THE POWER OF SAYING "I'M SORRY":
THE INFLUENCE OF APOLOGIES ON OFFENDERS' HEALTH BEHAVIORS AND CARDIOVASCULAR STRESS REACTIVITY AND RECOVERY

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Hurting others can lead to several undesirable consequences, including an increase in offenders' negative emotions (e.g., guilt and shame) and damage to their social relationships. Because negative emotions and strained social relationships may confer risk for cardiovascular disease, I reasoned that hurting others—especially if done repeatedly—might affect behavioral and biological correlates of cardiovascular health. Importantly, offenders can apologize to their victim to attenuate the negative consequences of their actions. Consequently, apologies may decrease negative emotions and repair one's relationship with the victim. On this basis, I tested whether offering an apology might influence offenders' behavioral and biological correlates of cardiovascular health. I focused on offenders' health behaviors and cardiovascular stress reactivity and recovery and tested whether apologizing (compared to ruminating and control) influenced these outcomes directly as well as indirectly through negative emotions and perceived forgiveness from their victim. Three studies (N = 1,046) yielded limited support for my predictions. Specifically, while Study 1 found that apologizing (vs. the comparison conditions) indirectly improved offenders' intended health behaviors by decreasing their feelings of shame, Studies 2 and 3 did not replicate this effect for intended or actual health behaviors. Regarding cardiovascular reactivity and recovery, Study 3 showed that while apologizing sometimes led to presumably beneficial patterns of autonomic activity compared to rumination (e.g., significantly

better heart rate recovery), it did not lead to any presumably beneficial patterns of autonomic activity compared to self-distraction and sometimes even led to worse such patterns compared to self-distraction (e.g., marginally poorer systolic blood pressure recovery). Implications for studying apologies' potential influence on offenders' behavioral and biological correlates of cardiovascular risk are discussed, as are potential limitations in the current methodology and plausible boundary conditions that might moderate the potential effect of apologizing on these outcomes.

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1.0 INTRODUCTION

Whether intentionally or not, we sometimes hurt people we love and care about. A person might, for example, lie to a spouse, forget to wish a parent a happy birthday, or refuse to help a friend during a difficult time. Such *interpersonal offenses*—instances in which we hurt or cause problems for another person—are among the top ten things that we tend to regret most at the end of life (Newall, Chipperfield, Daniels, Hladkyj, & Perry, 2009). Yet, we also appear to commit offenses frequently, with participants in previous research reporting hurting others at an average rate of nearly once a day (Schumann & Ross, 2010; also see Schumann & Dweck, 2014).

Hurting others and not resolving these offenses might have important consequences for offenders' health outcomes, including their cardiovascular risk. As previous research has shown, most people exhibit increases in blood pressure and heart rate during and after negative social interactions (Brondolo et al., 1999; 2003; Nealey-Moore, Smith, Uchino, Hawkins, & Olson-Cerny, 2007; Robles & Kiecolt-Glaser, 2003; Smith et al., 2009) and recurring or unresolved negative interactions including interpersonal offenses predict greater risk for premature hypertension via behavioral and biological pathways (Schoenthaler, Schwartz, Cassells, Tobin, & Brondolo, 2010; Sneed & Cohen, 2014).

Hurting others and not resolving these offenses might increase cardiovascular risk because doing so may increase two prospective risk factors for cardiovascular disease (CVD): the persistent experience of negative emotions (DeSteno, Gross, & Kubzansky, 2013; Krantz &

McCeney, 2002; Matthews, 2005) and reductions in diverse, supportive social relationships (Angerer et al., 2000; Hemingway & Marmot, 1999; Kawachi et al., 1996; Kop et al., 2005; Kreibig, Whooley, & Ross, 2014; Orth-Gomér et al., 1993; Reed et al., 1987; Sneed & Cohen, 2014; Wang et al., 2005). Indeed, hurting others can lead offenders to experience negative emotions about themselves and their actions (Fisher & Exline, 2010; Woodyatt & Wenzel, 2013a). It can also damage their social relationships and undermine the strength and structure of their broader social networks by reducing feelings of closeness with their victim, increasing victims' feelings of distrust and resentment toward them (Exline, Deshea, & Holeman, 2007; Gottman & Levenson, 1992; Johnson et al., 2004; Karremans & Van Lange, 2004; Kaye, 1991; Sias, Heath, Perry, Silva, & Fix, 2004), and leading people other than the victim to disapprove of them and their actions (Baumeister, Heatherton, & Tice, 1994; Fehr et al., 2010; Shnabel & Nadler, 2008; Shnabel et al., 2009; Woodyatt & Wenzel, 2013b).

Although the mechanisms underlying these associations between negative emotions, damaged social relationships, and cardiovascular risk are not completely understood, it is possible that experiencing negative emotions about one's actions and one's damaged social relationships might undermine offenders' motivation to care for themselves by engaging in healthful behaviors and might instead lead them to engage in risky health behaviors as a way to regulate their emotions—thus increasing their cardiovascular risk indirectly—as well as lead to adverse changes in intermediate cardiovascular physiology—thus increasing their cardiovascular risk directly. This suggests that reducing offenders' negative emotions and restoring their social relationships might decrease some of their correlates for CVD risk by leading to intermediate changes in behavior and physiology.

