimes used interchangeably with "self-worth," shares the significant, multifaceted nature of self-concept. For example, Sherman and Hartson (2011) propose that self-integrity is composed of six domains, or schematic representations [i.e., "roles (e.g., student), values (e.g., religion), group identities (e.g., race), central beliefs (e.g., ideology), goals (e.g., health), and relationships (e.g., family)"]. Because of the multifaceted nature of self-integrity, when one domain of self-integrity is threatened, the overall self-integrity is not altogether shaken. For example, individuals may not be good students in terms of academic achievement, but they still can be competent and worthy people because they do well in other aspects of life.

When some cognitions are important components of individuals' self-integrity, information that challenges these cognitions poses a threat to self-integrity (Cohen, Aronson, & Steele, 2000). Individuals defensively respond to information when that information threatens their self-integrity (Ditto & Lopez, 1992; Harmon-Jones & Mills, 1999; Markus & Wulf, 1987; Steele, 1988). Health information is particularly likely to elicit cognitions that pertain to people's self-integrity. This is because health information that recommends behavior directly challenges individuals' capabilities of making rational health decisions. In addition, that health information makes personal morbidity and

mortality salient (Goldenberg & Arndt, 2008; Greenberg, Solomon, & Pyszczynski, 1997). For example, health professionals' recommendations against excessive drinking threaten heavy drinkers' self-integrity of being capable of making rational lifestyle choices. One major obstacle that prevents heavy drinkers from being sober is their denial that they are alcoholics (Kurtz, 1988). This is one form of defensive processing.

Self-relevance.

It is particularly relevant to note that the degree of perceived threat to self-integrity varies as a function of self-relevance. "Self-relevance" refers to the extent to which a threatening message is relevant to one's self-concept. Festinger (1957) proposed that only when individuals can perceive self-relevance and cognitive dissonance at the same time are they motivated to seek information or adopt behavior that reduces cognitive dissonance. He wrote:

"If there is no behavior or action in which a person engages or possibly may engage that is relevant to a particular area of information, there will be no motivation from this source to acquire cognition concerning this particular area of information." (Festinger, 1957, p. 124).

"If the area of information is relevant to some impending or possible future behavior for the person, one would then expect to observe considerable motivation to acquire cognitive elements in this area as well as active seeking out of such information." (Festinger, 1957, p. 124).

The impact of self-relevance on people's defensive processing of threatening health messages manifests itself in a variety of health behaviors. One early example is illustrated in a 1954 Minnesota Poll (Festinger, 1957). Because the anti-smoking message

is more relevant to heavy smokers relative to non-smokers, the message engenders more cognitive dissonance and more defensiveness among heavy smokers than among non-smokers. Specifically, heavy smokers are more likely to reject the anti-smoking message to avoid further dissonance. In addition, heavy smokers are less likely to recall the anti-smoking message. Another example is how individuals' previous seat-belt-use behaviors impact responses to a message about protective advantages of seat belt use (Berkowitz & Cottingham, 1960). Berkowitz and Cottingham's (1960) study categorizes participants into a high self-relevance group and a low self-relevance group, according to their car ownership and driving habits. They expose participants to a message that promotes the protective advantages of wearing seat belts. The message is highly relevant to participants who have a car but who do not wear seat belts. The message has low relevance among non-car owners. Results show that participants with high self-relevance (i.e., being a car owner and/or not wearing seat belts) are less persuaded by the message than those with low self-relevance.

Subsequent studies confirm that people have increased sensitivity to threatening information when it is self-relevant (Markus & Wulf, 1987). Individuals with a high self-relevance to a health behavior are more likely to engage in self-serving strategies (Sherman, 2013), such as derogating a health message that links behavior to a disease (Jemmott et al., 1986; Kunda, 1987; Good & Abraham, 2007). A seminal study conducted by Liberman and Chaiken (1992) examines whether coffee drinkers process information about the link between fibrocystic disease and coffee consumption differently. The study reveals that heavy coffee drinkers process both high-threat

messages and low-threat messages in a biased manner. They also are less likely to believe the link between fibrocystic disease and coffee consumption. The large body of empirical evidence attests to the proposition that people defensively process the threatening information when they perceive a threat to their self-integrity.

The reason that higher self-relevance is associated with higher level of defensiveness is that for individuals with higher self-relevance, their self-system (i.e., the sum of self-concepts, Steele, 1998) and aversive affective state (Aronson, 1969) are more fully activated, and they feel more threatened after exposure to a threatening message. When individuals are exposed to self-relevant threatening information, their self-system is activated and they are motivated to "adjust or calibrate" their working self-concept to restore self-integrity (Markus & Kunda, 1986; Markus & Wulf, 1987; Schlenker, 1985; Steele, 1988). As Sherman and Cohen reasoned, "The self-system is activated when a person experiences a threat to an important self-conception or image…these events are threatening because they have implications for a person's overall sense of self-integrity" (pp.187-188). The same message that poses great threat to people with high self-relevance may pose little or no threat to people with low self-relevance, because self-system of the latter is not as fully activated. They are therefore not as motivated as their high self-relevance counterparts to maintain their self-integrity.

Negative Emotions in Defensive Processing

Emotions are mental experiences (Cabanac, 2002) that are event-specific and can provide motivational forces and behavioral tendencies consonant with the specific event (Ekkekakis, 2013; Frijda, 1986; Frijda & Scherer, 2009; Scherer, 2005; Tooby &

Cosmides, 2009). Emotions are actionable. This feature of emotions is fundamental: "without it (emotion), we would probably have no inclination to move toward or away from anything." (Batson, Shaw, Oleson, & Clark, 1992, p. 309) For example, the sound of a drill at the dentist's office may elicit fear or anxiety (instead of joy or calm) among people who are sitting in the dentist's chair. Experiencing fear or anxiety, people may associate this sound with physical pain. They may frown upon hearing the sound. They also may experience sweaty palms and an increased heart rate, and take the action to ask their dentists, "Will it hurt?"

Emotions, especially negative emotions, are extremely fast responses to message stimuli (Zajonc, 1980), which are faster than cognitions (Dillard & Seo, 2012). Negative emotions will detect or signal potential environmental threat (Schwarz, 1990), increase vigilance (Mandler, 1975), and prompt immediate response (Sander, Grafman, & Zalla, 2003; Cosmides & Tooby, 2013). According to Batson et al., (1992): "…change from a more valued to a less valued state is accompanied by negative affect" (p. 298). One primary function of negative emotions is that they motivate people to avoid the object that arouses negative emotions (Cabanac, 1999; Ekkekakis, 2013). For example, after being burned by fire or bitten by a snake, individuals experience negative emotions (e.g., fear or worry) and thus learn that they should stay a safe distance from fire or snakes in the future. Repeated experience of certain emotions triggered by an event will condition one's reactions to this event. This conditioning will guide responses to the same type of event in the future (Pavlov, 1927; Damasio, 1994; Gendron & Barrett, 2009). On subsequent sightings of open fire or snakes, individuals experience negative emotions

that will signal potential danger and motivate them to take action (e.g., avoid the offending source). The next time individuals see open fire or a snake, the negative emotions will signal the potential danger to the individuals and motivate them to take actions (e.g., to stay away). The same rationale applies to the situation when self-integrity is threatened. Specifically, when self-integrity is threatened, negative emotions arise and this negative emotional state signals danger (i.e., the self-integrity of being adaptively adequate is under threat).

This function of negative emotion has important evolutionary implications. It is obvious that individuals who are motivated by negative emotions to stay away from fire or snakes will not be burned or bitten, while those who do not experience negative emotions probably will not take adequate actions to protect themselves from danger. Previous research shows that dissonance process is mediated by negative affect (Fazio & Cooper, 1983). When individuals defensively process self-relevant health messages, they are protecting their self-integrity from being threatened. For example, if smokers have been exposed to anti-smoking messages before, the title or first few sentences of a new anti-smoking message may very well remind them of the negative emotions aroused by previous exposure to similar anti-smoking messages or other health messages (Gross, 2009). The smokers may defensively process the messages to protect their self-integrity as being capable of making appropriate lifestyle choices. Having a positive self-perception is good for mental health (Taylor & Brown, 1988). However, people who defensively process health messages deny themselves the opportunity to learn from health messages and better protect their health. For example, if individuals hold overly

optimistic beliefs about their health, they are less likely to take precautions and are more vulnerable to health risks (Weinstein, 1982).

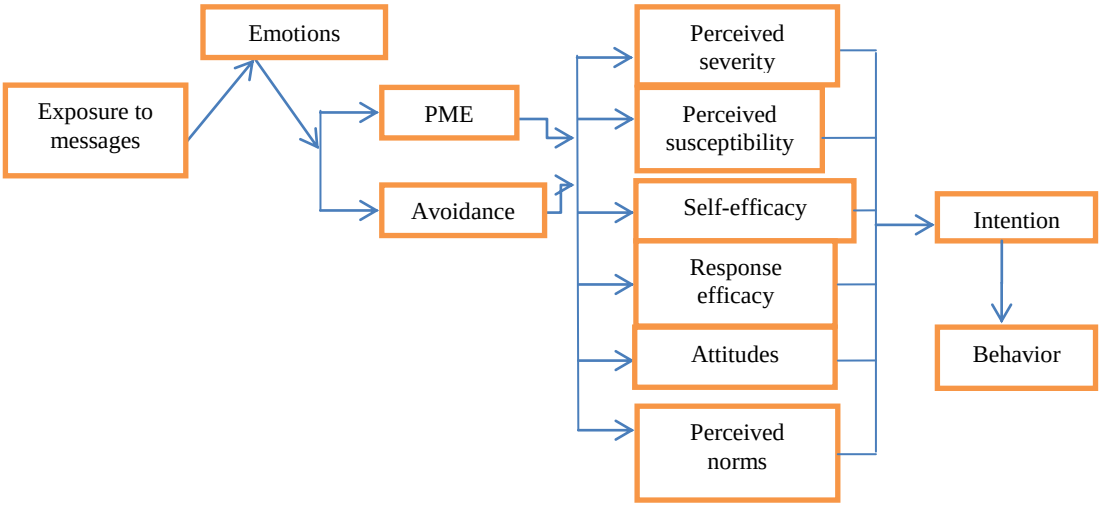
Although people have the need to gain accurate health information so they can evaluate their own health status and make health decisions for their long-term benefits (Trope, 1986; Trope & Pomerantz, 1998), they often are deterred by the negative emotions induced by the threats to their self-integrity (Leventhal, 1970). This has special implications for us to understand why it is difficult to persuade people to adopt behavior to protect their health (Stroebe, 2000). When negative emotions are aroused by health messages (Sherman & Cohen, 2002; 2006), people have two ways to restore their threatened self-integrity, as well as to reduce or remove their negative emotions: (1.) adopting the recommended health behavior, or (2.) defensive processing the message (Prentice-Dunn & Rogers, 1986; Witte, 1992, 1994). People dislike negative emotions, and these negative emotions motivate them to fulfill their goal of restoring self-integrity through a variety of cognitive and behavioral responses (Tooby & Cosmides, 2009). Evidence shows that individuals can reduce anxiety when they engage defensive processing, such as attributing the cause of failure to reasons beyond their control (McFarland & Ross, 1982), minimizing the importance of the issue in question (Mehlman & Snyder, 1985), derogating the message quality (Jemmott et al.,1986), or denying their personal risk (Weinstein, 1988). As the goal of maintaining self-integrity is fulfilled through a variety of defensive processing strategies, negative emotions are reduced or removed (Gross, 1999, 2009; Nabi, 1999).

Indicators of Defensive Responses to Threatening Health Information

Defensive processing of threatening health messages is manifested in a variety of indicators including perceived message effectiveness (PME), defensive avoidance, perceived severity, perceived susceptibility, self-efficacy, response efficacy, attitudes, norms, negative affective responses, intentions, and behaviors.

These indicators of defensive responses are not parallel. There is a mediating relationship between these indicators. Specifically, I propose the following mediating model about the defensive response indicators:

Figure 1 Mediating Model of Defensive Response Indicators



Exposure to threatening health messages engenders negative emotions such as anxiety (Harris & Napper, 2007), anger (Zhao & Nan, 2010), worry (De Wit, Das, & Raymond, 2008), fear (Harris & Napper, 2005), or guilt (Agrawal & Hustard, 2010). Negative emotions are extremely fast responses to threatening messages (Zajonc, 1980), which trigger or guide subsequent cognitive responses or behavior (Tooby & Cosmides,

2009). Theories concerning persuasion argue that emotions such as fear influence more temporally distal responses such as intentions and behaviors, indirectly, through cognitive constructs such as perceived self-efficacy (Armitage et al., 2008; Klein et al., 2011; Ruiter et al., 2001; Witte, 1992). Therefore, the present study proposes that emotional responses occur earliest in the mediation relationship. That is, exposure to threatening health messages causes negative emotions and the negative emotions further exert influences on cognitions and behaviors. Moreover, message recipients with higher self-relevance will have more negative emotions to health messages (because threatening messages pose a greater threat to self-integrity). These negative emotions will prompt more defensive cognitive and behavioral responses.

Next, message recipients probably use a variety of psychological strategies (e.g., avoiding or derogating the message) to deny the existence of the health risk the message poses. They do this to reduce negative emotions, displaying "defensive avoidance." Message recipients also will form their beliefs about whether a health message affects them personally based on whether they consider the message convincing (Ramsay, Yzer, Luciana, Vohs, & MacDonald, 2013; Yzer, Lorusso, Nagler, 2015). Empirical evidence shows that message recipients usually evaluate the self-relevant threatening health messages more critically (e.g., derogate the message quality) and consider them less convincing (Kunda, 1987; Liberman & Chaiken, 1992).

PME and message avoidance are the most proximal indicators of defensive responses to health messages (Dillard, Shen & Vail, 2007). Emotions are found to be causal precursors of PME (Yzer, Vohs, Luciana, Cuthbert, & Iii, 2011). Further, PME is

identified as the causal antecedent of cognitive responses such as attitudes (Dillard & Peck, 2000; Hullet, 2004), intentions (Dillard, Shen & Veil, 2007), and behavior (Gunther & Storey, 2001). In the mediating relationship, PME and defensive avoidance will exert influence on the subsequent cognitive responses (i.e., perceived severity, perceived susceptibility, perceived self-efficacy, response efficacy, attitudes, perceived norms, and intentions) and behavioral responses. Further, perceived severity*, perceived susceptibility*, self-efficacy*, and response efficacy*, attitudes*, and perceived norms* mediate the relationship between exposure to threatening health messages and intentions or changes. (* Indicates extensively tested constructs in several widely used health psychology models.)

For example, in Protection Motivation Theory (PMT; Rogers, 1975; 1983), perceived severity (i.e., beliefs about how severe a health risk is) and perceived susceptibility (i.e., beliefs about the likelihood of getting the disease) are threat appraisal. Comparatively, self-efficacy (i.e., the extent to which individuals believe they are capable of successfully performing the recommended behavior, Bandura, 1977) and response efficacy (i.e., the effectiveness of the recommended course of action) are coping appraisal (Bandura, 1977; Rogers, 1983). Message recipients assess how severe the threat is and how effective the coping strategies are that the health message provides. The intention to perform the recommended health behavior is a function of threat appraisal and coping appraisal (Maddux & Rogers, 1983). The threatening health message only increases intention to engage in healthy behavior when coping appraisal is stronger than threat appraisal. When coping appraisal is weak, (i.e., message recipients feel threatened and

incapable of dealing with the health risk), they defensively process the message and will not form intention to perform the recommended behavior (Maddux & Rogers, 1983; Rippetoe & Rogers, 1987; Yzer, Fisher, Bakker, Siero, & Misovich, 1998).

Further, self-efficacy, attitudes (i.e., the affective and value-laden evaluations of the recommended behaviors), and perceived norms (i.e., the perceived approval or disapproval of performing the recommended behaviors by important others or the larger society) jointly influences the formation of intention, according to the Integrative Model of Behavioral Prediction (IM) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Fishbein & Yzer, 2003). "The more one believes that performing the behavior in question will lead to 'good' outcomes and prevent 'bad' outcomes, the more favorable one's attitude toward performing the behavior;" and "the more one believes that specific others are (or are not) performing the behavior and the more one believes that specific others think one should (or should not) perform the behavior in question, the more social pressure one will feel (or the stronger the perceived norm) with respect to performing (or not performing) the behavior" (Fishbein, 2008, p. 839). Though the relative importance of attitudes and perceived norms differs as a function of different behaviors and social environments, generally, the more favorable the attitude toward performing the behavior and the stronger the social pressure with respect to performing the behavior, the stronger the intention will be.

Ultimately, behavior usually is considered the gold standard for measuring persuasion message effect (Glanz, Rimer, & Viswanath, 2008; Rhodes & Ewoldsen, 2012). In the present study, behavior refers to the overt action of people. Intention is the

most proximal antecedent of behavior (Ajzen, 1985; Fishbein, 2008; Rogers, 1983) and among the remaining 10 indicators of defensive responses indicators, intention concerning a certain behavior is the most important predictor of whether people will perform the behavior voluntarily (Ajzen & Fishbein, 2005; Fishbein & Ajzen, 1975; Fishbein & Yzer, 2003). However, environmental factors and message recipients' skills to perform the recommended behavior also are determinants of whether or not message recipients will perform the behavior (Yzer, Cappella, Fishbein, & Hornik, 2004). Thus, behavior intentions may not necessarily culminate in actual behavior.

In summation, my study integrates these theoretical approaches by proposing that exposure to threatening health messages leads to negative emotions, which further triggers defensive avoidance and PME evaluation accordingly. Defensive avoidance and PME further influence attitude, perceived norms, perceived severity, perceived susceptibility, self-efficacy and response efficacy, which are determinants of intentions and behavior. Definitions of the previously noted 11 outcome variables are listed in Table 1.

Table 1

Constructs and Definitions of the Most Commonly Measured Outcomes in Studies

Constructs	Definitions	Sample Items	Constructs Measured
Perceived message effectiveness	Participants' beliefs about whether a health message will affect them personally regarding the particular message objectives	Indicating the extent to which "The message was convincing."	Accuracy, perceived message quality, evidence strength, belief in link.
Defensive avoidance	Using a variety of psychological strategies to deny the existence of the health risk depicted in the message.	Indicating the extent to which they evaluated the message as "distorted," or "exaggerated," etc.	Defensive avoidance, message derogation, age-based denial, risk feedback avoidance, counter-arguments.
Perceived severity	Beliefs about how severe a health risk and its consequences are.	"It would be terrible to develop skin cancer."	Seriousness, average risk, perceived message threat, risk

			perception.
Perceived susceptibility	Beliefs about the likelihood of getting the disease.	"Compared to a person of my age and gender, my risk of getting skin cancer is: very low to very high."	Perceived vulnerability, feelings of vulnerability, relevance, self-risk.
Self-efficacy	The belief that one can overcome potential difficulties to make the behavior happen.	Indicating the extent to which the participants will answer "I know for sure that I could adhere to eating at least 5 portions of fruit and vegetables each day."	Self-efficacy, perceived control, situational temptation.
Response efficacy	Beliefs about the effectiveness of recommended behavior in avoiding the health risk.	Indicating the extent to which you believe "Eating at least 5 portions of fruit and vegetables each day will reduce my risk of heart disease and some cancers."	Response efficacy, effectiveness.
Attitudes	Affective, value-laden evaluations of the behavior	Rate sunscreen use on 4 pairs of semantic differentials (bad/good, negative/positive, foolish/wise, and unpleasant/pleasant).	Attitude.
Norms	Perceived approval or disapproval of performing a behavior by important others or society.	“Most people who are important to me think I should/should not engage in regular exercise.”	Descriptive norms, subjective norms, injunctive norms, moral norms.
Negative affective responses	Negatively valenced mental reactions to the threatening messages.	Indicating the extent to which you felt "(i) afraid, (ii) frightened, (iii) worried and (iv) uncomfortable while reading the leaflet."	Fear, worry, anger, anxiety.
Intentions	Perceived willingness likelihood of performing the recommended behavior	“I intend to drink in moderation during the next 6 weeks.”	Intentions, desire to quit, motivations.
Behaviors	Observable or overt actions of individuals.	"The percentage of participants who took at least one AIDS educational brochure." "When the sun was shining during the past 2 weeks...."	Alcohol consumption, fruit and vegetable consumption, physical activity, caffeine intake reduction, smoking cessation, condom use, etc.

However, after exposure to self-relevant threatening health messages, message recipients may not necessarily always process the messages defensively. According to self-affirmation theory (Steele, 1988), when individuals affirm self-integrity on an aspect unrelated to the health issue in a particular message *before* exposure to the threatening health messages, their self-integrity is secured, and they can more openly engage with the health messages. This is so because they no longer perceive it as a threat to self-integrity. In the following section, I elaborate on the theoretical roots and empirical evidence of self-affirmation, as well as the role of emotions in the self-affirmation process.

Self-Affirmation Theory

The Tenets and Theoretical Roots of Self-Affirmation Theory

The point at which self-affirmation starts its influence is when individuals' self-integrity is threatened, motivating them to restore self-integrity (Cooper et al., 1978; Sherman & Cohen, 2006; Steele, 1988). Individuals who engage in defensive information processing to shore up self-integrity lose the opportunity to benefit from the health recommendations. Self-affirmation provides an alternative way to protect self-integrity and maintain a global sense of moral and adaptive adequacy without jeopardizing the opportunity to learn from self-relevant threatening information (Cohen & Sherman, 2014; Sherman & Cohen, 2006; Steele, 1988).

Self-affirmation refers to "an act that manifests one's adequacy and thus affirms one's sense of global self-integrity" (Cohen & Sherman, 2014; see also Sherman & Cohen, 2006; Steele, 1988). By "affirming and sustaining valued self-images,"

individuals can maintain or restore their "overall adaptive and moral adequacy" (Steele, 1988), and enhance "their sense of themselves as good, virtuous, successful, and able to control important life outcomes" (Sherman & Cohen, 2006). People evaluate themselves based on the overall self-integrity. Because self-integrity is multifaceted (Baumeister, 1998; 2010), when one aspect of self-integrity is threatened, individuals can draw resources from other domains of self to restore their overall self-integrity (Allport, 1961; Horney, 1937; Murphy, 1947; Sherman & Cohen, 2006; Steele, 1988). The primary proposition of self-affirmation is that if individuals can affirm their self-integrity on an aspect that is important to them but unrelated to the threatened self-integrity domain (e.g., physical well-being) before their exposure to the threatening messages (e.g., health message), their defensive responses are reduced, and message acceptance is more likely to occur (Cohen & Sherman, 2014; Sherman & Hartson, 2010; Steele, 1988).