Following interpersonal offenses, then, how do individuals reduce their negative

emotions and repair their relationships? Further, what impact might this reduction and repair have on their cardiovascular risk? In the present research, I focused on the impact of apologies because previous research has consistently shown that offering an apology is one of the most effective ways in which offenders can reduce their negative emotions and repair their relationships (Exline et al., 2011; Fisher & Exline, 2007; Obhuchi, Kameda, & Agarie, 1989). Although a growing amount of research has tested the impact of apologies on victims' cardiovascular risk correlates (e.g., Anderson et al., 2006; Whited et al., 2010), little attention has been devoted to such correlates for offenders. As such, the present research is among the first to test whether apologizing can affect some of offenders' behavioral and biological correlates of cardiovascular risk and the first to test psychological pathways through which it may exert these effects.

1.1 THE POWER OF APOLOGIES: NEGATIVE EMOTION REDUCTION AND RELATIONSHIP REPAIR

Hurting others is associated with and leads to the experience of several negative emotions and, especially, guilt and shame (Hall & Fincham, 2008; McGraw, 1987; Smith, Webster, Parrott & Eyre, 2002; Tangney, Miller, Flicker, & Barlow, 1996; Witvliet, Bauer, & Ludwig, 2002). Whereas guilt arises from the belief that one's behavior was flawed, shame arises from the belief that one is a flawed person (Lewis, 1971; Tangney & Dearing, 2003; Tangney & Tracy, 2011). Offering an apology is one of the most effective ways in which offenders can decrease guilt and shame (Carpenter, Carlisle, & Tsang, 2014; Meek, Albright, & McMinn, 1995; Witvliet et al., 2002; Witvliet, Hinman, Exline, & Brandt, 2011), likely because it allows offenders to repair

their actions—thus decreasing guilt—and reaffirms offenders' commitment to the values they broke and reestablishes their moral character—thus decreasing shame (Barkan & Karn, 2006; Ohtsubo & Watanabe, 2009).

Apologizing also facilitates reconciliation between offenders and their victim (Exline et al., 2007; Fehr, Gelfand, & Nag, 2010; Obhuchi et al., 1989; Schumann, 2012) and increases the likelihood that offenders will receive forgiveness (Baumeister et al., 1995; Darby & Schlenker, 1982; Dobash & Dobash, 1984; McCullough, Worthington, & Rachal, 1997; Ohbuchi et al., 1989; Schumann, 2012; Takaku, Weiner, & Ohbuchi, 2001; Zechmeister & Romero, 2002). This is likely because apologizing increases victims' empathy for their offender (Barkat, 2002; McCullough et al., 1997) and leads them to view their offender more positively (Darby & Schlenker, 1989; Hareli & Eisikovits, 2006; Hodgins & Liebeskind, 2003), since presumably only sincere offenders would be willing to suffer the personal consequences of apologizing (e.g., admitting that they are the kind of person who has inflicted pain upon others; Ohtsubo et al., 2012; Ohtsubo & Watanabe, 2009). Receiving forgiveness is beneficial (Holmes & Murray, 1996), as it is associated with restored feelings of closeness (Tsang, McCullough, & Fincham, 2006) and relationship-facilitating behaviors, including cooperation and willingness to prioritize the needs of the relationship over one's personal needs (Karremans & Van Lange, 2004; Weiner, Graham, Peter, & Zmuidinas, 1991). Importantly, receiving forgiveness decreases offenders' guilt and shame above and beyond offering an apology (Witvliet et al., 2002).

Because an apology can attenuate two correlates of CVD vulnerability—negative emotions and damaged social relationships—it might also relate to behavioral and biological aspects of offenders' cardiovascular risk status, namely their health behaviors and their cardiovascular stress reactivity and recovery. Across three experiments, I tested the potential

effects of a brief apology intervention on these variables, as health behaviors and cardiovascular reactivity and recovery have all reliably been associated with future cardiovascular risk (Chida & Steptoe, 2010; Pearson et al., 2002). Figure 1 summarizes the theoretical model I tested in these experiments. In short, I predicted that apologizing would decrease offenders' negative emotions directly and also indirectly by increasing their perceived forgiveness from their victim. The experience of negative emotions about one's actions may undermine people's engagement in healthful behaviors (Webb, Hirsch, Visser, & Brewer, 2013) and lead to adverse changes in cardiovascular physiology (Herrald & Tomaka, 2002). I therefore predicted that apologizing, by decreasing offenders' negative emotions, would increase their motivation to engage in self-care and thus positively influence their health behaviors, as well as decrease their cardiovascular reactivity and recovery.

It should be acknowledged that instead of apologizing, offenders may also choose to respond defensively by justifying their behavior, minimizing responsibility, and/or downplaying the harm they caused (Fisher & Exline, 2010; Schumann, 2014). It is possible that such defensive responses might temporarily reduce offenders' guilt and shame about their actions by deflecting responsibility, suggesting that an apology might not offer socio-emotional benefits that extend beyond a defensive response. Yet, available evidence suggests otherwise, with prospective studies finding that defensiveness can negatively impact offenders' relationships by increasing negative affect and hostility over time (Gottman & Krokoff, 1989; Gottman & Silver, 1999; Jacobson & Margolin, 1994) and reducing feelings of empathy toward one's victim (Woodyatt & Wenzel, 2013a; 2013b). These findings imply that defensiveness may harm offenders' relationships in important ways. For example, feeling empathetic is essential for building and maintaining close relationships, because it facilitates several prosocial and relationship-

maintaining behaviors, including helping and forgiving (McCullough et al., 1997). Importantly, engaging in defensive responses and withholding an apology reduces the likelihood of reconciliation between victim and offender (Obhuchi et al., 1989). Because of these differential consequences associated with defensiveness versus apology, it seems unlikely that the outcomes proposed in this paper, that is improved health behaviors and cardiovascular function, would also apply to offenders who respond defensively.

1.2 THE POTENTIAL IMPACT OF APOLOGIES ON OFFENDERS' CARDIOVASCULAR HEALTH

A major cause of CVD is atherosclerosis, a progressive inflammatory syndrome that changes the endothelial lining of major arteries by promoting accumulation of low-density lipoprotein-cholesterol, foam cells, and cellular waste products, which may become encased by calcium later in the disease process (Demer & Tinut, 2008; Libby, 2002; Ross, 1995). This gradually restricts blood flow due to vessel blockage and can result in acute occlusion of blood flow because of the vulnerability of atherosclerotic plaques to rupture or to becoming emboli (Libby, 2001). The process of atherogenesis happens over many years and progresses from silent, preclinical changes in arterial morphology and function that lead to clinical CVD outcomes, such as ischemia, infarction, or stroke (Libby, 2001; 2002).

However, the speed at which preclinical atherosclerosis progresses to clinical outcomes is associated with several risk factors. For instance, epidemiological studies have identified the experience of negative emotions and problems in people's relationships as important sources of risk, showing that people who face problems with regulating negative emotions (Haines, Imeson,

& Meade, 1987; Kawachi et al., 1994; Krantz & McCeney, 2002) and who have fewer and/or less supportive relationships (Angerer, Siebert, Kothny, Mühlbauer, Mudra, & von Schacky, 2000; Berkman, Leo-Summers, & Horwitz, 1992; Berkman & Syme, 1979; Hemingway & Marmot, 1999; Kawachi et al., 1996; Kreibig et al., 2014; Seeman and Syme, 1987; Orth-Gomer et al., 1993; Wang, Mittleman, & Orth-Gomer, 2005) are at greater risk for accelerated progression of preclinical atherosclerosis and development of future clinical CVD outcomes.

While the exact mechanisms remain unclear, it is possible that negative emotions and damaged social relationships might increase some of the known risk factors for the development and progression of atherosclerosis. First, they might lead to changes in people's health behaviors by increasing engagement in lifestyles and diets known to contribute to atherogenesis (see Chambless et al., 1997; D'Agostino et al., 2008; Libby, 2015; Kronmal et al., 2007), including cigarette smoking and consumption of highly palatable foods with high levels of cholesterol and saturated fat.

Second, they might lead to changes in offenders' cardiovascular function. Challenging situations (e.g., situations that can result in negative personal consequences and that require resolution, which can include interpersonal offenses) tend to stimulate the sympathetic-adrenal-medullary axis through brain activation of autonomic responses (Steptoe, Wardle, & Marmot, 2005). Among others, this stimulation results in increased hemodynamic activity during and shortly after the challenging situation compared to a resting state, respectively referred to as increased cardiovascular reactivity and delayed cardiovascular recovery in response to the challenging situation (Chida & Steptoe, 2010; Gianaros & Sheu, 2009; Jennings et al., 2004; Kamarck & Lovallo, 2003). Otherwise healthy individuals who tend to express exaggerated cardiovascular reactivity (especially blood pressure reactivity) and poorer cardiovascular

recovery are at greater prospective risk for hypertension and early atherosclerosis (Jennings et al., 2004; Matthews, Zhu, Tucker, & Whooley, 2006; Chida & Steptoe, 2010; Treiber et al., 2003), potentially because repeated and sustained increases in blood pressure may lead to endothelial damage and vascular remodeling (e.g., arterial stiffness; Gianaros & Sheu, 2009; Ross, 1995).

When offenders have not yet apologized, it is thus possible that the consequences of their unresolved offense, including negative emotions, might increase their sympathetic responses in ways that increase risk, with the physiological changes that occur with frequent negative affective states possibly inducing arterial pathophysiology. Added to this speculation is that offenders tend to ruminate about their unresolved negative actions (Barber et al., 2005; Dixon et al., 2014; Terzino, 2010), which might further contribute to frequent or prolonged large magnitude cardiovascular stress reactions.

1.3 THE POTENTIAL IMPACT OF APOLOGIES ON OFFENDERS' HEALTH BEHAVIORS

Experiencing negative emotions about an offense is associated with less favorable health behaviors (Webb et al., 2013), including disordered eating (Peterson et al., 2016; Watson et al., 2011) and alcohol abuse (Davis et al., 2015; Webb, Robinson, Brower, & Zucker, 2006). Guilt and shame, in particular, appear to be associated with greater disordered eating (Bybee et al., 1996; Sanftner et al., 1995) and substance use (Dearing, Stuewig, & Tangney, 2005; Ianni, Hart, Hibbard, & Carroll, 2010), and targeting guilt and shame through an intervention among recovering alcoholics increased their self-reported ability to abstain from drinking three weeks

later (Scherer, Worthington, Hook, & Campana, 2011).