Self-affirmation not only reduces dissonance that challenges self-integrity, but also prevents people from performing behaviors that generate dissonance (Aronson, 1992; Steele, 1988; Steele & Liu, 1983; Tesser, Crepaz, Collins, Cornell, & Beach, 2000). There are four key prerequisites for effective self-affirmation: (1.) self-system is activated by threats to self-integrity; (2.) self-affirmation domain is irrelevant to the threatened aspect of self-integrity; (3.) the affirmed aspect of self-integrity (i.e., self-affirmation domain) is central to the individual who receives self-affirmation; and (4.) self-affirmation is induced before the threat is posed to self-integrity (Steele, 1998; Steele & Liu, 1983). The logic of the four prerequisites is as follows:

First, a threat is posed to self-integrity, such that self-system is activated for self-affirmation to exert its influence. When self-integrity is threatened, self-system is activated (Aspinwall, 1997; Tesser, 1988). Individuals are motivated to restore the threatened self-integrity (Steele & Spencer, 1992). Self-affirmation theorists further suggest that self-affirmation can bolster individuals' self-integrity, thereby removing the need to engage in defensive processing to restore self-integrity (Steele, Spencer, & Lynch, 1993). The aforementioned review about "self-relevance" indicates that the higher the level of self-relevance of the threat, the stronger the threat to self-integrity. And the stronger the threat to self-integrity, the more fully the self-system is activated (Sherman & Cohen, 2006). Further, the more fully the self-system is activated, the bigger the space becomes for self-affirmation to exert its influence, and the stronger the positive impact becomes for self-affirmation to restore self-integrity. On the other end, when self-integrity is not threatened, if individuals are self-affirmed, they demonstrate higher levels of defensiveness to self-relevant threatening information (Munro & Stansbury, 2009).

Second, the choice of the irrelevant aspect of self-integrity is not random. The self-affirmation domain should be central to the individuals receiving self-affirmation. It is ideal if the self-affirmation domain is consonant with individuals' most important self-concept. In other words, self-affirmation is most effective when the person has the inherent orientation that echoes the self-affirmation domain. For instance, worship is an effective self-affirmation domain for a religious person, while thinking of a classic painting is an effective self-affirmation domain for an artistic person (Steele & Liu, 1983). When the self-affirmation domain is central to a person's self-concept, self-affirmation

will be strong enough to distract the person whose self-integrity is threatened from focusing on the specific threat, and direct the person to think about the global self-integrity as morally and adaptively adequate. Because of this prerequisite, in self-affirmation implementation, participants usually are given opportunities to choose their most important values or most desirable personal characteristics as the self-affirmation domain to ensure that their important aspect of self-integrity, rather than unimportant ones, is affirmed.

Third, the self-affirmation domain is irrelevant to the threatened domain of self-integrity. When the self-affirmation domain differs from the threatened domain, the self-affirmation domain works as a resource from which individuals can restore and buttress their self-integrity. After overall self-integrity is maintained, individuals will not rely solely on the specific, threatened domain of self-integrity to evaluate themselves. However, if the self-affirmation domain is the same as the threatened domain, the specific threatened domain is restored and buttressed by self-affirmation. Under this situation, self-affirmed domain works as a standard against which individuals can justify their current cognitions and behaviors that are otherwise under threat.

For example, Steele and Liu (1983) conducted an experiment to compare whether self-affirmation was more effective in changing attitudes toward a tuition-increase message when the self-affirmation domain (i.e., political-economic) is important to the person compared to when it is not. Before the experiment, Steele and Liu (1983) tested whether participants were politically-economically oriented using the Schorr Test of

Value Activities scale[1] (Schorr, 1953). In the experiment, Steele and Liu (1983) described a situation where the university would consider increasing tuition, then asked participants to write arguments that favored tuition increase. Next, participants had an opportunity to affirm themselves on the political-economic subsets of the Allport-Vernon-Lindzey Study of Values scale.[2] After self-affirmation intervention, Steele and Liu (1983) measured participants' attitudes toward tuition increase. They found that participants who scored high on the political-economic orientation scale showed less dissonance-reducing attitude change compared to those who scored low on the scale. It is plausible to reason that tuition increase is a political-economic issue, and the participants who scored high on political-economic scale already had a tendency to oppose the tuition increase. When this tendency was further strengthened by the political-economic self-affirmation intervention, it was anticipated that participants with high political-economic tendencies were more likely to strengthen their original attitude more strongly than those with low political-economic tendencies.

Fourth, the timing of self-affirmation influenced its effect in reducing defensiveness. It also is important to note that self-affirmation can exert its positive influence on information processing only when individuals are exposed to self-affirmation before

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[1] The Schorr Test of Value Activities scale measures the six general value orientations, i.e., economics, aesthetic, science, religion, society, and politics. It requires the participants to answer "yes" or "no" to statements about their value preferences, e.g., "become a U.S. senator" or "teach art history." In Steele and Liu's (1983) study, participants were measured on the economics-politics subscale of the Schorr Test of Value Activities.

[2] The Allport-Vernon-Lindzey (AVL) Study of Values scale measures the same six general value orientations as in the The Schorr Test of Value Activities. The difference lies in the complexity of questions. The A-V-L scale requires participants to choose between two different value orientations, e.g., "If you were a university professor and had the necessary ability, would you prefer to teach: (a) poetry, (b) economics?"

exposure to threatening information (Briñol, Petty, Gallardo, & DeMarree, 2007; Cohen et al., 2000; Critter, Dunning, & Armor, 2010). Once individuals are exposed to threatening information and engage in defensive processing of the information, they channel mental resources into the spiral defensive processing, leaving few or no mental resources for self-affirmation (Cohen et al., 2000). In addition, once the defensive processing starts, the process cannot be reversed (Critter et al., 2010). In Steele and Liu's (1983) experiment, researchers asked participants to affirm themselves on their important values after they wrote the counter-attitudinal essay about tuition increase. Researchers found that the self-affirmed participants rated their counter-attitudinal essay stronger than their non-self-affirmed counterparts, which indicated that dissonance was not reduced after the post-essay self-affirmation procedure.

Subsequent studies further corroborate this finding. For example, in Critter and colleagues' study (2010), they ask participants to complete a task that ostensibly evaluates their creative thinking and problem solving abilities. There are three conditions in the study: (1.) pre-task self-affirmation, (2.) post-task self-affirmation, and (3.) non-self-affirmation control condition. In the pre-task self-affirmation condition, participants have the opportunity to affirm their self-integrity on their most important values (e.g., physical health or religious fulfillment) that are not related to the ability evaluated in the task before they receive bogus negative feedback on their task performance. In the post-task self-affirmation condition, participants affirm their self-integrity *after* they receive bogus negative feedback. Results show that participants in the post-task self-affirmation condition demonstrate more defensiveness to the bogus negative feedback than those in

the pre-task self-affirmation condition, proving the proposition that timing of self-affirmation is a key factor in determining whether self-affirmation can be effective in reducing defensiveness to threatening information.

Empirical Evidence of Self-affirmation's Impact

Health communication research extensively examines the impact of self-affirmation in reducing defensiveness. Empirical evidence shows that self-affirmation can uncouple the specific health threat from evaluation of self-integrity (Steele, 1998). Therefore, individuals can view themselves from an abstract (Klein & Monin, 2009; Trope & Liberman, 2003) and higher level of self-construal (Schmeichel & Vohs, 2009), from a global perspective (Sherman & Hartson, 2010; Steele, 1988), and more openly (Sherman & Cohen, 2006) without ruminatively thinking about the specific threat (Wakslak & Trope, 2003). More importantly, self-affirmation does not undermine the importance of the threat depicted in the message, but enhances attention to the argument strength in the message (Correll, Spencer, & Zanna, 2004).

There are four analytic reviews on self-affirmation (Epton, Harris, Kane, van Koningsbruggen, & Sheeran, 2015; Good & Abraham, 2007; McQueen, & Klein, 2006; Sweeney & Moyer 2015). These studies focus on some aspects related to the present study. They either examine the combination effect of self-affirmation and other interventions on several defensive responses (Good & Abraham, 2005), or examine the impact of self-affirmation on only message acceptance, intentions, and changes instead of the entire range of defensive response indicators (Sweeney & Moyer, 2015).

Good and Abraham's (2005) study explores the sensitivity of 11 defensive indicators (i.e., message acceptance, defensive avoidance, perceived severity, personal susceptibility, perceived prevalence, hopelessness/fatalism, religiosity, perceived manipulation, dissonance-reducing attitude change, egocentric contrast effects in social judgments, and T1 risk factors predicting T2 factors) of the combination impact of self-affirmation, self-relevance, and self-efficacy. They found that message acceptance, perceived severity, and personal susceptibility are the three most sensitive indicators of defensive processing. However, it is not possible to extract from the results whether these defensive indicators are sensitive to self-affirmation only, or to the other two factors (i.e., self-efficacy and self-relevance). McQueen and Klein's (2006) study reviews the effect of self-affirmation by focusing on delineating the conceptual framework rather than providing quantitative evidence. It is thus not entirely clear the extent to which self-affirmation is effective in reducing defensiveness to self-relevant threatening health information.

The Epton et al. (2015) and Sweeny and Moyer (2015) studies quantitatively analyze the impact of self-affirmation in health communication. Both studies find that self-affirmation is effective in reducing defensive responses to health messages. Specifically, Epton et al. (2015) analyzes 16 studies and detects positive impact of self-affirmation on three defensive indicators: message acceptance (d=0.17), intentions (d=0.14), and behaviors (d=0.32). Sweeny and Moyer (2015) also identify the positive impact of self-affirmation on intentions (d=0.26) and behaviors (d=0.27) by analyzing 41 studies. These two studies also test the moderating effects. Epton et al. (2015) found the

effect of self-affirmation in reducing defensiveness is more positive when the values self-affirmation domain is adopted and among the population with fewer White participants. Sweeney and Moyer (2015) tested four moderators: health topics, proximal vs. distal defensive responses (i.e., message acceptance and intentions vs. behaviors), self-affirmation domain, and specificity of health messages. They found that the self-affirmation domain does not influence the self-affirmation's effect in a way that is statistically significant. They also do not specify the direction of health topics' influence and conclude that different health topics do not substantially influence the self-affirmation process.

However, there has been no systematic review of self-affirmation's impact on the 11 defensive indicators (i.e., PME, defensive avoidance, perceived severity, perceived susceptibility, self-efficacy, response efficacy, attitudes, norms, negative affect, intentions, and behaviors) in health communications. More importantly, previous meta-analytic studies do not offer (coherent) answers about the extent to which the impact of self-affirmation varies as a function of self-affirmation domains, self-relevance levels, and health topics in reducing defensive responses. It also is important to recognize that the mediating role of emotions in the self-affirmation process is missing from the empirical studies (original studies and the meta-analytic reviews). In addition, very rarely did researchers justify why they measured the impact of self-affirmation on some indicators of defensive responses but not others. As a result, we do not know which of the 11 defensive response indicators is more strongly affected by self-affirmation. Therefore, we need a meta-analysis to disentangle these puzzles. In the following paragraph I

elaborate on the role of three moderators (i.e., the self-affirmation domain, self-relevance level, and health topic), as well as the potential mediator (i.e., positive emotions) in the self-affirmation process.

Multifaceted self: self-affirmation domain.

Self-integrity is multifaceted (Baumeister, 1998; Markus & Wurf, 1987). For example, Sherman and Hartson (2010) delineated that global self-integrity is composed of six domains: roles (e.g., parent), values (e.g., generosity), group identities (e.g., African American), central beliefs (e.g., Buddhism), goals (e.g., being healthy), and relationships (e.g., family members). When any domain is threatened, the remaining five domains can be used to affirm people's self-integrity (Baumeister, 2010; Sherman & Cohen, 2006). Because self-integrity is multifacted, self-affirmation is a rather flexible and fluid process (Sherman & Cohen, 2006; Steele, 1988). When one aspect of self-integrity is threatened, it can be restored by affirming another aspect. The aspect of self-integrity that can be used to affirm one's threatened self is referred to as "self-affirmation domain." For example, if individuals fail an intellectual task, they can seek self-serving beliefs about essential characteristics for success in, for example, marriage to bolster self-integrity as morally and adaptively adequate (Dunning, Leuenberger, & Sherman, 1995). In fact, the affirmed domain and the threatened domain should not be the same domain; otherwise, boomerang effects will occur (Aronson et al., 1995). For example, if a heavy drinker is affirmed as a healthy person who makes rational health choices, he tends to continue his drinking pattern because he gets immunity against the health information

(that persuades him to quit drinking) from this affirmation. In health communications, the most commonly used domains are values and desirable traits self-affirmation.

"Values self-affirmation" is a process of exposing individuals to a list of values, asking them to choose their most important value from the list, answering several questions about their most important value, and providing examples of how they implement this value in their everyday lives. Values are manifested in "the things that really matter in human existence: the job you choose, the way you spend your free time, the friends you make, the stuff you read" (Bruner, 1983). Values denote what is important to individuals and what choices they will make (Weiner & Craighead, 2009).

The overwhelming majority of research uses the Allport-Vernon Study of Values (SOV) (Allport & Vernon, 1931; Allpor, Vernon, & Lindzey, 1970). This value scale measures personal values by asking individuals' preferred ways of living. It consists of six domains: theoretical, economic, aesthetic, social, political, and religious. Each domain is grounded in a basic value (Spranger, 1928; Weiner & Craighead, 2009). For example, the theoretical domain is linked to the value of seeking truth by pursuing a career in science or investing time and money in scientific activities. Similarly, the economic domain is linked to the value of being practical by demonstrating interests in business careers and applied knowledge; the aesthetic domain is linked to the value of being artistic by preferring to be an artist or being willing to invest available resources to art; the social domain is linked to the altruistic value by showing interest and a willingness to participate in philanthropic activities; the political domain is linked to the value of power by demonstrating interest in influencing others or becoming a leader; the religious

domain is linked to the value of religion by showing a tendency to either perceive the world through the perspective of religion or pursue a career in religion (Lublinski, Schmidt, & Benbow, 1996; Oles & Hermans, 2010).

"Desirable traits characteristics self-affirmation" is a process of exposing individuals to one desirable trait or a list of desirable traits, asking them to choose a desirable trait that applies to them and provide an example of how they demonstrate this trait in their everyday lives. The specific traits used in each study varies. For example, some researchers use "kindness" as the self-affirmation domain (e.g., Armitage, Harris, & Arden, 2011; Jessop et al., 2014), while others use a list of desirable traits such as "enthusiastic, keen, conscientious, hardworking, intelligent, open-minded, responsible and determined" (e.g., Jessop, Simmonds, & Sparks 2009; Scott, Brown, Phair, Westland, & Schuz, 2013). Note that none of these desirable traits is related to health decisions or behaviors.

The impact of values and desirable traits self-affirmation in reducing defensive responses to threatening health messages receives extensive empirical support (e.g., Dillard, McCaul, & Magnan, 2005; Harris & Napper, 2007). However, although sporadic empirical evidence shows that values self-affirmation and desirable traits self-affirmation differ in their effectiveness in reducing defensive responses, it is unclear which self-affirmation domain is more effective based on previous meta-analytic reviews (Epton et al., 2015; Sweeney & Moyer, 2015). It seems that researchers do not justify why they chose one self-affirmation domain over the other in their experiments. If one self-affirmation domain can be found to consistently produce more defensiveness reduction in

one (or several) defensive indicator(s), future research and health promotion practice can choose a self-affirmation domain that is more suited to their goals. In the present study, I compare these two self-affirmation domains by asking whether desirable traits self-affirmation generates more positive emotions, and is therefore more effective than values self-affirmation in reducing defensive responses.

Centrality of a working self-concept: self-relevance.

Self-affirmation's effects differ between participants with high self-relevance and low self-relevance. "Self-relevance" is defined as the extent to which a working self-concept is central to an individual (Cooper & Mackie, 1983; McConnell, 2010; Petty & Cacioppo, 1979; Pilisuk & Skolnick, 1968; Zuwerink & Devine, 1996). In the present study, the working concept of self-relevance is defined as "individuals' perceived importance of their health behavior and the centrality of this behavior to their self-identities (Trope & Pomenratz, 1998)."

Self-relevance can be measured in two ways. One way is to measure it directly by asking how central a behavior is to individuals' self-perceptions (e.g., "drinking is part of who I am," McClure et al., 2013). The more central the health behavior is to self-identity, the greater the self-system activation is, if self-concept is threatened (Dunning et al., 1995; Higgins, King, & Mavin, 1982; Tesser, 1998). The other way is to measure how frequently individuals voluntarily perform a certain behavior, thereby placing them in a context where they can access their working self-concept related to the behavior. The longer and more frequently individuals perform an unhealthy behavior, the more important that behavior likely is to them. For example, researchers often measure the

amount and frequency of alcohol consumption as a way of measuring the centrality of the self-concept as a drinker (e.g., asking participants to "describe in detail the types and number of alcoholic drinks they consumed in a typical week," Armitage et al., 2011). Anti-drinking messages likely will threaten heavy drinkers more than moderate or non-drinkers because drinking is likely a part of their self-identities. So we see that the message more fully activates heavy drinkers' self-systems than moderate or non-drinkers' self-systems (Armitage et al., 2011; Steele, 1998), making heavy drinkers' aversive emotional state stronger (Aronson, 1969; Dillard, McCaul, & Magnan, 2005; Zhao, Peterson, Kim, & Rolfe-Redding, 2012).

Individuals with high self-relevance will be more motivated to maintain threatened self-integrity than those with low self-relevance. The question left unanswered is, "Will self-affirmation work better for individuals with high self-relevance compared to those with low self-relevance?" Mixed findings exist. For example, Zhao, Peterson, Kim & Rolfe-Redding (2012) shows that occasional smokers demonstrate more quitting intention at their one-month follow-up compared to daily smokers. But Harris and Napper (2005) finds that heavy drinkers show stronger risk perceptions than non-drinkers do of the message about the link between alcohol consumption and breast cancer. I test whether and how self-affirmation's effects vary as a function of people's self-relevance to the health risks in the meta-analysis. I further test it in the experiment by examining whether self-affirmed participants with high self-relevance have more negative emotions than those with low self-relevance.

Health topic.

Studies examine the effects of self-affirmation on a wide variety of topics, including promoting healthy behaviors (e.g., increasing vegetable and fruit consumption) and terminating unhealthy behaviors (e.g., reducing alcohol consumption). The effect of self-affirmation seems to vary as a function of different health topics. If an unhealthy behavior is performed repeatedly over a long time, part of self-concept will be formed around this behavior (Gardner, Bruijn, & Lally, 2011). Because unhealthy behaviors are associated with self-perceptions that are created by performing the behavior [e.g., being a drinker (McClure et al., 2013)], cessation topics pose a greater threat to one's sense of self. Accordingly, individuals need more self-affirmation resources to restore self-integrity in order to objectively process cessation messages. Thus, self-affirmation may be more effective in reducing defensiveness to health promotion topics than cessation topics (Jessop et al., 2009; Epton et al., 2014). However, the existing meta-analysis does not reveal whether the impact of self-affirmation is more positive in cessation topics or in promotion topics (Sweeney & Moyer, 2015). I test the health topics as a potential moderator in the meta-analysis in this dissertation.

Emotions in the Self-Affirmation Process

Researchers propose that affect is the motivator for biased processing of self-relevant information (Greenwald & Pratkanis, 1984; Markus & Wulf, 1987; Strickland, Taber, & Lodge, 2011). Biased information processing is not a purely cognitive process, but is emotionally charged (Smith, Haynes, Lazarus, & Pope, 1993; Strickland et al., 2011; Taber & Lodge, 2006). When individuals' self-concepts are challenged by self-

relevant information, emotional state is disturbed (Markus & Wulf, 1987) because their goal of maintaining self-integrity is frustrated (Greenberg & Pyszczynski, 1985; Greenberg, Pyszczynski, & Solomon, 1986). Conceivably, there are two components of self-affirmation's effectiveness: self-integrity and an elevated affective state (Cohen et al., 2000). Steele and Liu (1983) even reason that the enhanced moods, not the affirmed self-integrity, are the reason dissonance is reduced. In the present dissertation, I propose that after self-affirmation, the absence of negative emotions and the presence of positive emotions facilitate objective processing of self-relevant health messages.

The present study proposes that emotional responses occur earliest in the mediation relationship. Exposure to threatening health messages causes negative emotions, and negative emotions further exert influences on cognitions and behaviors. The negative emotions will be stronger when people perceive a mismatch between the recommended behavior and their current health behavior (Harris & Napper, 2005). The following text elaborates on why self-affirmation generates positive emotions, which facilitate objective processing.

Both maintaining positive self-perceptions and staying healthy are important. In fact, there is a trade-off between the long-term benefits from the threatening health information and the negative emotional experience elicited by the threatening information. Individuals often choose the goal of maintaining self-integrity and reducing negative emotions over the goal of reducing potential risks by following health recommendations. This is because the former requires less time, fewer resources, and fewer cognitive and behavioral commitments than the latter. By not inducing negative emotions and inducing

positive emotions, self-affirmation changes the relative weight of emotional costs to informational benefits (Trope & Pomerantz, 1998). When self-affirmed, individuals satisfy the motive of enhancing positive self-perceptions. Positive emotions ensue, followed by the individuals' adaptive adequacy, which then leads to less negative sensitivity (Zajonc, 1980) and more positive predictions of the following events (Isen, 1987). Negative emotions are not induced by, and positive emotions are elicited in response to exposure to a subsequent message (Cohn & Fredrickson, 2009). Due to the absence of negative emotions, the motivation for defensively processing health messages no longer exists and accordingly, people can focus on satisfying the motive of staying healthy by objectively processing threatening health information.

When individuals meet the goals, they have more positive emotions than when they do not (Isen, 2009; Wilson & Dunn, 2004). For example, individuals whose explicit behaviors are consistent with their implicit perception of achievement and affiliation have more positive emotions (Brunstein, Schultheiss, & Grässmanm, 1998). Presumably, self-affirmation elicits positive emotions that serve as a buffer against the negative emotional state caused by subsequent exposure to threatening health messages (Greenberg et al., 1992; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000; Trope & Pomerantz, 1998). These positive emotions act as resources individuals can use to cope with the health threat adaptively. Cohen et al. (2000) proposes that "When people are in a good emotional state, they are more rational." People with positive affects may be more resilient to life adversity, including being more open to threatening health information (Tesser et al., 2000).