Guilt and shame might lead offenders to adopt less favorable health behaviors in part because of their potential to promote self-punishment, which is something offenders may opt for especially when they perceive no alternative ways to compensate their victim (see Inbar, Pizarro, Gilovich, & Ariely, 2013; Mauger, Perry, Freeman, & Grove, 1992; Mosher, O'Grady, & Katz, 1980; Nelissen, 2012; Nelissen & Zeelenberg, 2009; Tanaka, Yagi, Komiya, Mifune, & Ohtsubo, 2015). While guilt can increase self-punishment in an attempt to repair one's relationship with the victim by showing remorse, shame can do so in an attempt to repair one's self-concept by showing that one cares about the social norms that were violated (Tanaka et al., 2015). The above studies found that offenders' tendency to self-punish manifested in several ways (e.g., as willingness to undergo physical pain, relinquish one's possessions, or forgo a pleasurable activity), which raises the possibility that guilty and ashamed offenders might also seek to self-punish by engaging in risky health behaviors. Apologizing, then, might decrease guilt and shame and consequently improve offenders' health behaviors.

Apologizing might also influence offenders' health behaviors by restoring their relationship with their victim. As ample research has found, having fewer and/or less supportive relationships is associated with less favorable health behaviors (Cohen & Lemay, 2007; DiMatteo, 2004; Harvey & Alexander, 2012; Lewis and Rook, 1999; Reblin & Uchino, 2008; Uchino, 2006; Umberson, 1987). While social relationships are thought to increase people's motivation to care for themselves by increasing their positive and decreasing their negative emotions (Cohen, 2004; Cohen et al., 2001; Uchino, 2006), relationships can also become stressors, as in the case of social conflict and negative social interactions (Cohen, 2004). Such negative social interactions can then undermine people's health behaviors by increasing their

experience of negative emotions (Uchino et al., 2001; Uchino, 2006; Walen & Lachman, 2000). In this sense, apologizing might decrease offenders' negative emotions and their likely consequences, including self-punishment, by facilitating relationship repair between victim and offender.

1.4 THE POTENTIAL IMPACT OF APOLOGIES ON OFFENDERS' CARDIOVASCULAR REACTIVITY AND RECOVERY

Da Silva, Witvliet, and Riek (2016) recently tested the effects of apologies on cardiovascular stress reactivity.[1] In this study, participants were asked to ruminate about an offense they committed and then to imagine apologizing to their victim. Adjusting for baseline levels, participants' heart rate decreased and high frequency heart rate variability increased while apologizing compared to ruminating, suggesting that apologizing might lead to parasympathetic activation and potentially sympathetic withdrawal.

Although not tested in their study, this effect might have emerged through a decrease in guilt and shame. As previous research has shown, both of these emotions elicit greater cardiovascular reactivity and poorer recovery. Concerning guilt, Gambaro and Rabin (1969) gave participants an opportunity to aggress against a person who had previously frustrated them. Participants who felt guilty (vs. not) for aggressing showed increased blood pressure while aggressing compared to baseline, suggesting an association between guilt and increased cardiovascular reactivity. They also showed a slower decrease in blood pressure after aggressing compared to baseline, suggesting an association between guilt and decreased cardiovascular recovery (see also, Schill, 1972). Concerning shame, Herrald and Tomaka (2002) led participants

to feel ashamed, angry, proud, or neutral. During the emotion-inducing episode, ashamed participants showed as much heart rate reactivity compared to baseline as angry participants and substantially more reactivity than proud and control participants. After the emotion-inducing episode, ashamed participants showed as much delayed recovery as angry participants in heart rate and pre-ejection period, and poorer recovery than proud and control participants, suggesting that feeling ashamed might lead to sympathetic activation and potentially parasympathetic withdrawal. Based on this evidence, it is possible that apologizing might decrease guilt and shame and consequently decrease cardiovascular reactivity and/or accelerate cardiovascular recovery.

Apologizing might also influence offenders' cardiovascular reactivity and recovery by restoring offenders' relationship with their victim. As previous research has shown, both imagined and actual interactions with other people can lead to immediate changes in cardiovascular function, most likely by leading to changes in their emotional state (Cacioppo et al., 2002; Cohen, 2004; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Relevant to the present research, past work has found associations between ambivalent and/or negative social interactions and increased ambulatory blood pressure and heart rate compared to neutral or positive interactions (Brondolo et al., 1993; 2003; Grewen, Girdler, Amico, & Light, 2005; Holt-Lunstad, Birmingham, & Light, 2008; Holt-Lunstad, Uchino, Smith, Olson-Cerny, & Nealy-Moore, 2003; Nealey-Moore et al., 2007; Robles & Kiecolt-Glaser, 2003; Smith et al., 2009). It is possible that apologizing might decrease these effects on offenders' cardiovascular function by decreasing the experience of negative emotions through facilitating relationship repair between victim and offender.

1.5 THE PRESENT RESEARCH

Three experiments tested the effects of a brief apology intervention among people who had hurt another person, regretted doing so, and had not yet apologized on their health behaviors and cardiovascular reactivity and recovery. I chose the regret criterion to ensure that participants experienced at least some negative emotions about their offense, whereas I chose the no-apology criterion to avoid sampling participants who had already successfully apologized and for whom apologizing may therefore no longer be important in terms of their negative emotion reduction and/or relationship repair.

I randomly assigned participants to write an apology to their victim compared to two other conditions and measured their intended and actual health behaviors and their cardiovascular reactivity and recovery, as well as a number of plausible mediators (e.g., negative emotions). Specifically, Study 1 tested the effects of an apology intervention on offenders' intentions to engage in healthful behaviors. Study 2 was similar, but also tested the effects of an apology intervention on offenders' actual health behaviors and their real-world apology behavior at a follow-up session. Finally, Study 3 assessed their cardiovascular reactivity while apologizing and recovery after apologizing during an in-lab session. To measure reactivity and recovery, I collected data on blood pressure and heart rate because previous research using animal models has implicated the role of prolonged and/or exaggerated sympathetic activation in atherogenesis (Manuck, Kaplan, Muldoon, Adams, & Clarkson, 1991) and both blood pressure and heart rate increase in response to sympathetic activation (Cacioppo, Tassinary, & Berntson, 2007). Like Study 2, Study 3 also tested the effects of an apology intervention on offenders' real-world apology behavior at a follow-up session.