For example, values self-affirmation produces feelings of love and connectedness (Crocker, Niiya, & Mischkowski, 2008). When people feel positive emotions, oxytocin is released (Uvnäs-Moberg, 1998). Oxytocin is a hormone and neurotransmitter that is identified to be related with higher trust (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005), lower stress (Quirin, Kuhl, & Düsing, 2011), and more importantly, decreased fear and anger in response to threatening social stimuli (Kirsch et al., 2005). Positive emotions provide people with the psychological resilience to face the possibility that their unhealthy behaviors put them at risk of certain diseases (Haidt, 2003; Salovey, Rothman, Detweiler, & Steward, 2000; Tugade, Fredrickson, & Feldman Barrett, 2004). Positive emotions also provide people a broader perspective, so they do not focus narrowly on immediate threats, but rather, consider future outcomes (Dreisbach & Goschke, 2004; Frijda, 1986). This allows people to be more interested in and open to threatening health information that includes diagnostic functions (Trope & Pomerantz, 1998).

It is important to note that whether and how positive emotions lead to objective processing of negative messages depends on the importance of the message to its recipients (Aspinwall, 1998; Isen, 2009; Smith & Shaffer, 1991). When presented with critical information about potentially substantial losses and calls for actions that can prevent these losses, people with positive emotions are less likely to be defensive against the information (Aspinwall, 1998; Aspinwall & Brunhart, 1998; Isen, 2009; Trope & Pomerantz, 1998). Positive emotions may bolster mental resources, which at-risk people can use to face threatening health information (Koningsbruggen & Das, 2009) and avoid unpleasant affective responses (e.g., fear or anxiety) aroused by negative feedback (i.e., a

mismatch between current behavior and recommended behavior). Otherwise, that negative feedback in the health information interferes with adaptive coping, including objective processing of information or willingness to adopt recommended behaviors (Harris & Napper, 2008; Leventhal, 1970; Trope & Neter, 2004).

Because positive emotions can lead to more trust and less stress (Kosfeld et al., 2005; Quirin et al., 2011), positive emotions facilitate attention to threatening health information (Aspinwall & Brunhart, 1998); increase health information acceptance (Trope & Pomerantz, 1998); and enhance positive beliefs (Crocker et al., 2008) or perceived response efficacy of the health promotion behaviors (Salovey & Birnbaum, 1989). Moreover, people who feel happy are more likely to perform health promotion behaviors than those who feel sad (Salovey & Birnbaum, 1989). Following this line of literature, we would expect that self-affirmation produces positive emotions, which further decrease defensive responses to threatening health messages.

In sum, the present meta-analysis builds on previous meta-analyses (Epton et al., 2015; Sweeney & Moyer, 2015) by conducting a more finely tuned analysis that examines the entire spectrum of defensive responses (i.e., PME, perceived severity, perceived susceptibility, self-efficacy, response efficacy, attitudes, perceived norms, negative emotions, intentions, and behaviors), with a larger pool of empirical studies. I also explore the mediation relationship between the 11 indicators of defensive responses. Moreover, the present study addresses the theoretical gap of whether and to what extent self-affirmation domains, health topics, and self-relevance levels influence defensive processing of self-relevant threatening health messages. In addition to the above three

moderating effects that need disentangling, the role (especially the mediating role) of emotions has been conspicuously neglected in self-affirmation research. Therefore, a purpose of this dissertation is to unveil the mediating role of emotions in the self-affirmation process. The present study also examines whether the role of emotions mediate the self-affirmation process. Specifically, self-affirmation reduces negative emotions and thus removes the motivation to defensively process health messages. Self-affirmation also produces positive emotions and enhances objective processing of health messages. In the following chapter, I specify how I conduced the meta-analysis.

Chapter 3: Meta-Analysis Method

Meta-analysis refers to "the quantitative procedures used to statistically combine the results of studies" (Cooper, 2008, p. 6). In meta-analysis, researchers search and summarize previous empirical studies to "address related or identical hypotheses," and draw conclusions from the empirical studies as a whole (Cooper, 2008). Effect size is the unit of analysis in meta-analysis, which refers to the "the magnitude of treatment effect or (more generally) the strength of a relationship between two variables" (Borenstein, Hedges, Higgins, & Rothstein, 2008, p. 3). The present meta-analysis examines the impact of self-affirmation on the 11 indicators of defensive responses and the effects of the three potential moderators in the self-affirmation process. I analyze the mediating role of emotions and the mediation relationship between the 11 indicators of defensive responses based on available data. The following section outlines procedures involved in conducting the present meta-analysis.

Literature Search and Inclusion Criteria

To be considered for inclusion, a study should:

(1) use self-affirmation as an intervention strategy to reduce defensiveness. Studies that measure participants' personal differences in their tendencies to self-affirm when facing risks were deleted (e.g., Ferrer et al., 2015) because the present study examines the impact of self-affirmation intervention rather than the impact of personal difference of self-affirmation tendency in health information processing. "Self-affirmation intervention" refers to a task that experimenters administer to affirm participants' self-integrity. "Self-affirmation tendency" is a personality trait that is not

changed by an intervention. Specifically, self-affirmation tendency, also called "cognitive self-affirmation inclination" (Pietersma & Dijkstra, 2012) or "spontaneous self-affirmation" (Taber et al., 2015; Taber, Klein, Ferrer, Kent, & Harris, 2015; Persoskie et al., 2015) refers to the extent to which individuals tend to think about their positive self-concept when their self is being threatened (e.g., Pietersma & Dijkstra, 2012).

(2) allow for extraction of the effect sizes. Studies in which effect sizes are non-existent (e.g., review articles and qualitative studies) are excluded.

(3) contain threatening health messages and measure cognitive, affective, and/or behavioral responses to these messages. I exclude studies involving a health topic about disease coping (e.g., phosphate control among hemodialysis patients) or physical responses (e.g., pulse rate). I exclude them because participants with certain diseases who are enrolled in clinical trials have increased risk perceptions of the disease. According to the literature review about self, these participants' self-systems are more fully activated and more receptive to self-affirmation intervention than the general population. Thus, the studies using patients rather than non-patients as a study population may have a higher effect size. In addition, the primary purpose of self-affirmation intervention in these clinical trials is to increase participants' adherence to medical prescription rather than behavioral changes, and the clinical trials usually provide additional assistance to the patients beyond the self-affirmation intervention, making it difficult to explicate what proportion of effect size can be attributed to self-affirmation alone. Therefore, it makes little sense to include clinical trials that use self-affirmation as the behavioral intervention strategy.

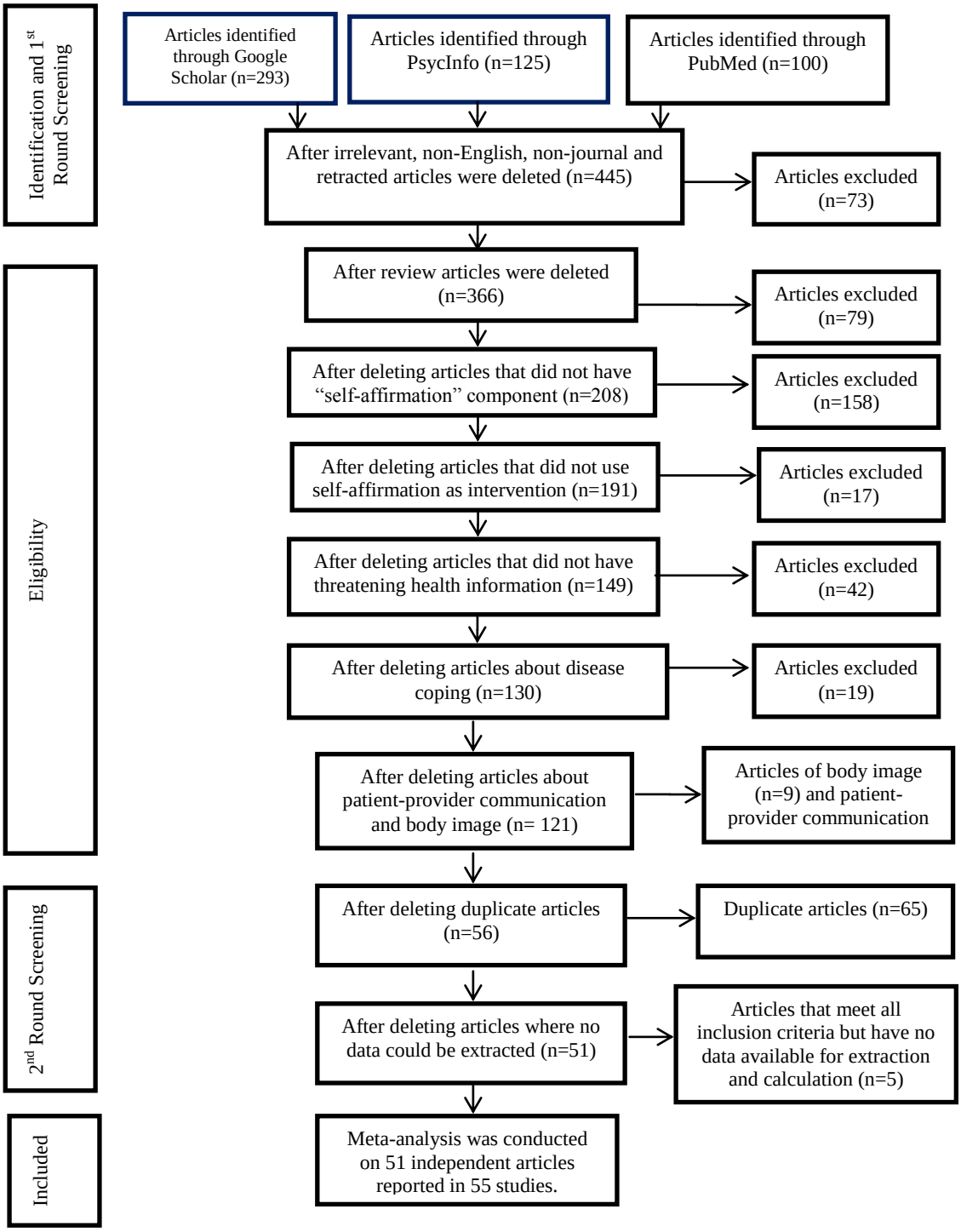
I also exclude studies that focus on the impact of self-affirmation on stress coping and anxiety relieving. These studies focus on examining the effectiveness of self-affirmations in enhancing psychological well-being in the face of adversity (e.g., Lange, Richard, Gest, de Vries, & Lodder, 1998), the effect of which usually is indicated by physiological factors (Creswell et al., 2007). As such, these studies are not useful, because the present meta-analysis examines a different aspect of effectiveness of self-affirmation, that is, reducing emotional, cognitive, and behavioral defensive responses to threatening information.

(4) be published in a peer-reviewed journal in English. I exclude conference papers, dissertations, and book chapters.

I searched our sample through three databases: Google Scholar, PsycInfo, and PubMed. Data search and collection was finalized on November 30, 2015. Using the key words “self-affirmation,” “health information,” “threatening,” and “defensive,” Google Scholar yields 293 articles. After deleting articles that do not meet the inclusion criteria, the number drops to 35. Using the key words “self-affirmation” and “health,” PubMed yields 100 articles. Deleting articles that do not meet the inclusion criteria leaves 26 PubMed articles. Deleting duplicate articles results in a sample of 56 articles. Among the 56 articles, there are five from which I am not able to extract data on relevant dependent variables (Dijkstra, 2014; Dijkstra and Asten, 2014; Elbert & Dijkstra, 2014; Ferrer et al., 2012; ten Hoor et al., 2014). Therefore, the final sample includes 51 articles with 55 studies.

The detailed sampling procedure is organized in Figure 2.

Figure 2 Study Sampling Flow Chart



Coding

To extract data about study characteristics and effect sizes for each outcome variable tested in the studies included, we developed a codebook (see Appendix A). We coded the following aspects: study characteristics, moderators, and effect sizes.

Coding of Study Characteristics

An independent coder and I coded all studies for these study characteristics: (1) publication year, (2) authors' last name(s), (3) academic affiliation of first author (i.e., communication, psychology, public health/medical school, or other), (4) country where research was conducted (i.e., United States, United Kingdom, Netherlands, or other), (5) health topics [i.e., the health behavior in the original studies and which type (i.e., whether the behavior is to promote healthy behaviors or stop unhealthy behaviors) it is], (6) whether self-affirmation strategy is administered before or after participants' exposure to threatening health information, (7) self-affirmation domains (i.e., values self-affirmation, desirable traits self-affirmation, or other types of self-affirmation), (8) participants' age, race, and sex.

Using percent agreement, I calculated inter-coder reliability for each study characteristics. Disagreements were nonexistent. I summarize these study characteristics in Table 2.

Table 2

Characteristics of Studies Included in the Meta-Analysis

Study	Country	Recommended	Self-	Self-relevance	Outcome variable

	Sample		health behaviors	affirmation domains	levels	
1. Reed & Aspinwall (1998)	66 college students; 100% women; 58% White, 24% African-American; mean age=20.6 (range 17-26 year)	US	Reduce coffee consumption	Kindness	High vs. Low- caffeine use	Self-efficacy, perceived threat, behavior
2. Sherman, Nelson & Steele (2000) (Study 1)	60 college students; 100% women	US	Reduce coffee consumption	Values	Coffee drinkers vs. non-drinkers	Message acceptance, intentions, thought listing
3. Sherman, Nelson, & Steele (2000) (Study 2)	61 college students; 51% women	US	Use condoms	Values	Sexually active students	Perception of the risk, preventive behaviors
4. Dillard, McCaul, & Magnan, (2005)	135 college students; mean age=20.5 (SD=2.7); 95.4% White	US	Quit smoking	Values	Smokers vs. non-smokers	Motivation to quit, smoking behavior, mood, feelings about self, seriousness, accuracy, and effectiveness, time spent viewing warning, thought process data
5. Harris & (2005)	82 college students; 100% women; mean age=18.8 (SD=1.3)	UK	Reduce alcohol consumption	Desirable positive thinking task	Heavy vs. moderate drinkers	Self-risk, average risk, imagination, belief in link, evidence strength, negative affect, intentions, alcohol consumption
6. Harris, Mayle, Mabbot, & Napper (2007)	87 college students; 55% women; Mean age=21 (range:18-40)	UK	Quit smoking	Desirable characteristics	Heavy smokers (10 or more cigarettes per day) vs. others	Threat, relevance, intention, control, self-efficacy, negative thoughts and feelings, health risks, desire to quit, and quit plans
7. Armitage, Harris, Hepton, & Napper	250 confectionary factory workers; 18% women; mean	UK	Quit smoking	Kindness	Smokers vs. non-smokers	Acceptance, intention, self-efficacy, behavior

(2008)	age=32 (range: 18-54 year)					
8. Croker, Niiya, & Mischkowski, 2008 (Study 2)	102 college students; 97% women; 70% White, 12% Asian, 18% other or mixed ethnicity; mean age=18.6 (range 17-22 year)	US	Quit smoking	Values	Smokers vs. non-smokers	Emotions, acceptance
9. Epton & Harris (2008)	93 college students; mean age=21.8 (range 18-46)	UK	Increase fruit and vegetable consumption	Kindness	NA	Self-efficacy, response efficacy, intentions, and alcohol consumption
10. Fry & Prentice-Dunn (2009)	197 college students	US	Take breast self-examinations	Values	NA	Avoidance, hopelessness, religiosity, intentions, and rational problem solving
11. Jessop Simmonds, & Sparks (2009)	163 sunbathers on a beach in the south of England; 100% women; 100% White	UK	Use sun screen	Values, kindness, positive traits	High risk, i.e., sunbathers	Negative affect, defensive avoidance, message derogation, response-efficacy, self-efficacy, attitude, intention, self-feelings, and mood
12. Klein & Harris (2009)	118 college students; 100% women;	US	Reduce alcohol consumption	Values	All were drinkers who consumed at least 7 alcoholic beverages each week, which was further categorized in two groups: i.e., moderately heavy drinkers and heavy drinkers	
13. Koningsbruggen & Das (2009)	84 participants recruited from Internet; 69% women; Mean age=38.19 (SD=14.58)	NL	Take type 2 diabetes test	Values	At risk of type 2 diabetes vs. not at risk of type 2 diabetes	Risk levels, message derogation, intentions, screening behaviors
14.	84 college	NL	Reduce	Values	Coffee	Accessibility of threat-related

Koningsbruggen, Das, & Roskos-Ewoldsen (2009)	students; 76% women; Mean age=23.62 (SD=3.66)		caffeine consumption		drinkers vs. non-coffee drinkers	cognitions, perceived message quality, intentions to reduce caffeine consumption.
15. Napper, Harris, & Epton (2009)	35 college students; 100% women	US	Reduce alcohol consumption	Values	Heavy drinkers (top quartile of alcohol consumption)	Thought listing items including supporting the evidence, counter-arguing the evidence, issue considered genuine and serious, minimizing issues, personal relevance, denying/reducing personal relevance, unrelated to the article, negative statements, positive statements. Questionnaire items including thought deeply about the information, tried not to think about the information, content relevant to self, content relevant to others, comparative risk, own risk
16. Klein, et al. (2010)	251 (64% college students; 37% with no college experience); 26% women; mean age=57.8 (SD=6.49); 80% White, 16% African-American	US	Take a fecal occult blood test	Values	NA	Perception of comparative risk, intention, screening
17. Ko & Kim (2010)	86 college students; 76.19% women; 100% European American	US	HIV prevention	Remote Associations Task	NA	Effectiveness of the brochure, perceived personal risk for HIV, intention
18. Zhao & Nan (2010)	84 college students; 58% women ; Mean age=20.88 (SD=2.22);	US	Quit smoking	Values	NA	Cognitive responses (positive and negative thoughts), perceived message strength, message derogation, anger, smoking intention, self-efficacy
19. Armitage, Harris, & Arden (2011)	278 adults from a medium-sized retailer; 66% women; 54% White, 11.5% African American,	UK	Reduce alcohol consumption	Self-affirming implementation	NA	Message processing, perceived threat, perceived message quality, message derogation, defensive avoidance

	20.9% Asian American, 5.1% others					
20. Good & Abraham (2011)	677 college students; 47% women; mean age=17.76 (range 16-23)	UK	Use sunscreen	Values	NA	Message acceptance, perceived susceptibility, age-based denial, perceived severity, intentions.
21. Griffin & Harris (2011)	165 adults recruited from community; 56% women; 58% White, 6% African American, 34% Asian American, 6% others; mean age= 32.1 (range 21-35)	CA	Reduce fish consumption	Values	Frequent consumer of tuna vs. infrequent consumers	Depth of thought, personal risk, message relevance, negative affect
22.Klein, Harris, Ferrer, & Zajac (2011) (Study 2)	120 college students; 100% women	US	Reduce coffee consumption	Values	Women who drank two or more cups of coffee per week	Feelings of vulnerability, message strength, intention, risk perception, negative affect
23.Pavey & Sparks (2011) (Study 1)	104 college students; mean age=21.1 (SD=4.82)	UK	Reduce alcohol consumption	Kindness & Autonomy	Those who consumed a large amount of alcohol vs. those who did not	Autonomous motivation
24.Pavey & Sparks (2011) (Study 2)	157 college students; Mean age=21.8 (SD=6)	UK	Reduce alcohol consumption	Kindness & Autonomy (explicit and implicit)	Those who consumed a large amount of alcohol vs. those who did not	Autonomous motivation, attitudes, intentions
25.Pieters ma & Dijkstra (2011)	537 college students	NL	Increase fruit and vegetable consumption	Values	Those who consumed a large amount of alcohol vs. those who did not	Intentions, fruit and vegetable consumption behaviors
26. Ferrer, Shmueli, Bergman, Harris, & Klein (2012)	265 college female students	US	Reduce alcohol consumption	Values	NA	Implementation intentions to reduce alcohol consumption and affect
27. Howell & Shepperd (2012) (Study 1)	40 college students;	US	Receive risk feedback of a vitamin deficiency	Trait	NA	Message avoidance
28.	104 college	US	Received risk	Trait	NA	Message avoidance

Howell & Shepperd (2012) (Study 2)	students		feedback of a vitamin deficiency			
29. Nan & Zhao (2012)	413 college students; 83% college students; 68% White, 32% others; Mean age=20.28 (SD=4.45)	US	Quit smoking	Values	Smokers vs. non-smokers	Message derogation, anger, negative thoughts
30. Pietersma & Dijkstra (2012) (Study 5)	195 college students; 63% women	NL	Reduce risk of cardiovascular disease	Achievement	NA	Intentions
31. Schneider, Gadinger, & Fischer, 2012	88 college students; 56% women; Mean age=22(SD=2.4)	GE	Quit smoking	Values	Smokers	Fear intensity, vulnerability, severity of threat, response efficacy, self-efficacy
32. Zhao, Peterson, Kim, & Rolfe-Redding (2012)	116 college students; 38% women; 53.7% White, 9.9% African-American, 23.1% Asian American, 9.9%, Hispanic, 13.2% others	US	Quit smoking	Values	Daily smokers vs. occasional smokers	Perceived effectiveness, message elaboration, valence of processing, message engagement, fear, perceived message strength, message derogation, quitting intentions, smoking behavior
33. Dijkstra & Asten (2013)	124 college students	NL	Increase fruit and vegetable consumption	Values	NA	Intentions
34. Napper, Harris, & Klein (2013)	80 college students; 50% women; Mean age=19.1 (SD=1.2)	UK	Increase fruit and vegetable consumption	Values	NA	Threat, efficacy, and intentions
35. Schuz, Schuz, & Eid (2013)	266 participants recruited	AU	Avoid sun exposure	Personal strengths and values	NA	Exposure behavior, sun avoidance intentions, risk perception

	from a public science event at a German University); 55% women; Mean age=33.78(range 11-71)					
36. Scott, Brown, Phair, Westland, & Schuz (2013)	121 college students; Mean age=20.29 (SD=1.75)	AU	Reduce alcohol consumption	Positive values and characteristics	Using Australian standard drinks to indicate different drinking levels	Alcohol consumption, intention, message derogation
37. Armitage, Rowe, Arden, Harris (2014)	67 comprehensive school students; 90% White; Mean=17.09 (SD=0.38)	UK	Reduce alcohol consumption	Implementation intention	Alcohol drinkers	Perceived threat, message derogation, intention, and self-efficacy
38. Barkoukis, Lazuras, & Harris (2014)	60 competitive athletes, 75% men,	GR	Quit doping use	Kindness	Doping users	Attitudes towards doping use, social norms, (descriptive and subjective norms), moral norms, self-efficacy beliefs (perceived behavioral control and situational temptation), and anticipate regret
39. Cooke, Trebaczyk, Harris, & Wright (2014)	80 college students; 50% women; Mean age=20 (SD=1.65)	UK	Increase physical activity	Values	NA	Intention, attitudes, subjective norms, and perceived behavioral control
40. Dijkstra (2014)	218 participants; mean age=23.4 (SD=8.09)	NL	Smoking cessation	Values	NA	Intention to quit smoking, perceived personal relevance
41. Düring & Jessop (2014)	328 college students; 50% women	UK	Increase physical activity	Values	NA	Attitudes, intentions, perceived behavioral control, and message derogation
42. Epton, et al. (2014)	1445 college students; 49% women; Mean age=18.9	UK	Smoking cessation	Values	NA	Self-efficacy, perceived control, intention, fruit and vegetable consumption, physical activity, binge drinking, and smoking,
43. Good, Harris,	123 college students; 50%	UK	Increase physical	Values	NA	Message acceptance, message derogation,

Jessop, & Abraham (2014)	women; Mean age=16.57 (SD=0.6)		activity			perceived risk, response-efficacy, self-efficacy, behavioral expectation, physical activity
44. Harris, et al. (2014)	332 college students; 50% women; 79.2% White, 12.3% Asian, 3.3% others; Mean age=22.3 (SD=5.9)	UK	Increase fruit and vegetable consumption	Values	NA	Intentions, fruit and vegetable consumption behaviors
45. Jessop, Sparks, Buckland, Harris, & Churchill (2014) Study 1	120 participants (39.17% were students); 67% women; Mean age=25.02(SD =6.87)	UK	Increase physical activity	Kindness	NA	Attitudes, perceived behavioral control, response efficacy, intention, exercise behavior
46. Jessop, Sparks, Buckland, Harris, & Churchill (2014) Study 2	116 college students; 52% women; Mean age=20.65(SD =4.72)	UK	Increase physical activity	Implementation intention	NA	Attitude, perceived behavioral control, response efficacy, intention, exercise behavior
47. Koningsbruggen et al. (2014)	91 adult participants recruited online; 100% female; mean age=22.01 (SD=2.81)	NL	Increase fruit and vegetable consumption	Values	NA	Anticipated regret, intentions, and behavior
48. Napper, Harris, & Klein (2014)	80 college students; 91.3% women; Mean age=19.1 (SD=1.2)	UK	Increase fruit and vegetable consumption	Values	NA	Threat, efficacy, intentions, mood
49. Puntoni, Sweldens, & Tavassoli (2014)	92 adults recruited a U.S. online panel; 100% women; Mean age=30.6(SD= 10.3)	UK	Not clear but indicated in the manipulation message: early detection	Kindness	NA	Own risk estimate and other risk estimate
50. DiBello, Neighbors, & Ammar (2015)	203 participants; 71.43% female, mean age=23.07 (SD=4.99); 51.61% White, 28.49% Hispanic/Latin	US	Smoking cessation	Values	NA	Image rating

	o, 16.13% Asian, 10.22% Black/African American, 0.54% Native American/American Indian, 11.83% self-classified as other.					
51. Dijkstra & Menninga (2015)	140 participants	NL	Smoking cessation	Values	100% smokers	Craving
52. Kim & Niederdeppe (2015)	396 college students; 76% female; mean age=20 (SD=1.66), 61% White and 25% Asian;	SG	Decrease alcohol consumption	Values (Values in Action)	58% participants engaging in heavy episodic drinking	Comparative risk perception, perceived risk, negative cognitive responses (i.e., boring, overstated, exaggerate, distorted, untrue, overblown, not very truthful, tried to manipulate their feelings or exploit them); identification, transportation
53. Klein, Hamilton, Harris, & Han (2015)	247 undergraduate students; 100% female	US	Decrease alcohol consumption	Values	NA	Perceived ambiguity regarding cancer prevention messaging, perceived risk of breast cancer, and message acceptance
54. Mays & Zhao (2015)	475 participants; mean age=24.7 (SD=3.2); 40.8% college students	US	Decrease indoor tanning use	Values	At lease used indoor tanning once in the past year	Perceived message strength, fear response (i.e., frightened, anxious, or nervous), and intentions
55. Meier et al. (2015)	110 participants; 41.8% female; 77.3% White	US	Decrease alcohol consumption	Values (Harber's Sources of Validation Scale)	NA	Problem importance, personal risk, alcohol-related beliefs, message scrutiny, and drinking behavior

Effect Size Calculation

In the present meta-analysis, "effect size" refers to the mean difference of each outcome variable in the self-affirmation group and in the non-self-affirmation control group. I calculate individual effect sizes for each of the 11 outcome variables in each study included. I code 11 outcome variables (i.e., PME, defensive avoidance, perceived severity, perceived susceptibility, self-efficacy, response efficacy, attitudes, norms, negative affective responses, intentions, and behaviors). It is important to note that I

categorize outcome variables in the original studies according to the conceptual definition of this study, instead of how authors of the original studies label them. Specifically, I examine how the measurement is operationalized in the original study and compare the operationalization with the definition in the present study to determine into which category it falls.

Three moderators were coded: (1) self-affirmation domain: desirable traits desirable characteristics, or Values[3], (2) health threat topic: terminating unhealthy behavior (smoking cessation, reducing alcohol consumption, reducing caffeine intake, etc.), or adopting healthy behaviors (completing breast cancer screening, applying sunscreen, increasing fruit and vegetable consumption, increasing physical exercise, etc.), (3) self-relevance levels: high (heavy coffee drinkers, daily smokers, at risk for certain disease, etc.), or low (occasional or non-coffee drinkers, occasional or non-smokers, not at risk for certain disease, etc.). Using percent agreement, I calculate inter-coder reliability for each moderator. Disagreements are nonexistent for moderators and effect sizes estimates.

I retrieve the effect size estimates for 11 outcome variables. Using percent agreement, I calculate inter-coder reliability for each variable. Percent agreement for the 11 outcome variables range from a low of 93.75% (perceived severity) to a high of 100%, with a mean percent agreement of 97.54%. The agreement between the two coders is high. Discrepancies were discussed and resolved.

[3] There are two studies using self-affirmation implementation as intervention. Due to the small number of studies, I was not able to conduct meta-analysis, and I did not include the effect size of self-affirmation implementation here.

Statistical Analysis Strategy

In the present study, I conduct the two sets of analyses. I first calculate whether or not the effect size of self-affirmation is consistent across studies. I then test whether or not the effect size of self-affirmation is consistent across different self-affirmation domains, different health topics, and different levels of self-relevance in these studies. I conduct the statistical analysis using Microsoft Excel 2010 spreadsheets following Borenstein et al. (2008)'s method. I elaborate on the specific steps in the following section.

Generally, there are two groups of effect sizes: d family and r family (Lakens, 2013). The d family effect size refers to "the mean difference between observations, divided by the standard deviation of these observations," while r family effect size refers to "the proportion of variance that is explained by group membership" (Lakens, 2013, p. 2). In the present study, I base effect size calculation on the mean difference between the self-affirmation group and non-self-affirmation group. The original studies that report results in r are converted to Cohen's d. Cohen's d equals the "difference between population means divided by average population standard" (Lakens, 2013, p.2). All effect sizes are further converted to Hedges' g, which corrects bias in Cohen's d and provides an unbiased estimation (Borenstein et al., 2008; Hedges & Olkin, 1985).

Both Hedges's g and Cohen's d refer to "the difference between population means divided by average population standard deviation" (Rosenthal, 1994, p.240). Although widely used, Cohen's d tends to overestimate the absolute value of population standardized mean difference, especially when the sample size of studies included is

small (Borenstein, et al., 2008; Hedges & Olkin, 1985). This overestimation often is referred to as “the uncorrected effect size” (Lakens, 2013). Hedge’s g corrects Cohen’s d by being further weighted by degree of freedom (see Formulae 8 and 9 below). The difference between Cohen’s d and Hedges’ g is very small, especially when the number of studies included is below 20 (Lakens, 2013). I take the unbiased approach to correct for the overestimation by calculating Hedges’ g (Cumming, 2012; Hedges, 1981).

A positive value of Hedges’ g indicates that the self-affirmation group is more effective in reducing defensive responses than the non-self-affirmation control group, whereas a negative g value indicates the opposite. Specifically, a positive g value indicates that, compared to control group, the self-affirmation group has higher PME, higher self-efficacy and response efficacy, higher perceived severity and susceptibility, more changes of attitudes and beliefs in the recommended direction, fewer negative affective responses, stronger intentions to perform the recommended behavior, and more behavior.

To obtain effect sizes for each study, I calculate Cohen’s d, the standardized mean difference (Cohen, 1977) between the self-affirmation group and non-self-affirmation control group. I obtaine d-index from: (1) the difference between the mean values of a dependent variable and standard deviations or errors for 47.27% of the studies (n=26) (see Formulae 1 and 2), (2) F and t values for 47.27% of the studies (n=26) (see Formulae 3 and 4); (3) chi-square values for 5.45% of the studies (n=3) (see Formulae 5 and 6).

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Where

Error! Reference source not found. and **Error! Reference source not found.**= the two group means; and

Error! Reference source not found.= the estimated common standard deviation of the two groups.

To estimate **Error! Reference source not found.** ,

Error! Reference source not found.=**Error! Reference source not found.**(2)

Where

Error! Reference source not found. and **Error! Reference source not found.** = the standard deviations of Group **Error! Reference source not found.** and Group **Error! Reference source not found.**, respectively, and

Error! Reference source not found. and**Error! Reference source not found.**= the sample sizes in **Error! Reference source not found.**.

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where t = the value of the t-test for the associated comparison, **Error! Reference source not found.** = the degree of freedom associated with the error term of the t-test (**Error! Reference source not found.**, and

$$t = \sqrt{F} \quad (4)$$

If the results are calculated by chi-square, the following steps (Formulae 5 and 6) are performed to convert χ^2 to Cohen's d.

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where

χ^2 = the chi-square value associated with the comparison, and n = the total number of observations in the comparison.

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The variance of Cohen's d is:

$$V_{d1} = \frac{n_{i1} + n_{i2}}{n_{i1} n_{i2}} + \frac{d^2}{2(n_{i1} + n_{i2})} \quad (7)$$

I then transform the Cohen's d to Hedges' g by correcting the bias of Cohen's d. (Formulae 8-10[4]).

The correction factor (J) is:

$$J = 1 - \frac{3}{4(n_{i1} + n_{i2} - 2) - 1} \quad (8)$$

By multiplying the correction factor (J), Cohen's d is corrected and converted to Hedge's g. n1+n2-2 is the degree of freedom for two independent observations. The biased-corrected standardized mean difference, Hedges' g, and the variance are:

$$g_1 = J \times d_1 \quad (9)$$

$$V_g = J^2 \times V_d \quad (10)$$

To meta-analyze the effect size for each defensive response, I summarize the effect size of each study by defensive response variables. Because more than half of the

studies (n=36) have only immediate post-tests and no follow-ups,[5] I include only immediate post-test measures in the meta-analysis. If I were to include all the measures in the meta-analysis when there is more than one measure for one construct, I would overweight the study with two or more measures for one construct (Borenstein et al., 2008). In this case, I would get an imprecise measure of the effect size.

To eliminate this problem, I combine the outcomes into one measure. For example, Napper, Harris, and Epton (2009) use three measures of defensive avoidance (i.e., counter-arguing the evidence, minimizing issues, and trying not to think about the information). In calculating effect sizes, I combine the three measures into one as an indicator of defensive avoidance. Another example is that Barkoukis, Lazuras, and Harris (2014) use "perceived behavioral control" and "situation temptation" to measures self-efficacy beliefs. I combine these two measures in meta-analysis calculation to avoid overweighting this study.

Fixed-Effect Model and Random-Effects Model

The individual effect size is weighted to calculate the summary effect size. There are two statistical models for calculating the summary effect size [fixed-effect model and random-effects model (Hedges & Vevea, 1998)]. These two models include different assumptions about the studies included in the meta-analysis. The fixed-effect model assumes that all studies included in the meta-analysis have a common effect size; whereas the random-effects model assumes that population effect size may vary from study to study (Borenstein et al., 2008; Hedges & Vevea, 1998). In other words, the

[5] More detailed results are in the "Results" section at the end of this chapter.

fixed-effect model assumes that the standard deviation of population mean (δ when d is used) or proportion (ρ when r is used) is 0. It is rare that the assumption of a fixed-effect model can be satisfied. Thus, the fixed-effect model can be viewed as a special case of a random-effects model when standard deviation is 0 (Becker & Schram, 1994; Borenstein et al., 2008; Schmidt, Oh, & Hayes, 2009). In the fixed-effect model, differences in effect sizes are due to random sampling errors and identifiable covariates, while in the random-effects model, the sources of study variance are random sampling error, identifiable covariates, and unmeasured covariates (Borenstein et al., 2008; 2010; Valentine, Pigott, & Rothsten, 2010). Because of the assumption of the fixed-effect model, researchers cannot generalize the results beyond the study population. Using the random-effects model, researchers can generalize results to a wider population (Borenstein, et al., 2010; Hedges & Vevea, 1998).

The theoretical assumption about the population value of the studies included in the meta-analysis (Borenstein, 2008) and the purpose of the meta-analysis [i.e., to examine the generalizability of the results (Hedges & Vevea, 1998)] should be the criteria for determining which model to choose. One goal of conducting the present meta-analysis is to corroborate the positive impact of self-affirmation in reducing defensive responses to threatening health messages, among both college students and the general population. When the goal of a meta-analysis is to generalize study results to a wider population, results generated by a random-effects model are preferred (Schmidt et al., 2009; Toulmin, 1961). However, if generalizing results to a wider population is not the purpose, a fixed-effect model is appropriate (Schmidt et al., 2009; Overton, 1998). When

presenting results using fixed-effect model, “generalizations of conclusions is only to a hypothetical set of studies that is identical to the study set at hand except for simple sampling error, that is, to a set of studies with exactly the same study population parameter values, study for study, and differing only in the sampling of subjects (usually people) within studies” (Schmidt et al., 2009; p. 101).

Although all of the studies measure the similar set of defensive responses and use self-affirmation as the intervention, the present study ensures heterogeneity because of the study population, the health topics, other study characteristics, and the way self-affirmation is manipulated. In addition, if the results about the impact of self-affirmation can be generalized to a broader population and settings, the present study can provide insights into subsequent health promotion research and practice. Thus, it seems that a random-effects model is more suitable. However, in the strictest sense, the sample of the present study is not a random sample of the population, and thus, the assumption of random-effects model is not completely fulfilled (Hedges & Vevea, 1998). Therefore, I analyze the effect size for each defensive variable using both a fixed-effect model (see Formulae 11-18) and random-effects model (see Formulae 19-29) and present results calculated by both models.

In terms of calculation, the difference between the fixed-effect model and the random-effects model is that in the fixed-effect model, studies are weighted by the inverse of sampling variance (Formula 11), whereas in the random-effects model, studies are weighted by the sum of the inverse of the sampling variance and between-study variance that indicates the variability across the population effects (Formula 22). Because

between-study variance is a constant value for a certain set of studies, effect sizes of studies calculated by the random-effects model are more similar to each other (i.e., less variance) than that calculated by the fixed-effect model. It is important to note that if the fixed effect and random-effects models generate similar effect size, it means that there is a common population effect size (Hedges & Vevea, 1998). In the following explanation, I specify the effect size calculation steps with formulae.

For the fixed-effect model, after I extract Cohen's d from the original studies and convert it to Hedges'g, I calculate the inverse of variance of Hedges'g.

$$W_1 = \frac{1}{V_{g1}} \qquad (11)$$

Then I calculate the summary effect size for the group of studies (e.g., there are 19 studies included in the present meta-analysis that measure PME. The summary effect size of PME is equal to the sum of weighted Hedges'g from all 19 studies divided by the sum of inverse-variance of Hedges'g):

$$M = \frac{\sum_{i=1}^{k}(W \times g_1)}{\sum_{i=1}^{k} W} \qquad (12)$$

The variance, standard error, confidence interval, Z-value, and p-value for the sum of Hedges' g are calculated by the following formulae (See Formulae 13-19):

$$V_M = \frac{1}{\sum_{i=1}^{K} W} \quad (13)$$

$$SE_M = \sqrt{V_M} \quad (14)$$

$$LL_M = M - 1.96 \times SE_M \quad (15)$$

$$UL_M = M + 1.96 \times SE_M \quad (16)$$

$$Z = \frac{M}{SE_M} \quad (17)$$

For a one-sided test, the p-value is:

$$p = 1 - \emptyset(Z) \quad (18)$$

For the random-effects model, calculation steps are the same from Formulae 19 to 29. The difference lies in how each study is weighted. In the fixed-effect model, each study is weighted by the inverse of its variance. In the random-effects model, each study is weighted by the sum of the inverse of its within-study variance and between-study variance. The step of getting within-study variance is demonstrated in Formula 11. To get an estimate of the between-study variance of the true standardized mean difference (i.e., "the variance of the effect size parameters across the population of studies," Borenstein et al., 2008, p.105), I need to know the heterogeneity among the effect sizes, or in other words, the "variation in true effect sizes" (Borenstein et al., 2008, p.107). First, I calculate the weighted sum of squares (*WSS*) of the effect size estimates (**Error!**

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$$Q = \sum_{i=1}^{k} W\, V_{g1}^{2} - \frac{\sum_{i=1}^{k}\left(W\mathrm{V}_{\mathrm{g1}}\right)^{2}}{\sum_{i=1}^{k} W} \qquad (19)$$

Then I calculate the quantity that "has the effect of putting the measure back into its original metric and also making it an average, rather than a sum, of squared deviations" (Borenstein et al., 2008, p.114).

$$C = \sum_{i=1}^{k} W - \frac{\sum_{i=1}^{k}(W)^{2}}{\sum_{i=1}^{k} W} \qquad (20)$$

Next, I use the weighted methods of moments (DerSimonian & Laird, 1986) to estimate **Error! Reference source not found.**the between-study variance of the true standardized mean difference indicated as tau-squared (τ^2), the estimate of which is indicated as T^2**Error! Reference source not found.**. Because Q**Error! Reference source not found.** is a standardized measure, its expected value is equal to the degree of freedom (df). Q-df represents the excess variation that exceeds the amount based purely on sampling error, or in other words, the "dispersion in true effects on a standardized scale" (Borenstein et al., 2008, p.114).

$$T^{2} = \frac{(Q - df)}{C} \qquad (21)$$

Where df = k -1, k is the number of pairs of comparisons.

For the random-effects model, instead of being weighted by within-study variance (**Error! Reference source not found.**), effect sizes are weighted by the sum of within-study variance (**Error! Reference source not found.**) and between study variance (**Error! Reference source not found.**):

$$W_1^* = \frac{1}{(\mathrm{V}_{g1} + T^2)} \quad (22)$$

The steps of calculating summary effect size including variance, standard error, confidence interval, Z-value and p-value by random-effects model are as follows:

$$M^* = \frac{\sum_{i=1}^{k} W^* g_1}{\sum_{i=1}^{k} W^*} \quad (23)$$

$$V_{M^*} = \frac{1}{\sum_{i=1}^{k} W^*} \quad (24)$$

$$SE_{M^*} = \sqrt{V_{M^*}} \quad (25)$$

$$LL_{M^*} = M^* - 1.96 \times SE_{M^*} \quad (26)$$

$$UL_{M^*} = M^* + 1.96 \times SE_{M^*} \quad (27)$$

$$Z^* = \frac{M^*}{SE_{M^*}} \quad (28)$$

And for a one-tailed test:

$$p^* = 1 - \emptyset(Z^*) \quad (29)$$

I perform subgroup homogeneity statistic procedures to examine whether the impact of self-affirmation differs as a function of self-affirmation domain, health topic, and self-relevance level. In the present study, there are three sets of subgroup analyses. Regarding self-affirmation domain, the mean effect size of the studies that used desirable traits self-affirmation is compared to the one that uses values self-affirmation. Regarding health topic, the mean effect size of the studies that examine termination of unhealthy behavior is compared to those that examine promotion of healthy behavior. Regarding self-relevance level, the mean effect size for participants with low self-relevance to the health risk is compared with that for participants with high self-relevance. Thus, I perform subgroup homogeneity statistics between (1) two different self-affirmation groups (i.e., desirable traits vs. values), (2) two groups of health behaviors (i.e., terminating unhealthy behaviors vs. promoting health behaviors), and (3) high vs. low levels of relevance groups. I conduct subgroup analysis in both fixed-effect and random-effects models. The steps are the same as discussed in the main effect section.

Borenstein et al. (2008) indicates that "Typically, the subjects or interventions in these studies would have differed in ways that would have impacted on the results, and therefore we should not assume a common effect size." In the present analysis, although the demographic characteristics of the study population are fairly homogeneous (e.g., 84.17% of participants were college students), they may differ in other aspects. More importantly, self-affirmation domains are different in the studies included. Both values self-affirmation and desirable traits self-affirmation are essentially the same in the sense

that they can boost individuals' overall self-integrity, but the procedures of the two self-affirmation methods are different and they may differ in their effectiveness. Therefore, in the present study, using a fixed-effect model alone is not fully justified.

To estimate whether the standardized mean differences are statistically different, I use Z-test to compare the means of the two subgroups (see Formulae 30-33).

First, I subtract one group mean from the other group mean:

$$\text{Diff} = M_B - M_A \qquad (30)$$

Then, I use Z-test to compare the two group means:

$$Z_{Diff} = \frac{Diff}{SE_{Diff}} \qquad (31)$$

Where

$$SE_{Diff} = \sqrt{V_{MA} + V_{MB}} \qquad (32)$$

Then, I calculate the two-tail p-value for Z. If it is statistically significant, it means the self-affirmation's effect for the two subgroups probably is not the same.

Besides calculating the standardized mean differences, I also calculate weighted sum of squares.

The sum of **Error! Reference source not found.** for group 1 is indexed as **Error! Reference source not found.** and the sum of **Error! Reference source not found.** for group 2 is indexed as **Error! Reference source not found.**. The sum of **Error! Reference source not found.** and **Error! Reference source not found.** values is

Error! Reference source not found..Then I calculate the statistics**Error! Reference source not found.** to determine whether the effect sizes from group 1 and group 2 are homogeneous (Formula 34).

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If the Q_b is statistically significant, the grouping factor (i.e., self-affirmation domains, health topics, and self-relevance levels) can explain the variance in effect sizes between studies beyond that associated with sampling error. Otherwise, the grouping factor cannot explain the variance in effect sizes.