In these experiments, I compared the effects of offering an apology to two other

responses that offenders commonly engage in: rumination and self-distraction (see Witvliet et al., 2011). Offenders tend to ruminate about their negative actions, especially when they have not yet been able to resolve them (Barber, Maltby, & Macaskill, 2005; Dixon, Earl, Lutz-Zois, Goodnight, & Peatee, 2014; Terzino, 2010). Unlike apologizing, ruminating tends to prolong the experience of negative emotions (Mor & Winquist, 2002; Rusting & Nolen-Hoeksema, 1998), prolong adverse changes in cardiovascular physiology to acute stressors, and delay their recovery (Glynn, Christenfeld, & Gerin, 2002). Instead of ruminating about their negative actions, offenders sometimes distract themselves from them by, for example, focusing on details from their daily lives (Witvliet et al., 2011). While self-distraction does not help offenders resolve their negative actions, it also does not prolong or exacerbate negative emotions (see Witvliet et al., 2011), suggesting that self-distraction represents an appropriate control condition to apologizing and ruminating.

Regarding health behaviors, I predicted that apologizing would positively influence offenders' intentions to engage in behaviors comprising a healthy lifestyle compared to the other conditions by leading to a decrease in their negative emotions about the offense directly, but also indirectly by increasing their perceived forgiveness from their victim. I expected that this decrease in negative emotions would, in turn, be associated with a decreased tendency to self-punish, which would be associated with better intended and actual health behaviors.

Regarding cardiovascular function, I predicted that apologizing and rumination would similarly increase cardiovascular reactivity compared to distraction, but that apologizing would lead to faster cardiovascular recovery compared to the other conditions. These predictions were based on research showing that offenders tend to experience apologizing as stressful (Leunissen, De Cremer, Van Dijke, & Folmer, 2014). According to this research, offenders believe that

admitting fault will further harm their self-concept and will not be especially effective in repairing their relationship with their victim, thus leading them to experience stress and increased negative emotions before, compared to after, offering an apology. As such, they might experience heightened cardiovascular reactivity while apologizing compared to baseline. Apologies, however, are effective in repairing offenders' self-concept and (perceived) relationship with the victim (Exline et al., 2007; Witvliet et al., 2002; 2011) and offenders tend to feel relief and positive emotional states after, compared to before, apologizing (Leunissen et al., 2014), suggesting that apologizing might improve cardiovascular recovery compared to both rumination and distraction.

Intended sample sizes for each study (300 in Study 1; 600 in Study 2; 150 in Study 3) were determined based on power analyses and considerations about the cost and efficiency of data collection. Specifically, analyses using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) suggested that approximately 159 participants would be needed to detect two of the main effects of interest at a power greater than .80, namely the effects of intervention condition on health behaviors and cardiovascular function. Even though no study to my knowledge has tested the link between apologies and health behaviors, studies on some of the tested mediators and health behaviors— including on the link between negative emotions and health behaviors (Davis et al., 2015; Webb et al., 2013)—suggested a medium effect size. Moreover, the study by Da Silva and colleagues (2016) that tested the effect of apologizing on cardiovascular function found a medium effect size of apologizing on heart rate reactivity. To allow for additional power to test several indirect pathways (e.g., from intervention condition to intended health behaviors through negative emotions), I more than doubled this sample size in Studies 1 and 2. For Study 3, I aimed to recruit a sample of 150 participants, which meets current guidelines recommending at least 50

participants per experimental condition (Simmons, Nelson, & Simonsohn, 2017).

2.0 STUDY 1: APOLOGIES AND INTENTIONS TO ENGAGE IN FAVORABLE HEALTH BEHAVIORS

Study 1 tested whether apologizing for an interpersonal offense improved offenders' intentions to engage in favorable health behaviors. I therefore recruited people who had recently committed an offense and either asked them to write an apology to their victim, ruminate about their offense, or distract themselves by writing about something neutral. As potential mediators of the expected effect of apologies, I measured participants' levels of guilt, shame, and self-punishment as well as their perceived forgiveness from their victim.

2.1 PARTICIPANTS AND EXPERIMENTAL DESIGN

Three hundred and eight participants (162 males, 143 females, 2 participants who identified with a different gender, 1 missing) from the United States completed the study through Amazon's Mechanical Turk for $2. Studies have indicated that participants from Mechanical Turk are more demographically diverse than participants from other convenience samples (e.g., college students), and that data collected through Mechanical Turk are at least as reliable than data collected through more traditional methods (e.g., Buhrmester, Kwang, & Gosling, 2011; Casler, Bickel, & Hackett, 2013; Hauser & Schwarz, 2016). Participants were between 18 and 68 years old (M = 32.45, SD = 9.04) and came from 45 different states. The majority of participants were

born in the United States (*n* = 304), while the remaining were born in China (*n* = 2), Brazil (*n* = 1), and Haiti (*n* = 1). Most participants were Caucasian (*n* = 255), followed by African American (*n* = 22), Asian (*n* = 20), American Indian or Alaskan Native (*n* = 7), and Native Hawaiian or Pacific Islander (*n* = 3). Finally, most participants identified as Christian (*n* = 138), followed by agnostic (*n* = 72), atheist (*n* = 65), something else, with an option to clarify in an open-ended question (*n* = 19), Buddhist (*n* = 6), Jewish (*n* = 5), Muslim (*n* = 1), and Hindu (*n* = 1).

Participants were eligible if they (a) had done something hurtful and/or regrettable to another person within the past 7 days; (b) had not yet apologized to this person; and (c) regretted what they did. Participants answered questions about these eligibility criteria at the beginning of the study and were directed to the end of the study if they did not meet all of these criteria.

2.2 MATERIALS AND PROCEDURES

Participants first answered background questions about their offense (e.g., an open-ended question asking them to describe the offense).[2] They then completed measures of their baseline levels of guilt, shame, self-punishment, and perceived victim forgiveness and were randomly assigned to an intervention condition (apology vs. rumination vs. self-distraction). Next, they completed the same guilt, shame, self-punishment, and perceived victim forgiveness measures for a second time. Finally, they completed a measure of their intended health behaviors and answered demographic questions.

Offense characteristics. Participants provided information about their offense by answering four questions. First, they were asked to describe what they did to the person they hurt, using three sentences or less. They then rated the severity of their offense, using a Likert

scale from 1 (*Not severe at all*) to 7 (*Extremely severe*). They next selected one or more categories that best described their offense (betrayal of trust; infidelity; fight or argument; insult; act of selfishness; physical violence; damage to, or loss of, physical property; failed obligation; rejection or exclusion; ending a relationship; other) and selected what type of relationship they had with the person they offended (friend; romantic partner; work colleague; family member; acquaintance; stranger; other).

Guilt and shame. To assess their guilt and shame, participants completed the State Shame and Guilt Scale (Marschall, Sanftner, & Tangney, 1994). This self-report measure includes ten items, five for each subscale, and was designed to measure state feelings of guilt (e.g., "I feel bad about what I did") and shame (e.g., "I feel like I am a bad person"). I decided to exclude one item from the guilt subscale ("I feel like apologizing, confessing"), because having apologized may inflate the apparent effect of the apology intervention on participants' self-reported guilt by making them more likely to answer this item negatively. Participants were asked to indicate how they felt in this moment on a Likert scale from 1 (*Not feeling this way at all*) to 5 (*Feeling this way very strongly*). I created composite scores by averaging across participants' answers on each subscale (Cronbach's $\alpha_{\text{Guilt pre-intervention}} = .82$; Cronbach's $\alpha_{\text{Guilt post-intervention}} = .87$; Cronbach's $\alpha_{\text{Shame pre-intervention}} = .89$; Cronbach's $\alpha_{\text{Shame post-intervention}} = .92$).

Self-punishment. [3] Next, participants completed the self-punishment subscale from the Differentiated Process Scale of Self-Forgiveness (Woodyatt & Wenzel, 2013a), which was designed to measure offenders' tendency to condemn and resent themselves. The scale includes seven items, including "I want to punish myself for what I have done" and "I deserve to suffer for what I have done". Participants were asked to rate their agreement with these items in this moment on a Likert scale from 1 (*Do not agree at all*) to 7 (*Strongly agree*). Cronbach's $\alpha_{\text{pre-}}$

$_{\text{intervention}}$ = .92 and $_{\text{post-intervention}}$ = .92.

Perceived victim forgiveness. Participants responded to three statements assessing the extent to which they felt they had been forgiven: "I feel that the person I hurt still blames me for what I did to him/her," "I feel that the person I hurt still holds a grudge about what I did to him/her," and "I feel that the person I hurt has forgiven me for what I did to him/her." Participants were asked to indicate their agreement with these items on a Likert scale from 1 (*Do not agree at all*) to 7 (*Strongly agree*). Cronbach's $\alpha_{\text{pre-intervention}}$ = .83 and $_{\text{post-intervention}}$ = .79.

Intervention. Next, participants were randomly assigned to one of three conditions. Participants in the apology condition were asked to: "Please imagine yourself genuinely apologizing to the person that you hurt. In your apology, please say what feels most natural and right to you." I chose not to instruct participants on how to apologize, because offenders' apologies can vary considerably in their quality (e.g., Schumann, 2014) and I did not want to constrain participants by asking them to apologize in a way that felt unnatural. I later asked participants to rate the quality of their own apologies to test if variations in these ratings would, for example, be associated with changes in their intended health behaviors (please see Appendix A for all methods and results pertaining to apology quality).

Participants in the rumination condition were asked to: "Please think back to your offense. Then, describe what it felt like for you to hurt the other person and what it must have felt like for the other person to be hurt. Please also write about the negative consequences the offense has, or may have, on your life as well on the life of the person you hurt." I asked participants to focus on these elements, because these are some of the topics that offenders are thought to ruminate about, and have been included in other rumination manipulations (Witvliet et al., 2011).

Participants in the self-distraction condition were asked to: “Please think about your daily routine and habits. Then, please describe your daily routine and habits in as much detail as you can.” I chose these instructions because offenders are thought to focus on details of their lives to distract themselves from their misdeeds (Witvliet et al., 2011). Moreover, similar instructions for self-distraction have been used by other researchers (McCullough, Root, & Cohen, 2006; Witvliet et al., 2011).