I also calculated **Error! Reference source not found.**, which indicates "the percentage of total variation across studies that is due to heterogeneity rather than chance" (Higgins, Thompson, Deeks, & Altman, 2003). Higgins et al. (2003) assigns tentative benchmark values for **Error! Reference source not found.Error! Reference source not found.** (i.e., low, moderate, and high to values of 25%, 50%, and 75%). An advantage of **Error! Reference source not found.** is that it does not depend on the number of the studies included and sample size in the meta-analysis. The **Error! Reference source not found.** value ranges from 0% to 100%. The higher the value, the more likely that the variability among the studies included in the meta-analysis is due to real heterogeneity rather than chance. If heterogeneity is detected (i.e., when the **Error! Reference source not found.** value is moderate or strong), subgroup analysis is suggested. The three moderators discussed above (self-affirmation domains, health topics, and self-relevance levels) are three potential sources of heterogeneity. If **Error! Reference source not found.** is small and nonsignificant, I can conclude that the effect sizes among the studies included are

relatively consistent (Higgins et al., 2003; Borenstein et al., 2008). I follow the method proposed by Borestein and colleagues (2008) to get **Error! Reference source not found.**

To calculate **Error! Reference source not found.**, I use Formula 34,

$$I^2 = \left(\frac{Q - df}{Q}\right) \times 100\% \qquad (34)$$

To get 95% confidence interval for **Error! Reference source not found.**, I use Formulae 35-40:

If **Error! Reference source not found.** then I first compute

$$B = 0.5 \times \frac{\ln(Q) - \ln(df)}{\sqrt{2Q} - \sqrt{2 \times df - 1}} \qquad (35)$$

If **Error! Reference source not found.**, then I compute

$$B = \sqrt{\frac{1}{2 \times (df - 1) \times (1 - (\frac{1}{3 \times (df - 1)^2})}} \qquad (36)$$

Then

$$L = \exp\left(0.5 \times ln\left(\frac{Q}{df}\right) - 1.96 \times B\right) \qquad (37)$$

and

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Then I get 95% confidence intervals using the following formulae:

$$LL = \left(\frac{L^2 - 1}{L^2}\right) \times 100\% \qquad (39)$$

$$UL_{I^2} = \left(\frac{U^2 - 1}{U^2}\right) \times 100\% \qquad (40)$$

Chapter 4: Results

Descriptive Statistics

Collectively, 51 articles and 55 studies conducted between 1998 and 2015 are included in the present meta-analysis. The majority of the studies are conducted by psychology researchers (*k*=39), followed by communication researchers (*k*=8). The total sample size for this meta-analysis is 10,611. Because not every study reported participant demographic information, I summarize participants' age, sex, ethnic descent, and education based on the studies that provide relevant information. Results show that an overwhelming majority of the participants are college students (84.17%) with a mean age of 23.21 years old (*SD*=7.84) and European ethnic descent (70.48%).

The descriptive statistics of the three moderators (i.e., self-affirmation domain, health topic, and self-relevance level) is also summarized. The number of studies that use values self-affirmation (*k*=37) is twice the number that use desirable traits self-affirmation (*k*=16). Table 3 presents the results based on studies that clearly report the number of participants in the self-affirmation group and control group. Not all studies do so. The studies that do not clearly report the number of participants in each group are not included in the descriptive analysis, but are included in the subsequent meta-analytic analysis (Armitage et al., 2011; Armitage et al., 2014; Jessop et al., 2014).

In addition, there are three studies (Armitage et al., 2011; Armitage et al., 2014; Jessop et al., 2014) that use implementation intention as self-affirmation domain, and there is one study that uses bogus positive feedback on a task as self-affirmation domain (Ko & Kim, 2013). Due to the limited number of studies, the four studies (Armitage et al.,

2011; Armitage et al., 2014; Jessop et al., 2014; Ko & Kim, 2013) are not included in the subsequent analysis of the comparative effectiveness between values self-affirmation and desirable traits self-affirmation. Regarding health topics, more studies examine the effectiveness of self-affirmation in cessation of unhealthy behaviors (*k*=31) than in promotion of healthy behaviors (*k*=24). However, the actual numbers of participants in these two groups are about the same (i.e., 5,112 participants in the cessation of unhealthy behaviors group and 5,500 participants in the promotion of healthy behaviors group). Therefore, there is no concern for the subsequent subgroup analysis about the variance created by sample size imbalance between the two health topics groups.

There are 18 studies that differentiate study population with high self-relevance (e.g., heavy smokers or heavy drinkers) and those with low self-relevance (e.g., non-smokers or moderate/non-drinkers). However, there are only 10 studies that clearly indicate the number of participants in the high self-relevance group and low self-relevance group. The complete descriptive statistics of study characteristics, study population characteristics, and three moderators are summarized in Table 3.

Table 3

Descriptive Statistics for the Studies in the Meta-Analysis

General characteristics of the studies	
Publication Year	
M	2011.19
Mdn	2012
SD	3.84
k	55
Academic Affiliation	
Psychology	39
Communication	8
Behavioral Science	4
Medical School	2

Business	2	
Country		
United States	20	
United Kingdom	27	
Netherlands	8	
Other	6	
Sample size (N)		
Sum total	10611	
M	192.93	
Mdn	120	
SD	216.10	
k	55	
	Self-Affirmation Group	Control Group
Sum total	3211	3150
M	86.78	85.14
Mdn	48	46
SD	95.21	89.05
k	37	37
%Women	66.00%	
M	114.33	
Mdn	73	
SD	119.61	
k	40	
% Participants whose sex is not identified	35.67%	
Age in years		
M	23.21	
Mdn	21.05	
SD	7.84	
k	33	
Ethnic descent		
% European	70.48%	
M	135.47	
Mdn	105	
SD	78.53	
k	15	
% African American	1.04%	
M	21.67	
Mdn	32	
SD	12.04	
k	6	
% Asian	11.34%	
M	46.71	
Mdn	41	

SD	23.48
k	7
% Hispanic	2.39%
M	34.50
Mdn	35
SD	33.23
k	2
% Mixed	7.71%
M	14
Mdn	14
SD	4
k	3
% Other	6.55%
M	46.25
Mdn	20
SD	58.95
k	4
% Undergraduate students	84.17%
% Participants whose education was not specified	11.06%
Self-affirmation domains	
% Desirable traits self-affirmation (% Control condition)	14.34% (14.84%)
M	56.125 (61.93)
Mdn	43 (45)
SD	41.12 (41.18)
k	16 (16)
% Values self-affirmation (% Control condition)	33.58% (33.50%)
M	105.15 (104.9)
Mdn	56 (57)
SD	118.72 (113.01)
k	20 (20)
Health topics	
% Promotion of healthy behaviors	48.18%
M	229.13
Mdn	118
SD	301.63
k	24
% of cessation of unhealthy behaviors	51.82%
M	164.90
Mdn	120
SD	111.56
k	31
Self-relevance levels	
% High self-relevance	55.64%

M	75.5
Mdn	71.5
SD	48.25
k	10
% Low self-relevance	33.46%
M	45.4
Mdn	40.5
SD	21.17
k	10

Main Effect

The central hypothesis of the present study predicts that self-affirmation is effective in reducing defensive responses. Results from both the fixed-effect and random-effects models show that compared to non-self-affirmation control groups, self-affirmation generates more statistically significant PME (**Error! Reference source not found.**= 0.351, *CI* = 0.266 to 0.435; **Error! Reference source not found.** = 0.372, *CI* = 0.286 to 0.458), higher perceived susceptibility (**Error! Reference source not found.**= 0.255, *CI* = 0.152 to 0.358; g_{random} = 0.254, *CI* = 0.151 to 0.357), and higher response efficacy (**Error! Reference source not found.**= 0.272, *CI* = 0.135 to 0.410; g_{random} = 0.276, *CI* = 0.087 to 0.466) in the recommended direction (see Table 4). The hypothesis is partially supported. This means that self-affirmation's positive impact on PME, perceived susceptibility, and response efficacy is corroborated within the studies that measure these outcome variables; more importantly, these positive effects of self-affirmation can also be generalized to studies beyond the ones included in the present meta-analysis. In addition, for perceived susceptibility and response efficacy, effect sizes calculated by both fixed-effect and random-effects models are quite similar, which means

that there is true population mean for each of the two outcome variables (Hedges & Vevea, 1998).

Table 4

Sample Size-Weighted Effect Sizes and Heterogeneity of Tests Statistics by Theoretical Concepts (Fixed-Effect Model and Random-Effects Model

Theoretical concepts	g	95% CI	p	Q	Q's p-value	I^2
Perceived message effectiveness						
Fixed	0.351	[0.266, 0.435]	0.000	152.487	0.000	88.196%
Random	0.372	[0.286, 0.458]	0.000			
k	19					
N	2485					
Defensive avoidance						
Fixed	0.164	[0.119,0.210]	0.000	55.377	0.000	85.475%
Random	-0.001	[-0.155, 0.153]	0.505			
k	16					
N	2776					
Perceived severity						
Fixed	0.046	[-0.056, 0.148]	0.208	19.544	0.034	38.60%
Random	0.138	[0.003, 0.622]	0.023			
k	11					
N	1729					
Perceived susceptibility						
Fixed	0.255	[0.152, 0.358]	0.000	10.298	0.415	0
Random	0.254	[0.151, 0.357]	0.000			
k	11					
N	1744					
Self-efficacy						
Fixed	0.108	[0.063, 0.153]	0.000	98.50	0.000	86.800%
Random	0.151	[-0.006, 0.308]	0.000			
k	14					
N	2544					
Response efficacy						
Fixed	0.272	[0.135, 0.410]	0.000	14.864	0.021	46.178%
Random	0.276	[0.087. 0.466]	0.002			
k	7					
N	898					
Attitudes						
Fixed	0.067	[-0.014, 0.149]	0.052	17.359	0.027	53.910%
Random	0.134	[-0.044, 0.313]	0.070			
k	9					
N	2334					
Norms						
Fixed	-0.024	[-0.114, 0.067]	0.203	2.939	0.230	31.960%
Random	-0.025	[-0.115, 0.066]	0.203			
k	3					
N	1585					
Negative affect						
Fixed	-0.092	[-0.166, -0.019]	0.000	104.879	0.000	87.605%
Random	-0.039	[-0.278, 0.200]	0.374			
k	12					
N	1609					

Intentions						
Fixed	0.058	[0.001, 0.114]	0.005	157.620	0.022	83.043%
Random	0.246	[-0.456, 0.949]	0.001			
k	27					
N	4497					
Behavior						
Fixed	0.248	[0.174, 0.322]	0.000	151.779	0.000	88.880%
Random	0.251	[0.176, 0.329]	0.000			
k	17					
N	3146					

According to the fixed-effect model, self-affirmation also leads to higher self-efficacy (**Error! Reference source not found.** = 0.108, *CI* = 0.063 to 0.153), more intentions (**Error! Reference source not found.** = 0.058, *CI* = 0.001 to 0.114) and fewer negative affects (**Error! Reference source not found.** = -0.092, *CI* = -0.166 to -0.019). While the effect sizes generated by the random-effects model are in the same direction as revealed by the fixed-effect model, they are not statistically significant. This result means that within the studies that measure these outcome variables and are included in the present meta-analysis, self-affirmation has a positive impact. But the results may not be generalized to other populations. In addition, the random-effects model shows that self-affirmation leads to more perceived severity (g_{random} = 0.272, *CI* = 0.087 to 0.466), which means that the impact of self-affirmation on perceived severity is robust and can be generalized to studies beyond those included in the present meta-analysis. Surprisingly, the fixed-effect model demonstrates that self-affirmation also generates more defensive avoidance (**Error! Reference source not found.** = 0.164). However, this result is reversed in the random-effects model (g_{random} = -0.001). This means that there is much between-study variance in the studies that measure defensive avoidance, which can be due to the moderating effects that I discuss later, or due to some other factors (e.g.,

there is great variance in how defensive avoidance is operationalized). In addition, though not statistically significant, both the fixed-effect and random-effects models show that self-affirmation's effect on attitudes is in the hypothesized direction (**Error! Reference source not found.** = 0.067, g_{random} = 0.134), but its effect on perceived norms is not as hypothesized (**Error! Reference source not found.** = -0.024, g_{random} = -0.025). Again, the effect sizes of perceived norms generated by both fixed-effect and random-effects models is quite similar, which means that there is a common population mean for the impact of self-affirmation on perceived norms.

According to Cohen's (1988), 0.2, 0.5, and 0.8 are three benchmarks for evaluating the magnitude of the effect sizes, which indicate small, medium, and large effect sizes, respectively. Four outcome variables' effect sizes (PME, perceived severity, perceived susceptibility, and response efficacy), are between g = 0.20 (small) and g = 0.5 (medium) and the remaining variables' effect sizes (i.e., self-efficacy, attitudes, negative emotions, intentions, and behavior) are even smaller than g = 0.20.

It is important to note that Table 4 demonstrates that the values of I^2 (i.e., the proportion of observed variance is real) varied across outcome variables, with PME (88.20%) and behavior (88.88%) showing the highest proportion of real observed variance, and perceived susceptibility (0%) showing no real observed variance. One plausible reason is that PME and behaviors might be a function of how they are measured. To further probe the reason, I summarize how PME is operationalized and what types of behaviors are measured. It is also important to note that the effect sizes for perceived susceptibility, response efficacy, and perceived norms generated by the fixed-

effect and random-effects models are quite similar, which indicates little or no between-study variance in the three sets of studies that measure perceived susceptibility, response efficacy, and perceived norms, respectively. This means there is little or no between-study variance for these three outcome variables, which is supported by the results from heterogeneity tests (Q & I^2). That is, perceived susceptibility, response efficacy, and perceived norms have the three lowest proportions of observed variance. Again, this may imply that the operationalization of these three outcome variables is quite similar across the studies that measured them.

Table 5 demonstrates how PME is operationalized. In the present meta-analysis, PME refers to "the extent to which message recipients believe that health messages will affect them personally in terms of the particular message objectives." (Yzer et al., 2015). Table 5 shows that among 19 studies that measure PME, there are eight different labels, including (message/conclusion) message derogation (k=6), acceptance (k=6), (message/evidence) strength (k=4), effectiveness (k=2), belief in the link/supporting the evidence (k=3), perceived message quality (k=1), issue considered genuine and serious (k=1), and accuracy (k=1).

Table 5

Operationalization of Perceived Message Effectiveness

Study	Construct name	Operationalization
1.Reed & Aspinwall (1998)	Belief in the link	"I believe that caffeine consumption is linked to FBD" and "I believe that women should take steps to reduce their daily caffeine consumption in order to prevent the development of FBD."
	Ratings of argument of strength	"I believe the information provided in the passge supported the claim the caffeine consumption can result in fibrocystic disease" "I believe the information provided in the passge supported the claim that caffeine consumption does

		not result in fibrocystic disease.”
2.Sherman, Nelson & Steele (2000) (Study 1)	Conclusion acceptance	“To what extent do you agree or disagree that there is an association between caffeine and fibrocystic disease?”
3.Dillard et al., (2005)	Accuracy; effectiveness of the message	Assessed the message “not at all accurate” and “totally ineffective” on a 10-point scale.
4.Harris & Napper (2005)	Belief in the link; Evidence strength	“How convincing did you find the content of the leaflet? (unconvincing/convincing)”; “I believe that drinking alcohol increases a women’s chances of developing breast cancer”; “The evidence linking alcohol consumption and breast cancer is … very weak/very strong”.
5.Armitage et al., (2008)	Acceptance	“How important do you think it is that people stop smoking in order to avoid the problems mentioned in the article”
6.Crocker et al. (2008)	Acceptance	“How skeptical were you when reading the article” (not at all-to a great extent) “To what extent do you think that the conclusion of the article was justified on the basis of existing research findings?” (not at all-very well justified)
7.Jessop, Simmonds, & Sparks (2009)	Message derogation	“To what extent they felt the information about skin cancer (i) was overblown, (ii) was exaggerated, (iii) tried to manipulate their feelings and (iv) tried to strain the truth.”
8.Ko & Kim (2009)	Effectiveness	“How effective did you feel the brochure was?,” “How interested are you in learning more information about topics covered in the brochure?”
9. Koningsbruggen & Das (2009)	Message derogation	“The message was distorted,” “The message was exaggerated” “The message was too extreme”
10.Koningsbruggen, Das, Roskos-Ewoldsen (2009)	Perceived message quality	“The evidence linking caffeine consumption and health problems is reliable”
11.Napper, Harris, & Epton (2009)	Supporting the evidence; Issue considered genuine and serious.	Participants were asked to list their thoughts about the message and then coded their thoughts in the two categories: “supporting the evidence”, “issue considered genuine and serious”
12.Armitage et al., (2011)	Message derogation	“What did you think about the information you just read? Did you think it was…” to which participants responded on four scales (e.g., not at all overblown-very overblown).
13.Good & Abraham (2011)	Message acceptance	“How convincing/reasonable did you find the message?” “The evidence linking exposure to UV light to skin

		cancer/photoageing is very weak-very strong” “I believe that exposure to UV light is linked to skin cancer/photoageing”
14.Klein, Harris, Ferrer, & Zajac (2011) (Study 2)	Message strength	Not specified
15.Zhao & Nan (2010)	Perceived message strength	“The PSA was convincing,” “The PSA said something important to me,’’ and “The PSA gave me a good reason not to smoke.”
16. Nan & Zhao (2012)	Message derogation	“The extent to which you thought the PSA was ‘exaggerated,’ ‘distorted,’ ‘overstated,’ and ‘overblown’.”
17. Scott, Brown, Phair, Westland, & Schuz (2013)	Message derogation	“The message about alcohol consumption strained the truth.”
18.Good et al., (2014)	Message derogation and acceptance	Derogation: “What did you think about the information about physical activity that you just read?’-‘it was exaggerated’, ‘It tried to manipulate my feelings’; acceptance: “It was persuasive’
19.Klein, Hamilton, Harris, & Han (2015)	Message acceptance	To what extent they believed the following: “Alcohol causes breast cancer,” “The evidence linking alcohol to breast cancer is …,” “I believe that drinking alcohol increases the chances of women developing breast cancer.”

How PME is operationalized is intertwined. On one hand, some studies use different labels but actually operationalize PME the same way [e.g., Harris and Napper (2005) measured “evidence strength” and “belief in the link;” Good and Abraham (2011) measured “message acceptance”]. Both studies operationalize PME in the same way. They ask participants to indicate the extent to which they agree with the following three items: the message is convincing, they believe performing the unhealthy behaviors can increase their risks for certain diseases, and the health evidence is weak or strong. On the other hand, some studies used the same label but actually operationalized PME in different ways. For example, both Armitage et al. (2008) and Crocker et al. (2008) measure “message acceptance.” However, Armitage et al. (2008) asks the participants to

indicate the extent to which they consider it important to change their unhealthy behaviors to avoid negative health consequences mentioned in the health message. Crocker et al. (2008) asks participants the extent to which they are skeptical of the message and how justified the health conclusion in the message is. This inconsistency of how PME is measured across different studies contributes to the high between-study variance and makes it more difficult to draw a determined conclusion from existing results and less meaningful to compare effect sizes from different studies.

I also summarize the effects sizes of behaviors in a forest plot (see Figure 3). The forest plot demonstrates the magnitude of effect sizes of behavior. I summarize how I measure each type of behavior in Table 6.

Figure 3

Forest Plot of Behavior

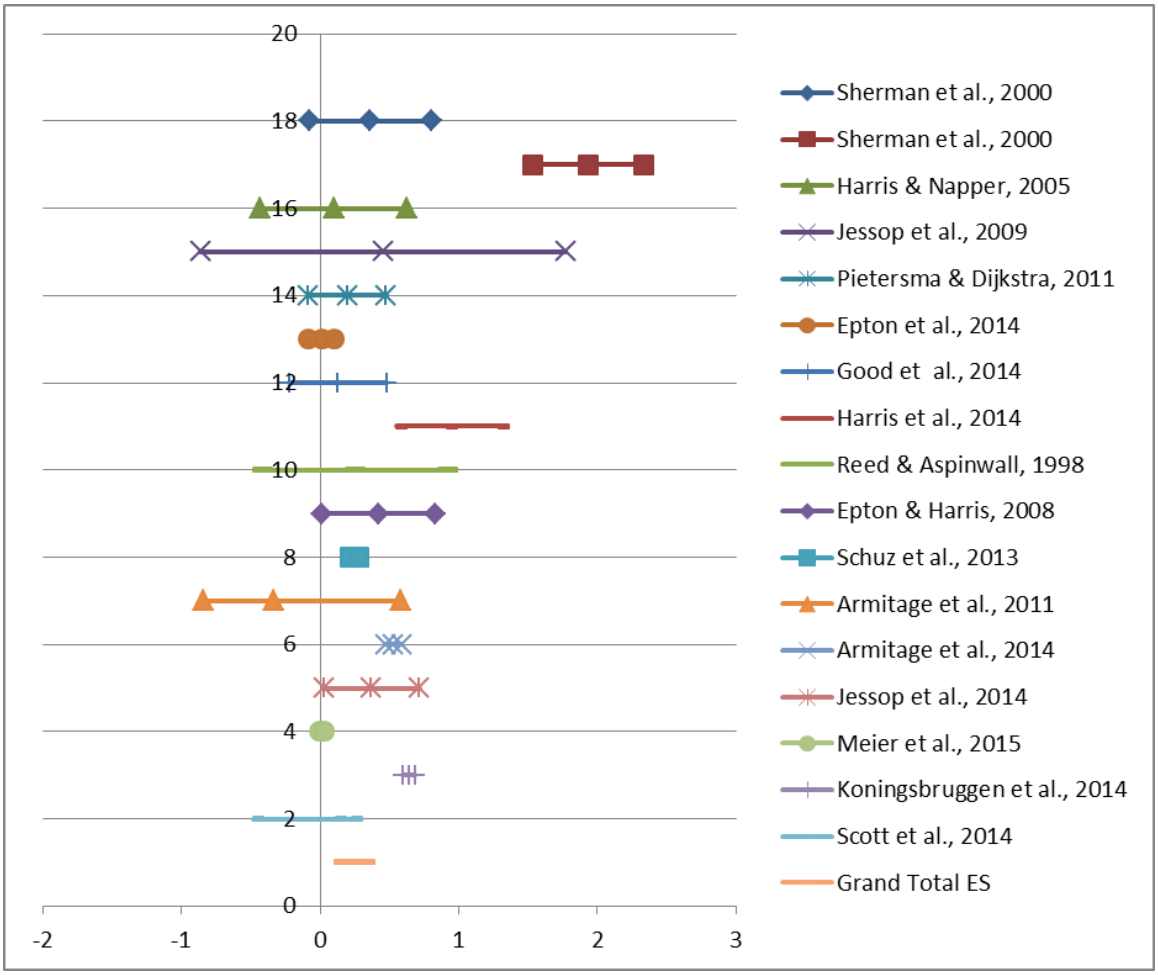

Table 6

Operationalization of Behavior

Behavior type	Behaviors	Measurement
Cessation		
	Coffee consumption	1. Estimate the "average number of caffeinated beverages they had consumed per day during the previous week." 2. "How many cups of coffee did you drink in the past 7 days?"

	Alcohol consumption	1. "'How much alcohol have you consumed in the last 7 days?' were given in terms of pints of beer/lager/cider, sots, glasses of wine, and bottles (with illustrative examples) and later translated into units of alcohol by the experimenter." 2. The Frequency Quantity Questionnaire (FQQ, Dimeff, Baer, Kivlahan, & Marlatt, 1999): "(a) drinks consumed during heaviest dirking episode, (b) drinks consumed on a typical weekend night, (c) drinking days, and (d) occasions drinking to intoxication in the past 2 weeks." Weekly drinks were calculated using the Daily Drinking Questionnaire (DDQ, Collins, Parks, & Marlatt, 1985): "Enter the number of drinks you consumed and the number of hours spent drinking each day during the past 7 days." 3. General Lifestyle Survey was used (Office for National Statistics, 2010). Participants were asked to indicate "on which days they had drunk alcohol in the last 7 days and the type and amount of alcohol that they drank on each day").
	Smoking cessation	1. "Whether or not an individual took a leaflet was coded surreptitiously by the experimenter"; 2. Participants were asked to recall their "number of cigarettes smoked per week"
	Deliberate sun exposure avoidance	Participants were asked indicate "When the sun was shining during the past 2 weeks…"-"I tried to get as tanned as possible," and "I often went outside to get a tan."
Promotion	Fruit and vegetable consumption	1. Using a validated 7-day diary measure (Cox et al., 1997), "participants were given detailed instructions about when and how to record their fruit and vegetable consumptions (including fruit and vegetables in mixed dishes) and the ways in which they consumed them (e.g., 'fruit as a starter')." 2. A validated Dutch questionnaire (Bogers, Van Assema, Kester, Westererp, & Dagneilie, 2004) was used. "The main vegetable categories were 'cooked vegetables' and 'raw vegetables/salad.' The main fruit categories were 'tangerines,' 'oranges/grapefruits/lemons,' 'apples/pears,' 'bananas,' and 'other fruits'. For each category, participants were asked how often they ate or drank it during the previous month. The answer options ranged from 'never or less than 1 day a month' (0), '1–3 days a month' (1), and '1 day a week' (2) to '7 days a week' (8)." 3. Using the question adapted from Wiedemann et al., (2009), "Currently, do you eat at least 5 portions of fruit and vegetables on a typical day? (1, No, and I do not intend to do so; 2, No, but I am thinking about it; 3, No, but I strongly intend to; 4, yes, but it's difficult for me; 5, Yes, and it is easy for me.)" 4. Participants were asked the following question: "In the last seven days, on how man days did you eat two portions of fruit and 200 grams of vegetables? (0 days, 1 day, 2 days, 4 days, 5 days, 6 days, 7 days)."
	Physical exercise	1. "Participants were asked to report the number of days in the previous 7 days in which they had engaged in moderate-to-vigorous physical activity for at least 60 min (0-7)." 2. Participants were asked to quantify the number of days they had engaged in 30 min or more of exercise by answering "In the past seven days on how many days have you engaged in 30 minutes or more of exercise?" 3. The Short Form of International Physical Activity Questionnaire (IPAQ-SF, Booth, 2000) was used.

		Participants were asked to "indicate how many times, and for how long, they had engaged in vigorous exercise (defined as 'activities that take hard physical effort and make you breathe much harder than normal'), moderate exercise (defined as 'activities that take moderate physical effort and make you breathe somewhat harder than normal') and walking the past 7 day." Another question was asked about sedentary lifestyle (hours sitting).
	AIDS preventive behavior	"Proportion of participants taking at least one AIDS educational brochure"
	Sunscreen use	Participants were asked by the single item "are you currently wearing sunscreen (SPF 15 or above) on exposed skin? ('yes'/'no').

Figure 3 further illustrates the magnitude and heterogeneity of effect sizes. There is a lot of variation between studies. Sherman et al.'s (2000) Study 2 demonstrates the biggest effect size of behavioral changes (e.g., whether participants took the pamphlet of HIV protection at the end of the experiment), whereas the effect sizes of remaining studies were much smaller.

Table 6 demonstrates types of behavior measured by the studies included in this meta-analysis (k=17). I categorize health behaviors into two groups: cessation of unhealthy behaviors (k=7) and promotion of healthy behaviors (k=10). Under the "cessation of unhealthy behaviors" category, four different behaviors, including coffee consumption, alcohol consumption, smoking cessation, and deliberate sun exposure avoidance are measured, while under "promotion of healthy behaviors," four different health behaviors, including increasing fruit and vegetable consumption, increasing physical activity, using condom and sunscreen are measured. For some behaviors, different studies have different measures. For example, measuring behavior after exposure to anti-smoking messages, Harris and Napper (2005) measured the number of cigarettes smoked in the past seven days, while Armitage et al. (2011) recorded whether participants took the leaflet about smoking cessation at the end of the experiment. Given

the differences in different health behaviors and different scales used to measure behavior, the high variance in overall effect size is unavoidable.

Moderating Effect

Homogeneity analyses indicate that the effect sizes of eight outcome variables are heterogeneous. Higgins et al. (2003) assign tentative benchmark values for **Error! Reference source not found.**low, moderate, and high to values of 25%, 50%, and 75%. The higher the value, the more likely that variability among the studies included in the meta-analysis is due to real heterogeneity rather than chance, which is an indictor of the presence of moderators. The results show that the **Error! Reference source not found.** values of seven variables (i.e., PME, defensive avoidance, perceived severity, self-efficacy, negative affective responses, intentions, and behaviors) are over 75% while the **Error! Reference source not found.** value of attitudes over 50% and below 75% (see Table 4), which implies moderators are present.

Perceived susceptibility is not included in the moderator analysis because its **Error! Reference source not found.**(i.e., the proportion of real observed variance) is 0, indicating the observed variance is spurious and there is nothing further to explain (Borenstein et al., 2008). The variable, “norms,” is not included either in subgroup analysis due to lack of enough studies (k = 3). The Q of perceived severity is statistically significant (p = 0.034), which means that the proportion of observed variance is real. However, Q is influenced by sample size. It is possible that when sample size is large, Q is statistically significant but in fact the proportion of observed variance is spurious. Therefore, we need to integrate **Error! Reference source not found.**that is not

influenced by study sample size into consideration. Regarding perceived severity, **Error! Reference source not found.**is lower than moderate. Similarly, the Q of response efficacy is statistically significant (p = 0.021) but **Error! Reference source not found.**is slightly lower than moderate (**Error! Reference source not found.**=46.18%). Taking the conservative approach, I include both perceived severity and response efficacy in subgroup analysis. In the following paragraphs, I demonstrate the results of three subgroup analyses by self-affirmation domains (desirable traits vs. values self-affirmation), health topics (cessation of unhealthy behaviors vs. promotion of healthy behaviors), and self-relevance (high self-relevance vs. low self-relevance) among the remaining 10 outcome variables.

According to both the fixed-effect and random-effects models, compared to values self-affirmation, desirable traits self-affirmation is more effective in enhancing PME (**Error! Reference source not found. Error! Reference source not found.**=0.47, *CI*=0.24 to 0.71; g_{random} =0.65, *CI*=0.47 to 0.82). According to the fixed-effect model, desirable traits self-affirmation showed more perceived severity (**Error! Reference source not found. Error! Reference source not found.**= 0.38, *CI*=0.19 to 0.58), more self-efficacy (**Error! Reference source not found. Error! Reference source not found.**= 0.21, *CI*=0.10 to 0.31), more response efficacy (**Error! Reference source not found. Error! Reference source not found.**= 0.39, *CI*=0.11 to 0.68), and less defensive avoidance (**Error! Reference source not found. Error! Reference source not found.**= -0.29, *CI*=-0.42 to -0.16). Although the random-effects model demonstrates the effect

sizes of the above five outcome variables in the same direction, none of the effect sizes is statistically significant.

Regarding health topics, compared to promotion of healthy behaviors, both fixed-effect and random-effects models show that self-affirmation leads to more PME (**Error! Reference source not found. Error! Reference source not found.**=0.44, *CI* = 0.00 to 0.86; g_{random} =0.54, *CI* =0.06 to 1.02) and less defensive avoidance (**Error! Reference source not found. Error! Reference source not found.**= 0.50, *CI* = 0.20 to 0.80; g_{random} = 0.63, *CI* = 0.11 to 1.15) when it is applied to cessation of unhealthy behaviors. According to the fixed-effect model, when self-affirmation is applied to cessation of unhealthy behaviors, it leads to lower self-efficacy compared to when it is applied to promotion of healthy behaviors (**Error! Reference source not found. Error! Reference source not found.**= -0.18, *CI* = -0.26 to -0.10). The effect size demonstrated by the random-effects model is in the same direction, but not statistically significant (g_{random} = -0.27, *CI* = -0.67 to 0.03).

For subgroup analysis of self-relevance levels, the present meta-analysis has only three outcome variables: PME, perceived threat, and negative affect. Both fixed-effect and random-effects models show that low self-relevance participants have more PME (**Error! Reference source not found. Error! Reference source not found.**= 0.82, *CI* = 0.47 to 1.17; g_{random} = 0.80, *CI* = 0.02 to 1.57) and more negative effect (**Error! Reference source not found. Error! Reference source not found.**= 1.56, *CI* = 1.06 to 2.06; g_{random} = 1.57, *CI* = 0.02 to 1.57). The complete results of moderating analysis are summarized in Table 7.

Table 7

Mean Weighted Effect Sizes by Categorical Moderating Variables (Fixed-Effect Model vs. Random-Effects Model)

Moderator			Self-affirmation domain		Health topics		Self-relevance levels	
			Desirable traits	Values	Promotion	Cessation	High	Low
PME		N (ctrl)	356 (329)	839 (831)	177 (177)	701 (665)	114 (114)	137 (137)
		k	5	12	4	14	6	6
	R	g	0.469	-0.003	-0.06	0.48	-0.67	0.12
		95% CI	[-0.14, 0.13]	[0.28, 0.66]	[-0.32, 0.20]	[0.08, 0.89]	[-1.09, -0.26]	[-0.53, 0.78]
		difference	0.47		0.54		0.80	
		95% CI	[0.24, 0.71]		[0.06, 1.02]		[0.02, 1.57]	
	F	g	0.66	0.01	-0.06	0.38	-0.74	0.08
		95% CI	[0.51, 0.81]	[-0.08, 0.11]	[-0.32, 0.20]	[0.03, 0.74]	[-1.00, -0.49]	[-0.16, 0.31]
		difference	0.65		0.44		0.82	
		95% CI	[0.47, 0.82]		[0.00, 0.86]		[0.47, 1.17]	
Defensive avoidance		N (ctrl)	620 (585)	746 (748)	730 (549)	445 (461)	-	
		k	8	8	9	8	-	
	R	g	-0.34	-0.24	-0.25	0.25	-	
		95% CI	[-0.12, 0.32]	[-0.59, 0.12]	[-0.31, -0.07]	[0.24, 0.35]	-	
		difference	-0.34		0.50		-	
		95% CI	[-0.46, 0.08]		[0.23, 0.78]		-	
	F	g	-0.09	0.21	-0.10	0.25	-	
		95% CI	[-0.21, 0.03]	[0.16, 0.26]	[-0.49, -0.00]	[0.07, 0.43]	-	
		difference	-0.29		0.35		-	
		95% CI	[-0.42, -0.16]		[0.24, 0.46]		-	
Perceived threat		N (ctrl)	302 (270)	481 (474)	353 (348)	632 (509)	91 (91)	95 (97)
		k	6	7	5	9	2	3
	R	g	0.30	0.22	0.13	0.28	0.08	0.46
		95% CI	[-0.22, 0.74]	[-0.08, 0.52]	[-0.25, 0.51]	[0.10, 0.46]	[-1.13, 1.28]	[-0.10, 1.01]
		difference	0.08		0.15		0.38	
		95% CI	[-0.50, 0.66]		[-0.63, 1.47]		[-0.94, 1.70]	
	F	g	0.45	0.06	0.13	0.28	0.06	0.48
		95% CI	[0.30, 0.60]	[-0.05, 0.19]	[-0.25, 0.51]	[0.10, 0.46]	[-0.25, 0.38]	[0.16, 0.80]
		difference	0.38		0.15		0.42	
		95% CI	[0.19, 0.58]		[-0.27, 0.57]		[-0.25, 0.38]	
Self-efficacy		N (ctrl)	1021 (997)	351 (311)	1059 (993)	1006 (982)	-	
		k	7	7	6	8	-	
	R	g	0.21	0.14	0.26	-0.0021	-	
		95% CI	[0.18, 0.35]	[-0.08, 0.50]	[0.19, 0.42]	[-0.25, 0.25]	-	
		difference	0.07		-0.27		-	
		95% CI	[-0.27, 0.40]		[-0.57, 0.03]		-	
	F	g	0.26	0.06	0.16	-0.02	-	
		95% CI	[0.18, 0.35]	[0.01, 0.11]	[0.14, 0.22]	[-0.08. 0.05]	-	
		difference	0.21		-0.18		-	
		95% CI	[0.10, 0.31]		[-0.26, -0.10]		-	
Response efficacy		N (ctrl)	363 (272)	147 (148)	345 (307)	153 (78)	-	
		k	6	3	6	3	-	
	R	g	0.40	0.03	0.29	0.26	-	
		95% CI	[0.16, 0.63]	[-0.29, 0.34]	[-0.13, 0.44]	[0.23, 0.58]	-	
		difference	0.37		-0.03		-	
		95% CI	[-0.03, 0.77]		[-0.39, 0.34]		-	
	F	g	0.41	0.01	0.28	0.26	-	

		95% CI	[0.23, 0.58]	[-0.21, 0.24]	[0.11, 0.45]	[0.02, 0.50]	-	
		difference	0.39		-0.02		-	
		95% CI	[0.11, 0.68]		[-0.30, 0.26]		-	
Attitudes	R	N (ctrl)	354 (318)	86 (843)	1060 (997)	859 (832)	-	
		k	5	3	5	3	-	
		g	0.170	0.176	0.21	0.08	-	
		95% CI	[-0.04, 0.38]	[-0.24, 0.60]	[-0.21, 0.62]	[-0.18, 0.34]	-	
		difference	-0.01		-0.12		-	
		95% CI	[-0.47, 0.46]		[-0.61, 0.36]		-	
	F	g	0.14	0.06	0.08	0.04	-	
		95% CI	[-0.02, 0.30]	[-0.03, 0.16]	[-0.01, 0.17]	[-0.07,0.14]	-	
		difference	0.08		-0.04		-	
		95% CI	[-0.11, 0.26]		[-0.18, 0.09]		-	
Negative affect	R	N (ctrl)	283 (212)	368 (369)	172 (113)	671 (635)	75 (75)	65 (67)
		k	6	7	3	9	3	3
		g	-0.04	-0.17	-0.02	-0.03	0.40	-1.10
		95% CI	[-0.63, 0.28]	[-0.27, 0.20]	[-0.25, 0.21]	[-0.42, 0.35]	[0.13, 0.79]	[-1.48, -0.72]
		difference	0.13		0.01		-1.57	
		95% CI	[-0.38, 0.65]		[-0.46, 0.43]		[-2.06, -1.06]	
		g	-0.09	-0.24	-0.11	-0.09	0.46	-0.10
	F	95% CI	[-0.20, 0.02]	[-0.36, -0.11]	[-0.22, 0.01]	[-0.22, 0.04]	[0.13, 0.80]	[-1.48, -0.72]
		difference	0.15		0.01		1.56	
		95% CI	[-0.02, 0.32]		[-0.16, 0.19]		[1.06, 2.06]	
Intentions	R	N (ctrl)	1165 (1097)	1450 (1319)	2816	1711	-	
		k	15	13	10	15	-	
		g	0.21	0.05	0.14	0. 35	-	
		95% CI	[-0.04, 0.45]	[-0.23, 0.33]	[-0.01, 0.10]	[0.03, 0.23]	-	
		difference	0.16		0.21		-	
		95% CI	[-0.22, 0.53]		[-0.03, 0.21]		-	
	F	g	0.11	0.02	0.04	0.13	-	
		95% CI	[0.05, 0.02]	[-0.05, 0.10]	[-0.03, 0.30]	[0.02, 0.68]	-	
		difference	0.08		0.21		-	
		95% CI	[-0.03, 0.20]		[-0.15, 0.57]		-	
Behavior	R	N (ctrl)	362 (384)	1091 (1123)	483 (505)	1002 (1037)	-	
		k	7	9	8	9	-	
		g	0.41	0.55	0.40	0.32	-	
		95% CI	[0.27, 0.55]	[0.17, 0.93]	[0.27, 0.54]	[0.02, 0.62]	-	
		difference	-0.14		-0.09		-	
		95% CI	[-0.54, 0.27]		[-0.42, 0.24]		-	
	F	g	0.41	0.31	0.42	0.51	-	
		95% CI	[0.27, 0.55]	[0.17, 0.93]	[0.23, 0.62]	[0.16, 0.87]	-	
		difference	0.10		0.09		-	
		95% CI	[-0.23, 0.43]		[-0.32, 0.50]		-	

Note. N=the number of participants in the self-affirmed group. (ctrl)=the number of participants in the control group. k=the number of studies. R=random-effects model. F=fixed-effect model.

The Role of Emotions

Among the 55 studies included in the meta-analysis, there are only 13 that examine the role of emotions. Out of the 13 studies, there is only one that focuses

specifically on the mediating role of other-directed positive emotions (e.g., love and empathy) in the self-affirmation process (Crocker et al., 2008). According to the empirical evidence from Crocker et al.'s study (2008), the hypothesis that self-affirmation generates positive emotions is supported. Specifically, values self-affirmation generates more love than other positive emotions, and love is a mediator between exposure to values self-affirmation and message acceptance. However, this study is not included in the meta-analytic procedure because a single study cannot be used for meta-analysis. The other 12 studies examine negative affect as an outcome variable. The hypothesis that exposure to threatening health information generates negative emotions, and self-affirmed participants have fewer negative emotions than their non-self-affirmed counterparts is supported by the meta-analytic results, according to the fixed-effect model (**Error! Reference source not found.** = -0.092, *CI* = -0.166, -0.019). The random-effects model demonstrates slightly smaller effect size (g_{random} = -0.039, *CI* = -0.278, 0.200). This means that self-affirmation's impact on reducing negative emotions is not robust across different populations and research settings.

Table 4 demonstrates that negative affect has high variance (**Error! Reference source not found.** = 87.605%). To further probe how negative affect is measured by the 12 studies included, I summarize the specific operationalization in Table 8.

Table 8

Operationalization of Negative Affect

Negative Emotions	Label	Operationalization
Sherman, Nelson, & Steele, (2000)	Post-test mood	Asked participants to rate "How would you describe your mood, right now?" Responses ranged from "extremely bad mood" to "extremely good mood."
Dillard, McCaul, & Magnan	Post-test mood	Asked participants to rate "How would you

(2005)		describe your mood right now?" Responses ranged from "extremely bad" to "extremely good" and from "extremely happy" to "extremely unhappy."
Harris & Napper (2005)	Negative affect (anxiety, fear and worry combined	Ratings of anxiety: "The article made me feel a bit anxious" (not at all/extremely)" and fear: "I felt fearful while reading the leaflet" (strongly disagree/strongly agree).
Jessop, Simmond, & Sparks (2009)	Negative affect	Asked participants to rate to what extent they felt (1) afraid, (2) frightened, (3) worried, and (4) uncomfortable."
Zhao & Nan (2010)	Message-induced anger	"How much the PSA made you feel 'angry,' 'irritated,' 'annoyed,' and aggravated.'"
Nan & Zhao (2012)	Message-induced anger	"How much the PSA made you feel 'angry,' 'irritated,' 'annoyed,' and aggravated.'"
Klein, Harris, Ferrer, & Zajac (2011) (Study 1 and Study 2)	Feelings of vulnerability (worry, anxiety, and fear)	Five questions: 1-2."Two items asked participants how worried and anxious they were about getting breast cancer." 3. "Asked participants how the article made them feel on a scale from not at all anxious to extremely anxious." 4. "How worried they were about the possible effects of drinking alcohol." 5. Asked participants to rate "I felt fearful while reading the article."
Schneider, Gadinger, & Fischer (2012)	Fear intensity	"How afraid, worried, uncomfortable, or disgusted participants felt after having seen each warning."
Zhao, Peterson, Kim, & Rolfe-Redding (2012)	Fear	"The degree to which the labels made you feel 'Afraid,' 'Scared,' 'Fearful,' and 'Frightened.'"
Koningsbruggen et al., (2014)	Anticipated regret	Asked participants to rate two items: "If I did not succeed in eating at least two portions of fruit and 200 grams of vegetables every day in the next week, I would feel regret" and "If I did not succeed in eating at least two portions of fruit and 200 grams of vegetables every day in the next week, I would feel upset."
Mays & Zhao (2015)	Frightened, nervous, and anxious	Assessed whether participants felt "frightened," "nervous," and "anxious."

Table 8 shows that the labels for negative affect are mixed. Affect, mood, and emotion are used interchangeably and may not accurately represent the constructs they actually measured. Sherman et al. (2000) and Dillard et al. (2005) use the label "mood," but actually measure participants' affective responses after exposure to self-affirmation intervention and threatening health messages. Though Harris and Napper (2005), and

Jessop and Sparks (2009) use labels such as “negative affect,” they actually measure message-induced emotions, such as anxiety and fear. Some other studies focus on one specific emotion and measure several differentiated derivatives of that specific emotion. For example, Zhao and Nan (2010) measure “anger,” “irritated,” “annoyed,” and “aggravated” when measuring message-induced anger. Zhao, Peterson, Kim, and Rolfe-Redding (2012) measure “afraid,” “scared,” “fearful,” and “frightened” as derivatives of message-induced fear. Therefore, we need to be cautious when interpreting the effect of self-affirmation in reducing defensive processing. Examining moods or general affective responses rather than specific message-induced emotions may introduce confounders researchers cannot identify or disentangle. Participants may be thinking of something else that happened to them when answering questions about their mood or affect rather than reflecting on what emotions the health messages arouses. This may attenuate the actual impact of self-affirmation in reducing negative emotions.