Participants in all conditions were given at least three minutes to complete the intervention (i.e., they were not able to move on from the page until the three minutes had passed), but were encouraged to take as much time as they needed after these three minutes had passed.

Intended health behaviors. Finally, I developed a list of eight items to assess participants’ intended health behaviors. Seven of these referred to modifiable (un)healthful behaviors that are thought to be relevant for people’s cardiovascular health (Ayas et al., 2003; Briasoulis, Agarwal, & Messerli, 2012; Chambless et al., 1997; D’Agostino et al., 2008; Klop, De Rego, & Cabezas, 2013; Kronmal et al., 2007; Rehm, Taylor, & Room, 2006) and one referred to participants’ general intention to take care of the self. Participants indicated the extent to which they intended to engage in these behaviors from now on using a Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*): “Eat a balanced diet,” “Get enough sleep,” “Exercise enough,” “Limit my intake of unhealthy foods,” “Smoke less or not at all (to be answered only if participant smoked regularly or occasionally),” “Take fewer drugs or no drugs at all (to be answered only if participant took drugs regularly or occasionally),” “Drink less alcohol or no alcohol at all (to be answered only if participant drank alcohol regularly or occasionally),” and “Take care of myself.” Cronbach’s α was .81.

2.3 RESULTS

Before performing analyses, I excluded one participant's answers because she did not follow instructions. This participant was in the apology condition and had not answered any of the open ended questions seriously (e.g., instead of describing an offense she committed, she typed an incomprehensible string of words). Pre-intervention correlations, means, and standard deviations are displayed in Table 1, while post-intervention correlations, means, and standard deviations are displayed in Table 2. Descriptive statistics of all variables per intervention condition are displayed in Table 3.

2.3.1 Offense Characteristics.

Participants reported a variety of offenses, including fights or arguments (46.6%), insults (37.8%), acts of selfishness (28.3%), betrayal of trust (24.1%), failing an obligation (17.6%), rejection or exclusion (13.7%), ending a relationship (5.2%), damage to, or loss of, physical property (4.9%), infidelity (3.3%), physical violence (2%), or something else (7%). Offenses ranged considerably in severity (M = 4.84, SD = 1.24, range = 2-7; e.g., low severity: declining invitations to social events; moderate severity: insulting or purposefully ignoring the victim; high severity: being unfaithful or ending a relationship). Most offenses were committed against friends (33.9%), followed by romantic partners (30.6%), family members (25.7%), work colleagues (5.9%), acquaintances (2.6%), and others (1.3%).

2.3.2 Data Analytic Plan

I tested my predictions using a fully saturated structural equation model with observed variables. I dummy-coded participants' intervention condition into two variables and used the apology condition as the comparison condition, resulting in an apology versus rumination and an apology versus self-distraction variable. All analyses reported in this paper involving structural equation modeling were conducted using EQS, version 6.1 (Bentler, 2006).

I assessed potential direct and indirect effects of the intervention condition on intended health behaviors by testing the two dummy-coded intervention variables as predictors of guilt and shame. I tested guilt and shame, in turn, as predictors of self-punishment, which I then tested as a predictor of participants' intended health behaviors. I also tested the two dummy-coded intervention variables as predictors of perceived victim forgiveness, which I then tested as a predictor of guilt and shame, subsequent self-punishment, and intended health behaviors.

In these analyses, I controlled for pre-intervention levels of guilt, shame, self-punishment, and perceived victim forgiveness, as well as for all preceding variables in the model (e.g., when testing the association between guilt and self-punishment, I controlled for pre-intervention guilt, shame, punishment, and perceived victim forgiveness, as well as for apology versus rumination, apology versus distraction, and post-intervention perceived victim forgiveness). Doing so leads the unstandardized coefficients at post-intervention to represent residualized change, that is, the effect of one variable (e.g., intervention condition) on changes in an outcome variable (e.g., guilt; Newsom, 2015). I also allowed the two predictor variables (apology vs. rumination and apology vs. distraction) and all control variables (pre-intervention guilt, shame, self-punishment, and perceived victim forgiveness) to covary (see Kaplan, 2009). Finally, I also allowed the residuals of post-intervention guilt and shame to covary, because of

their typically high correlation (Tangney et al., 1996). Despite their high correlation ($r_{\text{post-intervention}}$ = .70 in this study), these emotions can lead to differential outcomes (Tangney et al., 1996), suggesting that shame might be associated with self-punishment to a larger extent than guilt, or vice versa. The sample variance-covariance matrix is displayed in Table 4.

The normalized estimate of Mardia's coefficient indicated substantial deviations from normality (z = 8.43, p < .001). I therefore used scaled maximum likelihood estimators corrected for non-normality to interpret the results of the analyses reported below (Satorra & Bentler, 1988). The results of the tested model are displayed in Figure 2. Supplementary analyses of the data are reported in Appendix A.

2.3.3 The Effect of Intervention Condition on Intended Health Behaviors.

Apologizing did not have a total effect on intended health behaviors compared to rumination (B = −.12, z = -.94, p = .35) or self-distraction (B = .12, z = 1.19, p = .23). However, offering an apology could still influence intended health behaviors indirectly (Hayes, 2013), for example, by reducing offenders' negative emotions.