Another hypothesis of the present meta-analysis is that self-affirmation leads to more positive emotions that facilitate objective processing of threatening health messages. However, among the 55 studies, only one examines positive emotions. The mechanism of how self-affirmation works is not completely clear. The impact of self-affirmation in reducing defensive processing is not the direct proof of whether self-affirmation works. I then examine the remaining 54 studies to see what types of procedures or questions researchers use to directly measure whether self-affirmation works to increase participants’ overall self-integrity.

Further review of the 54 studies reveals that there are only five studies that examine how participants feel about themselves immediately after self-affirmation intervention. Sherman et al. (2000), Armitage et al. (2011), Cooke et al. (2014), and Harris et al. (2014) use single measure, while Napper et al. (2009) uses multiple measures. Specifically, Sherman et al. (2000) measures "self-feeling" by asking participants to answer the following question: "How do you feel about yourself?" on a 9-point scale anchored at "poorly" and "extremely positively." Armitage et al. (2011) measures state self-esteem immediately after self-affirmation intervention, using the single-item question: "I have high self-esteem" followed by a 5-point scale anchored at "not very true of me" and "very true of me" (Robin, Hendin, & Trzesniewski, 2001). Both Cooke et al. (2014) and Harris et al. (2014) ask the participants' thoughts about self-affirmation: "The task on values made me think about …, things I don't like about myself (1) things I like about myself (7), things I'm bad at (1), things I'm good at (7), things I don't value about myself, and (1) things I value about myself (7)." Napper et al. (2009) uses three measures: (1) thoughts about self-affirmation: "The questionnaire made me: Think about positive aspects of self, focus my attention on who I am, Think about things personally important to me, Think about my values;" (2) self-feeling: "How do you feel about yourself?" 0 (poorly) to 6 (extremely positive);" (3) moods: positive mood (happy/elated) and negative mood (sad/depressed) on a 4-point scale from 0 (definitely does not apply to my feeling at this moment) to 3 (definitely does apply to my feeling at the moment). In addition, other studies do not measure participants' reactions to self-affirmation intervention directly, but ask independent coders to rate participants' self-

affirmation rating according to the following three criteria: “How positive are you about yourself in the passage?”; “To what extent have you stuck to the task asked of you?”; and “How important does the value you have selected appear to be to you?”

These measurements often are used as a manipulation check to ensure that when values self-affirmation is used, participants choose their most important value and feel good about themselves; and if desirable traits self-affirmation is used, participants have positive self-perceptions after they recall their most desirable traits. Because of the wide variety of measures used in examining how participants feel about themselves, and the fact that there were only five studies, I am not able to meta-analyze the effect sizes. These results do offer some sporadic empirical evidence that participants feel good about themselves after self-affirmation, which provides support for the theoretical proposition that self-affirmation enhances self-integrity. If researchers can conduct a mediation analysis to examine whether the enhanced self-integrity mediates the relationship between exposure to threatening health messages and their subsequent cognitive and behavioral responses, they can reveal an alternative mechanism of self-affirmation in addition to the proposed role of emotions in the self-affirmation process. However, none of the studies further examines the mediating role of enhanced self-integrity in the self-affirmation process.

The Mediation Relationship Between the 11 Outcome Variables

If we can establish a mediation relationship between the 11 outcome variables, we can better understand the mechanism of the impact of self-affirmation on a variety of defensive responses. However, there are only 16 studies that measure whether some of

the 11 outcome variables mediate the influence of condition on intentions or behaviors. These studies examine whether behavioral intentions or behaviors are mediated by the remaining defensive outcome variables. The most commonly examined mediation relationship is whether intention mediates the impact of condition on behavior (k=7). Consistent with previous studies, results show that intention is a mediator of the relationship between exposure to self-affirmation and behavioral changes (Armitage et al., 2011; Armitage, Rowe, Arden, & Harris, 2014; Cooke, Trebaczyk, Harris & Wright, 2014; Epton & Harris, 2008; Jessop et al., 2009; Koningsbruggen & Das, 2009; Pietersma & Dijkstra, 2011). For the remaining outcome variables that are tested, studies demonstrate inconsistent results. None of the studies examines the potential mediation relationship among the remaining 10 outcome variables. I summarize the results in Table 9.

Table 9

Mediation Relationship Between the 11Outcome Variables

Study	Mediators	Mediation starting point	Mediation endpoint	Mediating effects detected
Harris & Napper (2005)	Perceived susceptibility	Self-affirmation	Behavior	Yes
Armitage et al. (2008)	PME	Self-affirmation	Intention	Yes
Crocker et al. (2008)	Positive emotions	Self-affirmation	PME	Yes
Epton & Harris (2008)	Response efficacy	Self-affirmation	Behavior	Yes
	Self-efficacy	Self-affirmation	Behavior	No
	Intention	Self-affirmation	Behavior	Yes
Koningsbruggen	PME	Self-affirmation	Intention	No

& Das (2009)				
	Intention	PME	Behavior	Yes
Koningsbruggen et al. (2009)	Reaction times to threat-related words	Self-affirmation	PME	No
	Reaction times to threat-related words	Self-affirmation	Intention	No
Jessop et al. (2009)	Negative affect, PME, defensive avoidance, self-efficacy, response efficacy, attitude, intention	Self-affirmation	Behavior	No
Klein, Harris, Ferrer, & Zajac (2011)	Perceived susceptibility	Self-affirmation	Intention	Yes
Pietersma & Dijkstra (2011)	Intention	Self-affirmation	Behavior	Yes
Armitage et al. (2011)	Perceived severity, PME, self-efficacy, intention	Self-affirmation	Behavior	No
Pavey & Sparks (2012)	Autonomous motivation	The interaction of the prime type and alcohol consumption	Attitudes	Yes
	Autonomous motivation	The interaction of the prime type and alcohol consumption	Intentions	Yes
Armitage et al. (2014)	Perceived threat, message derogation, self-efficacy, intention	Self-affirmation implementation intention	Behavior	No
Barkoukis, Lazarus, & Harris (2014)	Perceived norms, attitudes	Self-affirmation	Behavior	Yes
Cooke, Trebaczyk, Harris, & Wright (2014)	Attitudes, intentions	Self-affirmation	Behavior	No
Koningsbruggen, Harris, Smits, Schuz, Scholz, & Cooke (2014)	Negative emotions (i.e., regret)	Self-affirmation	Intention	Yes
Mays & Zhao (2015)	Negative emotions (i.e., fear)	Self-affirmation	Intention	Yes

Chapter 5: Discussion

Although research supports the proposition that self-affirmation is effective in reducing defensiveness to threatening health messages, there also is empirical evidence to the contrary. The present analysis examines when and why self-affirmation reduces defensiveness to threatening health messages. Possible moderators of self-affirmation's impact on reducing defensiveness include self-affirmation domains, health topics, and self-relevance levels. Overall, results from the meta-analysis somewhat support that self-affirmation (in an important but unrelated self-domain) can maintain positive self-regard, and thus offset defensive responses to threatening health messages. However, the present study also demonstrates the limitations of current self-affirmation strategy as an intervention to reduce defensive processing of health information and to facilitate behavior, which I explain in the following section.

Descriptive Statistics

Descriptive statistics show that the 84.17% of participants in the studies I include in my meta-analysis are undergraduate students. This finding has important implications for results interpretation. Because this is a non-representative sample, it is highly probable that the results from existing self-affirmation literature cannot be generalized to the real world health campaign that targets different populations. More importantly, according to Sear (1986, p. 515), "college students are likely to have less-crystallized attitudes, less-formulated senses of self, stronger cognitive skills, stronger tendencies to comply with authority, and more unstable peer group relationships." Because

undergraduate students have “less-formulated senses of self,” the existing self-affirmation domains that work effectively among them may not work equally effectively among older adults. In addition, the present study reveals that desirable traits self-affirmation was more effective than values self-affirmation in reducing defensive responses, which may not be true for the general population. It is possible that for older adults who have stronger stances on what the most important values in their lives are, values self-affirmation may work better. It also is possible that because college students have stronger cognitive skills, the self-affirmation intervention domains and health messages used in the studies included in the present meta-analysis do not work effectively for other populations, especially the most vulnerable or most at-risk populations that have weaker cognitive skills (e.g., alcoholics who are enrolled in rehabilitation program).

Another finding that is worth noting is that 70.48% of participants are of European ethnic descent. In addition, 54 out of 55 studies are conducted among participants in western countries (i.e., the United States, United Kingdom, Netherlands, Canada, Australia, and Germany). Participants of other ethnic descent and from non-western countries or cultures are neglected in existing literature. Hofstede (1984) categorizes cultures into two groups: individualism and collectivism, which refer to the extent to which a society views or evaluates its people as individuals or as a group. According to Hofstede’s value dimension (1984), in countries with individualistic orientation, people are defined by their own actions and are primarily concerned with their own interests and their immediate family members’ interests, while in countries with collectivistic cultural orientation, people are defined by group’s actions and

primarily concerned with the interests of the group(s) with which they affiliate. The countries (i.e., the United States, United Kingdom, Netherlands, Canada, Australia, and Germany) represented in the studies included in my meta-analysis are all highly individualistically oriented (Hofstede, 1984). Countries or cultures that are collectivistically oriented do not receive equal research attention in the empirical studies included in the meta-analysis.

Culture is highly relevant to the self-affirmation process. Culture plays an important role in shaping self-integrity (Markus & Kitayama, 1991). People from collectivistic and individualistic cultures have different self-construe that features different primary bases for self-evaluation, which further influences their motivational and behavioral patterns (Hofstede,1984; Markus & Kitayama, 1991; Steele, 1988). As Markus & Kitayama (1991) argues, “having an interdependent self as opposed to an independent self-concerns the ways in which the knowledge about self and other is processed, organized, and retrieved from memory” (p. 232). Specifically, people from individualistic cultures are motivated to pursue goals that demonstrate their most important self-defining values, and these goals take priority over those of families or organizations. Conversely, people from collectivistic cultures are more motivated to pursue goals that represent interdependent relationships and connectedness with others (Markus & Kitayama, 1991). The different tendencies manifest themselves in every aspect of people’s lives, including information processing and health behavioral choices (Heine & Lehman, 1997; Hofstede,1984; Markus & Kitayama, 1991). Thus, researchers

cannot take for granted that self-affirmation strategies that are effective for people from individualistic cultures are equally effective for people from collectivistic cultures.

Asians and Latin Americans, who have collectivistic cultural orientations that influences their values, beliefs, and motivations, are the two fastest growing immigration populations (Grieco, et al., 2012) in the United States. Current self-affirmation domains concern individuals' important values or desirable traits. It is possible that groups' important values and important others' desirable traits work better for people with collectivistic cultural orientation as self-affirmation strategies. However, based on current empirical evidence, whether existing self-affirmation strategies work equally well for people with collectivistic vs. individualistic cultures is unknown. Cultural appropriateness is important for enhancing health promotion effectiveness and reducing disease burden among immigrants (Cohen & Sherman, 2014). Future research may develop and test culturally appropriate self-affirmation strategies for people with collectivistic cultural orientation.

Meta-Analytic Findings: Main Effect

The present meta-analysis provides a consistent picture of self-affirmation's effect in reducing defensive responses to threatening health messages. This finding is consistent with the central tenet of self-affirmation (Cohen & Sherman, 2014; Sherman & Cohen, 2006; Steele, 1998) and further corroborates previous meta-analytic reviews on self-affirmation's impact in health communication (Epton et al., 2015; Sweeney & Moyer,

2015).[6] The meta-analytic findings about main effect of self-affirmation also add to existing reviews by providing a more comprehensive (i.e., 55 studies and 11 outcome variables analyzed) and fine-grained (i.e., results obtained from both fixed-effect and random-effects models) analysis.

The impact of self-affirmation on PME, perceived susceptibility, response efficacy, and behaviors are most robust and consistent among all of the 11 outcome variables, as both fixed-effect and random-effects models demonstrate positive effect sizes. This implies that the positive effects can be generalized to the studies that are identical to the studies included in the present meta-analysis. Moreover, these results also can be generalized to studies with a broader study population, and we could expect to get similar results except for sampling error (Hedges & Vevea, 1998; Schmidt et al., 2009). Among the remaining eight outcome variables, fixed-effect and random-effects models show different effect sizes, which indicates the absence of a common population effect size for each of these variables.

It is noteworthy that among the 11 outcome variables, the main effect size of PME is the highest and the most consistent. Why are the effects on PME stronger than other outcome variables? One possible reason is that self-affirmed participants may have more agreeableness that leads to higher PME. But participants may only process the messages heuristically. We may not expect self-affirmation to have as strong an effect on PME as on other outcome variables [e.g., increased feelings of vulnerability

[6] In all of the studies included in the present meta-analysis, participants received self-affirmation intervention before their exposure to threatening health messages. Therefore, the timing of self-affirmation intervention is consistent with the original theoretical proposition of self-affirmation (Sherman & Cohen, 2006; Steele, 1998).

(Koningsbruggen & Das, 2009).] Some researchers propose that self-affirmation increases message recipients' motivations to systematically process health messages (Correll et al., 2003). However, although the present meta-analysis did not offer direct evidence, it may suggest that message recipients rate messages as "convincing" or "having high quality" not because they read and think carefully about the message recommendations, but because when they have positive feelings about themselves (right after self-affirmation intervention), they may tend to "accept" any health message presented to them. Research shows that self-affirmation generates positive emotions (Crocker et al., 2008), and it is possible that positive emotions enhance persuasion through heuristic processing so that message recipients do not pay enough attention to message strength or quality (Mackie & Worth, 1989; Schwarz & Bless, 1991). This finding also may imply that the impact of self-affirmation on PME and on subsequent cognitive responses may be different. For example, self-affirmation increased self-efficacy may occur because self-affirmation enhances message recipients' positive self-perceptions as being "capable of controlling important outcomes" (Stelle, 1988, p. 262) and may not completely depend on how message recipients process messages (Zhao & Nan, 2009).

Another reason might be that overall, the health messages used as stimuli in the experiments in this meta-analysis are not "threatening" enough, so participants' self-systems are not fully activated. Under this scenario, agreeableness generated by self-affirmation intervention may make participants more tolerant of the discrepancies

between their existing cognitions (or even behaviors) and the recommendations in the health messages (McFarland & Ross, 1982; Schneider, 2001).

Further examination of the operationalization of PME also offers some insight into explaining why other outcome variables, especially perceived susceptibility, have lower effect sizes than PME. It is not uncommon that the message referent is not specified in the measures of PME (Yzer et al., 2015). For example, by asking "to what extent do you think the message was convincing?," participants may think the message was convincing because other people are susceptible to the health risk, but not so much that they themselves are at risk. Therefore, when participants answer questions about their own susceptibility or intentions, they may show more defensiveness due to denial of personal relevance.

Another interesting finding is that self-affirmed participants show more defensive avoidance when exposed to cessation topics. According to the central proposition of self-affirmation theory, self-affirmed participants should have less defensive avoidance than their non-self-affirmed counterparts. The finding of the present meta-analysis is inconsistent with this proposition. One plausible explanation lies in the operationalization of defensive avoidance. For example, some studies operationalize "defensive avoidance" as "When I read the information about drinking, my first reaction was that I didn't want to think about it" (Armitage et al., 2011; Jessop et al., 2009). Participants may respond to this question as "strongly agree" not because self-affirmation did not work, but because the defensive response was their "first reaction," even when this reaction was changed after they were self-affirmed.

A second explanation is that people can accept the message content while derogating the message source (Scott et al., 2013) or format (Rhine & Severance, 1970). For example, after exposure to a breast cancer screening message, participants may accept the effectiveness of mammogram in detecting breast cancer and increase their self-efficacy in how to get a mammogram, but they may not like the picture of a lumpectomy in the message and do not want to think about it. Because the studies included in the meta-analysis do not differentiate participants' defensive avoidance reactions to the message content and to the message source/format, there is no empirical data available to draw definitive conclusions. In future studies, researchers should distinguish participants' defensive avoidance to message content, source, and format in the measurement. Employing standardized measures for the same construct also is crucial for researchers to clarify this question.

A third possibility that we cannot rule out with existing data is that the health messages used in these studies are not threatening enough. Previous studies show that when self-system is not fully activated, self-affirmation increases people's confidence in their beliefs and behaviors and thus they hold on tighter to their beliefs and behaviors. This results in holding on tighter to beliefs and behaviors instead of objectively processing threatening information (Briñol et al., 2007). Under this condition, people "carefully scrutinize information that might provide a more validated opinion" (Briñol et al., 2007). It may also be the reason why self-affirmed participants show more defensive avoidance.

Importantly, both fixed-effect and random-effects models in the present meta-analysis not only reveal a positive impact of self-affirmation in increasing PME, perceived susceptibility, and response efficacy, but also show a positive effect of self-affirmation in facilitating behavior. Changing behavior is the ultimate goal of health campaigns and one of the most important indicators of a campaign's effectiveness. Though according to Cohen's criteria of evaluating the magnitude of effect sizes, the effect sizes of behavior are small according to the fixed-effect model (and moderate according to the random-effects model). Cohen (1988) also suggests that the criteria are to be used "only when no better basis for estimating the ES [effect size] is available" (p. 25). As a simple and one-time psychological intervention, self-affirmation's effect in facilitating behavior is promising. As Prentice and Miller (1993, p. 163) argues, "importance (of effect size) is a function of how minor a manipulation of the independent variable or how resistant a dependent variable will still produce an effect." As proposed by self-affirmation theorists, the more subtle the self-affirmation process, the stronger its impact in reducing defensive responses to threatening health messages (Sherman & Cohen, 2006; Steele, 1988). Though existing self-affirmation strategies are not the most minimal (among all possible psychological interventions), if self-affirmation procedures can be integrated with health messages in real world health promotion campaigns (e.g., Jessop et al., 2009), or be used to start the conversation during patient-physician counseling sessions (e.g., Bean, Covarrubias, & Stone, 2014), self-affirmation intervention can be minimal and more subtle. Thus we could expect the impact of self-affirmation would not be attenuated in real word situations.

In addition, the sample size of the present meta-analysis is relatively small (*M*=192.93, *SD*=216.10). Statistically, the chance of detecting a mean difference between a self-affirmation group and a non-self-affirmation group is bigger as the intervention has a larger sample size. However, we still need to be cautious in predicting self-affirmation's impact in real world health promotion campaigns. The present meta-analysis has a quite homogeneous study population. More than 80% of participants are undergraduates, and thus the magnitude of the effect size measure would be much bigger than when self-affirmation is administered to a more heterogeneous population, as "population heterogeneity can reduce the magnitude of the effect size measure" (Olejnik & Algina, 2000, p. 281). Thus it also is possible that self-affirmation may have a smaller effect in reducing defensive responses to threatening health information in health promotion campaigns that target populations other than college students.

One thing worthy of noting is we should not over-interpret the effect sizes of behavior. Behavioral changes from the 17 studies included in the present meta-analysis are still based on participants' self-reports. Social desirability remains a concern in participants' reports of their behaviors (Harris et al., 2007). Though behavior included in the present meta-analysis is measured at least one week after laboratory study participation, they may still tend to report behavior that is consistent with their report of cognitive responses in the laboratory (Slater, 2006). When participants are aware that their (report of) health behaviors are being monitored or judged, they adjust behaviors or report of behaviors according to their understanding of the experimenters' expectations. However, only two (Armitage et al., 2011; Scott et al., 2013) of 17 studies that measured

alcohol drinking behavior address this concern by citing previous research to argue that the reliability of their behavioral measurement is based on self-report. For example, self-reports of seven-day recalls are highly consistent with biomarkers (Babor et al., 2000; Del Boca & Noll, 2000). Again, researchers need to practice caution when interpreting the high consistency. Whether participants tend to report their drinking behavior more accurately when they knew their biological sample will be taken to check their drinking amount is unknown.

In addition, some behaviors measured are just convenient substitutes that may lead to overestimation of behavior. For example, measuring whether participants take the pamphlet or free health product sample at the end of the experiments may show participants' intention or may just show participants' courtesy. It also is possible that they take the leaflet because they feel pressured to do so. When interpreting behavioral changes, researchers should not overestimate self-affirmation's impact in facilitating behavioral changes. Participants may take a pamphlet, but not translate that pamphlet-taking behavior into real behavior recommended in the pamphlet.

Meta-Analytic Findings: Moderating Effect

Results from moderator analyses further indicate that the main effect of self-affirmation tells only part of the story. Self-affirmation appears to produce stronger effects in particular circumstances. In the following section, I discuss the implications of the effect of three moderators: self-affirmation domains, health topics, and self-relevance levels.

Self-Affirmation Domains

The proposition of self-affirmation has spawned a variety of self-affirmation domains, including values, desirable traits (e.g., kindness), implementation intention, and bogus positive feedback. The present study conducts subgroup analysis between values self-affirmation and desirable traits self-affirmation. This addresses the concern raised by McQueen and Klein (2006) as to whether different self-affirmation domains have different effects in reducing defensiveness. Results from both fixed-effect and random-effects models show that desirable traits self-affirmation is more effective than values self-affirmation in increasing PME. There are no differences between the two domains on forming intentions and facilitating behavior. Fixed-effect and random-effects models differ on which self-affirmation domain is more effective in the remaining outcome variables.

Again, PME stands out as the most consistent (between fixed-effect and random-effects models) and the strongest effect size (moderate according to fixed-effect and random-effects models). This result from subgroup analysis offers a particularly relevant implication for recognizing and understanding differences between desirable traits and values self-affirmation. That is, desirable traits self-affirmation and values self-affirmation may have different mechanisms in reducing defensiveness. Desirable traits self-affirmation may reduce defensiveness mainly through producing more positive emotions. However, values self-affirmation may reduce defensiveness mainly through maintaining self-integrity, while maintaining self-integrity may not necessarily produce positive emotions. Participants who are exposed to desirable traits self-affirmation may

have more positive emotions (that can better reduce defensiveness) than those who are exposed values self-affirmation. If researchers can provide empirical evidence that desirable traits self-affirmation generates more positive emotions, and these positive emotions further exert influence on subsequent cognitive responses and behaviors, we can understand the mechanism behind why and how self-affirmation works to reduce defensiveness. It also is possible that desirable traits self-affirmation generates more enhanced self-integrity, which leads to more defensiveness reduction. Further research is needed to solve the puzzle. Researchers and health promotion professionals then can utilize the most effective self-affirmation domain or further refine the existing self-affirmation domain with an emphasis on enhancing its effects in either generating more positive emotions or more enhanced self-integrity (depending on what empirical evidence shows).

Compared to desirable traits self-affirmation, values self-affirmation concerns relatively broader and more abstract questions that urge participants to think deeply about their own life philosophy (Allport et al., 1970). Sherman and Cohen (2006) suggested that the broader the self-affirmation domain, the more effective self-affirmation is. However, results of the present study do not support this proposition. When people think about the most important value (from these categories: art, business, society, religion, science, and politics) and how they execute that value in their lives, they may not always experience positive emotions. One sample question from the Allport-Vernon-Lindzey value scale that has been most widely adopted by self-affirmation researchers is: “Do you think a good government should aim chiefly at: a. more aid for the poor, sick, and old?, b.

the development of manufacturing and trade?, c. introducing highest ethical principles into its policies and diplomacy?, or d. establishing a position of prestige and respect among nations?." Participants who choose "politics" as the most important value domain in their life and answer this type of question may have their core value maintained. One sample question from the desirable traits self-affirmation scale would be: "Indicate whether you are 'enthusiastic,' 'keen,' 'conscientious,' 'hardworking,' 'intelligent,' 'open-minded,' 'responsible,' and 'determined' by circling either 'yes' or 'no' for each trait" (Jessop et al., 2009). Next, participants are asked to give a brief example of how they demonstrate that trait in their everyday lives. Compared to values self-affirmation, desirable traits self-affirmation requires less cognitive processing at abstract level, while interventions that require much cognitive effort may cause participants' fatigue that negatively affects the intended results (Porter, Whitcomb, & Weitzer, 2004).

In addition, desirable traits self-affirmation seems to be a more natural (and thus more subtle) intervention that can be more easily integrated with a health message. The more natural and subtle that the procedure of administering self-affirmation intervention is, the better its effects in reducing defensiveness are (Cohen & Sherman, 2014;Sherman & Cohen, 2006). For example, Jessop et al. (2009) asks participants to select from a list one desirable trait that applies to them, and then gives the participants the following information: "If you have responded 'yes' to any of the above (desirable traits), then you would be an ideal candidate to take part in our 'Safety in the Sun 2006 Challenge' to use sunscreen (SPF 15 or above) when sunbathing for the rest of this year. What you decide to do today can later improve the quality of the life that you will enjoy in the future. It's

up to you. You are a unique and special person. Don't you deserve looking after?" (Jessop et al., 2009, p. 534). In this example, researchers integrate the self-affirmation intervention naturally with the health message, which indicates a possibility of administering self-affirmation in real world health promotion campaigns. In this study, Jessop finds that desirable traits self-affirmation works better in reducing defensiveness than values self-affirmation that is not integrated with the health message.

According to the aforementioned literature review about positive emotions, when people achieve their fundamental goal (of maintaining self-integrity), they experience positive emotions. However, what types and how intense the positive emotions are is largely unknown. It also is highly possible that people may think of the difficulties they have encountered when they were executing that value in their lives. They also may think of something in that domain that disappoints them. Under this condition, people may have negative emotions, such as anger or sadness. When exposed to a variety of desirable traits such as kindness, participants easily can think of something they have done to demonstrate kindness and feel good about themselves. More importantly, they may have more positive emotions after they think of their desirable traits relative to their most important values. This explanation cannot be tested based on the empirical data included in this meta-analysis. Future research can explore whether these two self-affirmation domains work to reduce defensiveness through different mechanisms.

The results also imply that current self-affirmation strategies can be strengthened to have more consistent and stronger effects in reducing defensive responses to threatening health messages. There are two possible routes: one is to administer self-

affirmation intervention more subtly, and the other is to explore more effective self-affirmation domains. Steele (1988) suggests "to the extent that self-affirmation motivates consistency restoration, any adaptation that effectively affirms the larger self should be an effective adaptation." Affirming on academic success (Ko & Kim, 2010) or status goods purchase (Sivanathan & Pettit, 2010) also can be effective in reducing defensiveness. As Taylor and Sherman (2007) propose, there are many ways to achieve self-enhancement. When people think of positive attributes of their family members, friends, or even the schools they have attended; they are affirming themselves (Taylor & Sherman, 2007). These domains seem to be more natural self-affirmation domains relative to values self-affirmation (i.e., choosing the most important personal value from a scale and writing a paragraph about how to execute this value). It is critical for researchers to explore the effectiveness of theses self-affirmation strategies among others.

A potential advantage of the self-affirmation domains mentioned above is that they also seem to be more feasibly deployed than the two self-affirmation strategies meta-analyzed in the present study. This is especially true during patient-doctor appointments or small group therapy. The less intrusive the administration of self-affirmation, the better the effect of self-affirmation in reducing defensive responses to threatening information (Hartson & Sherman, 2011; Sherman & Cohen, 2014). This discussion also can be put in the broader context of psychology research. When participants feel they are manipulated by, and are aware of, the purpose of a psychological intervention, the intervention no longer will work as purported. However,

few studies included in the present meta-analysis examine whether participants know the purpose of self-affirmation intervention or whether they feel manipulated.

Self-Relevance Levels

Due to the limited number of studies that clearly report the results of the 11 outcome variables for participants with high and low relevance separately, the present meta-analysis only conducts subgroup analysis on three outcome variables: PME, perceived severity, and negative affect. It is not surprising that with the minimal nature of administration of self-affirmation intervention and the difficulties participants (especially participants with high self-relevance) experience when changing their lifestyles (e.g., eating more vegetable or quitting smoking), participants with low self-relevance have more defensiveness. This finding supports the proposition that self-affirmation is not effective, or even makes people unduly confident about themselves, in the absence of threat (Briñol et al., 2007). However, the finding that self-affirmation is less effective in increasing PME in the high self-relevance group than the low self-relevance group indicates the ineffectiveness of existing self-affirmation strategies and underscores the importance of refining current self-affirmation strategies or finding alternatives. The results also imply that current self-affirmation domains are not sufficient by themselves to act as a very effective intervention strategy among participants with high self-relevance. This implication echoes the previous discussion about self-affirmation domains.

In addition, it is interesting to note that participants with higher self-relevance levels show more negative affective responses. The effects of a health campaign cannot

be maximized unless the threatened self of high self-relevance participants can be adequately restored, such that they can objectively process health messages.

Health Topics

Health topics also moderate the effects of self-affirmation by showing higher PME in cessation topics. Both the fixed-effect and random-effects models show that cessation topics generate more PME, perceived severity, and intentions. Jessop et al. (2009) reasons, “It is possible that action is more easily instigated by self-affirmation manipulations than is desistence from a behavior.” Theoretically, for individuals who perform an unhealthy behavior over an extended period time, a health message advocating behavioral changes poses a greater threat to these individuals because part of their self-concept is formed around this unhealthy behavior (Gardner, Bruijn, & Lally, 2011). Individuals’ self-system is more fully acticated when they perceive a greater threat to their self-integrity. Thus, there is a bigger space for self-affirmation to exert its influence. However, the findings do not attest to this assumption. It is possible that current self-affirmation strategies are not adequately effective in restoring threatened self-integrity when they are applied to cessation of unhealthy behaviors.

It is also possible that the messages for cessation of unhealthy behaviors are not threatening enough to activate participants’ self-system. When indivdiuals’s self-integrity is not threatened, self-affirmation increases their confidence in existing beliefs and they respond to health message more defensively (Briñol et al., 2007). Though the threatening level of health messages are an important factor that influences the impact of self-affirmation (Zhao & Nan, 2010), few studies included in the present meta-analysis

examine the threatening level of health messages. Indeed, the more self-relevant a health message is, the more threatening it is (Dillard et al., 2005; Liberman & Chaiken, 1992), reserachers should not assume the threatening level of health messages but need to test it empirically.

Researchers need to be wary of interpreting this finding, given that there are relatively few studies included in this subgroup analysis. If we can determine that cessation topics pose significantly more threats to self-integrity, researchers and health campaign planners need to consider using different self-affirmation strategies for the two different health topics. We need more adequately powered empirical studies to disentangle this intriguing question.

Meta-Analytic Findings: The Role of Emotions in the Self-Affirmation Process

Previous empirical studies criticize the scant research attention paid to examining the mechanism of self-affirmation (Harris & Epton, 2009, 2010; Schuz et al., 2013; Sherman & Cohen, 2006; Sherman & Hartson, 2011; Zhao et al., 2012). Before data collection for this dissertation was completed (November 30, 2015), there had been no systematic effort to reveal the mechanism of self-affirmation. The present meta-analysis proposes that emotions play the mediating role in the self-affirmation process. However, due to limited empirical evidence about the role of (positive) emotions as mediators, the intriguing questions of whether self-affirmation generates positive emotions, and whether these emotions facilitate acceptance of threatening health information, remain to be answered.

As noted in the “Results” section, only one study clearly measures the mediating role of positive emotions (Crocker et al., 2008). This study finds that feelings of love account for the effect of values self-affirmation in increasing message acceptance. The results of Crocker’s study (2008) require replication, but the study might suggest that positive emotions function as a reminder to people of important things beyond the narrow and temporary self-threat, thus reducing defensive responses to threatening information. This is consistent with the proposition that “discrete, context-relevant emotions selectively affect information processing, recall, and judgment” (Nabi, 2003, p. 228).

It is worth noting that the current measures of emotions in self-affirmation literature are mixed and sometimes inappropriate. It is important to measure threat-specific affective responses (message-induced emotions) instead of free-floating affect or moods that are chronic and not event-specific, because threat-specific emotions may hold the key to revealing the mechanism of self-affirmation. This may be true especially with respect to how self-affirmation influences more temporally distal outcome variables, such as intentions and behavior (Klein, Harris, Ferrer, & Zajac, 2011). Future studies should make clear what is measured: mood or message-induced emotions. Mood refers to the “more diffuse kinds of affective experience” (Bodenhausen et al., 1994), and the origins of the mood are unknown in the self-affirmation experiments (Schwarz & Clore, 1983). Researchers cannot accurately gauge message recipients’ affective responses to health messages when measuring moods because moods are free-floating and not necessarily message-induced (Ekkekakis, 2013).

In addition, no studies included in the meta-analysis measure dimensional structure of emotions (valence-arousal). Measuring dimensional structure of emotions is necessary because discrete measurement of emotions cannot demonstrate the "arousal" aspect of emotions. "Arousal" is an indicator of the how calm or how excited the affective response is (Lang, 2009). The more aroused a stimulus is, the more likely the motivational system is activated and the more likely there will be a response to the stimuli (Yzer, Vohs, Luciana, Cuthbert, & MacDonald III, 2011). For example, arousal is found to be associated with perceived convincingness of manipulation messages (Yzer et al., 2011). By combining the two types of measurements, researchers can capture the important components (especially the cognitive appraisal component) that determine different functions of qualitatively different emotions. Researchers also could determine to what extent one's motivational system is activated.

Issues also exist in how discrete emotions are measured in the studies included in the present meta-analysis. Some studies examine the combined effects of self-affirmation on the two discrete emotions (i.e., fear and anger). Both of the emotions are negative valenced (Lazarus, 1991). They both are affective responses to unfavorable situations (i.e., exposure to self-relevant threatening health messages) when their goals are frustrated (i.e., the goal of maintaining self-integrity is frustrated). However, these two emotions have remarkably different effects in subsequent cognitive processes and action tendencies.

Fear is an emotion with negative valence and high-level arousal (Witte, 1998; Witte & Allen, 2000). Fear is aroused when individuals perceive their environment is

threatened, and the situation is out of their control (Lazarus, 1991). Fear's action tendency is to activate protective behavior, such as escaping from or avoiding the threatening object (Lazarus, 1991; Nabi, 1999, 2002). When message recipients experience intensive fear, they probably will avoid the message without processing it further (Hale, Lemieux, & Mongeau, 1995; Leventhal, 1970). Anger "consists of feelings of displeasure, high arousal, and dominance" (Russell & Mehrabian, 1974, p. 79). Anger activates retributive behavior (Nabi, 2002). Message recipients who experience message-induced anger tend to engage in critical thinking and are more influenced by argument quality (Chaiken, 1987; Nabi, 2002; Petty & Cacioppo, 1986). Anger does not necessarily lead to defensive processing (Dillard, Plotnick, Godbold, Freimuth, & Edgar, 1996; Gault & Sabini, 2000). Mixing different negative emotions together may attenuate the real impact of self-affirmation in reducing defensiveness. Future studies need to differentiate negative emotions that have different cognitive appraisals and action tendencies when examining self-affirmation's impact in reducing negative emotions or negative emotions' mediating role in the self-affirmation process.

Mediation Relationship Between the 11 Outcome Variables

Theoretically, there is a mediation relationship between the 11 indicators of defensive responses to self-relevant threatening health messages. However, neither the original empirical studies included in this meta-analysis nor the existing meta-analyses (Epton et al., 2015; Sweeney & Moyer, 2015) systematically examine the mediation relationship between the 11 indicators, which did not practice what theories preach. Instead of hypothesizing a direct causal relationship between self-affirmation intervention

and the indicators of defensive responses, the present study hypothesizes a mediation model, in which self-affirmation influences the mediator variable (e.g., PME) that in turn influences another indicator of defensive responses (i.e., perceived severity, perceived susceptibility, self-efficacy, response efficacy, attitudes, and perceived norms; see Figure 1). Thus, if there is a linear relationship between the indicators, the total effect of self-affirmation on an indicator (e.g., perceived severity) should be equal to the sum of the direct effect (i.e., the extent to which perceived severity changes when participants are self-affirmed and PME is held constant) and the indirect effect [i.e., the extent to which perceived severity changes when the impact of self-affirmation is held constant and the PME changes by the amount it would have changed had self-affirmation been administered (Baron & Kenny, 1986; Preacher & Kelley, 2011)]. However, previous meta-analyses interpret the impact of self-affirmation on each of these indicators based on the direct effect of self-affirmation instead of the sum of direct effect and indirect effect, which may underestimate the impact of self-affirmation in reducing defensive responses to threatening health messages.

One possible reason that the studies included in the meta-analysis neither examine the complete mediation relationship among the 11 defensive outcome variables nor identify mediation relationship as hypothesized (e.g., Barkoukis, Lazarus, & Harris, 2013; Harris & Napper, 2005) is that the studies do not have enough statistical power to test and detect mediation (Fritz & MacKinnon, 2007). According to Fritz and MacKinnon's (2007) guidelines on the sample size in mediation testing, if using Baron & Kenny's (1986) mediation test method, researchers want to test the mediating role of

intentions between attitudes and behaviors, under the hypothetical scenario that the effect size of attitudes' impact on intentions is medium, and that of intentions' impact on behaviors is small, researchers need at least 405 study participants to maintain a power of 0.8 (Fritz & MacKinnon). However, the majority of the studies included in the present meta-analysis were under-powered, with 20 studies having a sample size of fewer than 100; 19 studies having a sample size between 100 and 200; and eight studies with sizes between 300 and 400. Five studies' sample sizes were more than 400, however, none of these studies tested the mediation relationship. Future studies may consider testing mediating relationship among the variety of defensive outcome variables at the stage of study design and adjusting recruitment of participants accordingly.

Limitations and Future Research Direction

The present meta-analysis identifies some limitations and provides some insights about future self-affirmation research in health communication area. One limitation is that the present study does not include clinical trials with self-affirmation intervention. To date, health communication researchers use either values or desirable traits as the self-affirmation domain without justifying why they chose one over the other. Choice of a self-affirmation domain should not be random. Self-affirmation is generated through self-construal and continuous interactions with environments (Cohen & Sherman, 2014). Different populations have remarkably different self-construal and interactions with their environments, which lead to the fact that a self-affirmation domain that is effective for one population may not be effective for another. The majority of the study populations in our sample are college students. Researchers may consider conducting pilot tests in future

investigations to explore which self-affirmation domain works best for their specific target population. More research attention needs to be paid to the vulnerable population (e.g., population with lower socioeconomic status) who are most likely to suffer from health care disparities (Betancourt, Green, Carrillo, & Ananeh-Firempong, 2003).

The second limitation is that the present study does not examine or rate the threat level of health messages. It is highly relevant because when health information is too threatening, current self-affirmation may not be effective enough to restore self-integrity that is threatened by health messages. Conversely, when health information is not threatening enough, self-affirmation will not be effective, either (Harris & Napper, 2005). To meta-analyze the threat level of health messages, I need to extract the full health messages from the original studies. A short summary or description of the health message in the methods section does not suffice. However, a majority of the studies did not attach their original health messages. It would be beneficial for future studies to fully demonstrate their message stimuli for more meaningful investigation of self-affirmation's impact.

The third limitation is that the present meta-analysis does not examine the duration of behavior. The present meta-analysis includes behavior measured immediately post-test or at a one-week follow-up. Whether self-affirmation's effects are durable is of both theoretical and practical importance. Theoretically, self-affirmation can exert its adaptive potential over a relatively long period (Cohen & Sherman, 2014). Furthermore, greater initial behavior is positively associated with more changes in the long run (Jeffery, Wing, and Mayer, 1998). Empirical evidence shows that behavior can be

sustained at the one-month follow-up (Armitage et al., 2011), among high-risk groups (Harris & Napper, 2005), or among participants with strong involvement of health issues (Pietersma & Dijstra, 2011). Although mixed effects were detected at the six-month follow-up (Epton et al., 2014; Klein et al., 2010), we could expect more behavior in the long run if we expose participants to the health messages repeatedly (Zhao et al., 2012). As more empirical evidence about the long-term behavior is available, future meta-analytic review can further examine the duration of behavior and attrition of self-affirmation's impact.

The findings of the present study suggest that self-affirmation is an effective intervention strategy in changing a variety of health behavioral intentions or health behaviors. However, it is disappointing that self-affirmation strategy has not yet been integrated in designing large-scale media health campaign messages. It is crucial to note that self-affirmation is a psychological intervention that is easily implemented (Cohen & Sherman, 2014; Jessop et al., 2009; Zhao & Nan, 2010). Thus, it is feasible to embed self-affirmation in the beginning of a media campaign message to remind target audience of their most important values or most desirable personal traits (Jessop et al., 2009; Zhao & Nan, 2010). For example, if health professionals want to promote cervical cancer screening among married women, they might consider designing health messages by including verbal and/or visual cues of the target audiences' important values and characteristics (e.g., "You are a caring mom. You have done a great job of taking care of your family members. Now it's time to take care of youself. Please take a minute to know more about cervical cancer screening"), before introducing health risks of cervical cancer

and recommendations of cervical cancer prevention. The target audience (i.e., married women) may be self-affirmed on an important aspect of their self-integrity (i.e., relationship with their family members or their desirable traits, such as “caring,” “patient,” and “diligent”). Importantly, the effectiveness of such self-affirmation intervention in media campaigns needs to be corroborated by empirical examination.

Conclusion

In conclusion, the present study lends empirical support to self-affirmation as an effective intervention strategy to reduce defensiveness to threatening health messages. It also raises several intriguing research questions and fruitful avenues for future exploration. Moderator analysis further offers the promising information that self-affirmation works particularly well under certain circumstances with median to large effect sizes (Cohen, 1988). It would be beneficial to refine and further test the effectiveness of different self-affirmation domains across different populations and settings. Based on existing empirical evidence, the mechanism of the self-affirmation process is largely still unknown, and awaits future exploration.

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Appendix A

Self-Affirmation Meta-Analysis: Coding Protocol

Begin coding:

Step 1: Bibliographic Information

Record the study title; publication year; authors' last names, academic affiliation of the first author, (i.e., communication, psychology, public health/medical school, or other) and country where the research was conducted (i.e., United States).

Note: For articles that contain two or more studies, you need to identify and record all the above information from all qualified studies.

If one article contained more than one study, differentiate the studies with Study 1, Study 2 and so forth, in front of the study title.

Step 2: Study Population Information

Record sample size, participants' mean age, race, sex, and occupation. Also record rewards/compensation type (i.e., whether participants were rewarded by extra course credit, fulfilling research or class requirement, cash/lottery/gift card, or the combination of extra credit and cash).

Note: Record the mean age (e.g., 21. 34) and the standard deviation (e.g., SD=3.5). Record all available information about race (e.g., the percentage of each race in the total population). Record all available information about sex (e.g., how many participants were women or men).

Step 3: Self-affirmation Domain

Scan the "Abstract" section and "Method" section (particularly the "Procedure" part) of each qualified study, and record which self-affirmation domain the study used.

Step 4: Health Topics

Scan the "Abstract" section and "Method" section (particularly "Health Message" part) of each qualified study, and record which health topic the study was about. The behavior written in the study (e.g., alcohol consumption) should be recorded. There are two categories of health topics: (1.) cessation of unhealthy behaviors (e.g., smoking cessation), and (2.) promotion of healthy behaviors (e.g., increase fruit and vegetable consumption). Also record the category to which the behavior belongs (e.g., alcohol consumption belongs to "cessation behavior").

Step 5: Self-relevance Levels

Scan the “Abstract” section and “Method” section (particularly “Participants” or “Recruitment” part) of each qualified study, and identify if there is information about self-relevance. Oftentimes, the studies use “health risk” to refer to the same construct self-relevance indicates. For example, the more alcohol individuals drink (i.e., heavy drinkers), the higher the self-relevance they have.

Information Extraction for Effect Size Calculation

Step 6: Sample Size

For sample size, record the actual number of participants who were assigned to the self-affirmation condition or control condition. Next to the column for total sample size, there are two columns for the sample size in the self-affirmation condition and control condition, respectively.

If there is more than one method (domain) of self-affirmation, the additional column is for the sample size in the second self-affirmation condition.

For articles that have follow-up studies, if there was attrition in the study population, record the actual number of participants that answered the follow-up questions.

Step 7: Mean of Outcome Variables

For the 11 outcome variables, if it was measured, record the mean of that variable. If it was not measured, record “NA” in that cell. If the variable was measured but the mean value was not reported, please go to Step 10.

Note: First, please refer to Table 2 to check the definition and operationalization of each outcome variable. Outcome variables may have different labels but have essentially the same operationalization. Therefore, it is important to check definition and operationalization of each outcome variable in the present meta-analysis. When the label of an outcome variable is different, you need to check and decide whether the outcome variable has essentially the same operationalization as one of the 11 outcome variables in Table 2.

Step 8: Standard Deviation of Outcome Variables

For the 11 outcome variables, if it was measured, record the mean of that variable. If it was not measured, record “NA” in that cell.

Step 9: F-value, correlation coefficient, and/or t-value

For the 11 outcome variables, if it was measured, record the F-value, correlation coefficient, and/or t-value of that variable. If it was not measured, record “NA” in that cell.