Indeed, apologizing led to greater guilt reduction compared to rumination (B = .50, z = 6.39, p < .001) but not compared to self-distraction (B = .12, z = 1.33, p = .18). Apologizing also led to greater shame reduction compared to both rumination (B = .52, z = 6.13, p < .001) and self-distraction (B = .21, z = 2.57, p = .01). Further, apologizing marginally increased perceived victim forgiveness compared to rumination (B = -.20, z = -1.76, p = .08), but did not influence perceived victim forgiveness compared to self-distraction (B = .04, z = .37, p = .71). Perceived victim forgiveness, in turn, was associated with marginally lower guilt (B = -.10, z = -1.94, p = .05), but was not associated with shame (B = -.05, z = -1.19, p = .23).

Guilt was associated with marginally greater self-punishment (B = .20, z = 1.93, p = .05) and shame was associated with significantly greater self-punishment (B = .47, z = 5.22, p < .001). Perceived victim forgiveness was not associated with self-punishment independently from guilt and shame (B = -.09, z = -1.49, p = 14), and intervention condition did not have independent effects on self-punishment ($B_{\text{Apology versus Rumination}}$ = -.06, z = -.60, p = .55; $B_{\text{Apology versus Self-Distraction}}$ = -.04, z = -.41, p = .68)

Self-punishment was not associated with intended health behaviors (B = -.04, z = -.62, p = .54). However, shame was independently associated with poorer intended health behaviors (B = -.28, z = -3.36, p = .001), while guilt (B = .09, z = 1.21, p = .23) and perceived victim forgiveness (B = .003, z = .05, p = .96) did not have independent associations with intended health behaviors.

The indirect effects from intervention condition to intended health behaviors were each assessed through 95% bootstrapped confidence intervals based on 1,000 samples and mirrored the above findings. Specifically, apologizing indirectly improved offenders' intended health behaviors by decreasing their shame compared to both rumination (indirect effect = -.1438; 95% CI [-.2583, -.0477]) and self-distraction (indirect effect = -.0573; 95% CI [-.1288, -.0074]). There was no evidence for any other indirect effect from apologizing to intended health behaviors; all remaining indirect effects ranged from [.00012] to [.0098] and contained the value zero in their confidence intervals. After controlling for all tested mediators, apologizing did not influence intended health behaviors compared to rumination (B = -.01, z = -.06, p = .95), but led to marginally worse intended health behaviors compared to self-distraction (B = .17, z = 1.84, p = .07).

2.4 DISCUSSION

Study 1 tested whether apologizing (vs. ruminating or self-distracting) improved offenders' intentions to engage in healthful behaviors and if it did so by decreasing their negative emotions (either directly or through increases in perceived victim forgiveness) and subsequently decreasing their tendency to self-punish. The findings were in line with several of my predictions, showing that apologizing decreased guilt compared to rumination and decreased shame compared to rumination and self-distraction. Importantly, apologizing indirectly improved offenders' intentions to engage in healthful behaviors by decreasing their shame, suggesting that offering an apology might have benefits for offenders' intended, and potentially actual, health behaviors. The findings of Study 1 also supplement previous research showing that apologizing decreases offenders' guilt and shame (Carpenter et al., 2014; Meek et al., 1995; Witvliet et al., 2002; 2011) and that low guilt and shame are associated with a reduced tendency to self-punish (Inbar et al., 2013; Mosher et al., 1980; Nelissen & Zeelenberg, 2009; Tanaka et al., 2015).

Although I anticipated that reductions in guilt and shame would be associated with better intentions to engage in healthful behaviors through a decrease in self-punishment, I found no evidence for this prediction. Indeed, the only variable that was associated with changes in intended health behaviors was shame. This raises two important questions: first, why it was shame, but not guilt, that was associated with changes in intended health behaviors and second, why shame was associated with intended health behaviors, if not through self-punishment.

Regarding the first question, researchers have suggested that shame is more likely to lead to maladaptive outcomes than guilt. This is because shame's focus on a flawed self as opposed to a flawed behavior tends to lead people to feel worthless, undeserving, and small, and is therefore especially overwhelming and difficult to regulate (Dearing et al., 2005; Lewis, 1971; Tangney &

Dearing, 2002). Indeed, while negative emotions in general have been linked to engagement in unhealthful behaviors (Kassel, Stroud, & Paronis, 2003; Khantzian, 1997; Scherer et al., 2011; Webb et al., 2006), shame in particular has been linked to engagement in such behaviors, including disordered eating (Sanfter et al., 1995) and intake of alcohol and drugs (Dearing et al., 2005; Ianni et al., 2010).

Regarding the second question, as an especially overwhelming negative emotion, shame might interfere with offenders' intended health behaviors by decreasing their ability to constructively regulate this negative emotion (Gratz & Roemer, 2004; Gross & Thompson, 2007). Difficulty regulating negative emotions has indeed been linked to several unhealthful behaviors, including consumption of highly palatable foods, disordered eating, and drug abuse (e.g., Baer, Fischer, & Huss, 2006; Fox, Axelrod, Paliwal, Sleeper, & Sinha, 2007). Shame, in particular, might decrease offenders' ability to control their impulses and lead them to engage in pleasurable behaviors in an attempt to down-regulate uncomfortable feelings of shame, despite their harmful health-relevant consequences (e.g., increased consumption of alcohol and drugs; see Dearing et al., 2005; Ianni et al., 2010). Shame might also consume some of the cognitive resources that are necessary to carry out certain health-relevant behaviors, such as planning to prepare a meal or scheduling time for physical exercise (see Sabag-Cohen, 2009; Tangney, Baumeister, & Boone, 2004). Indeed, while both guilt and shame lead to decreases in working memory (suggesting that their experience uses available cognitive resources), shame's impact on working memory is more severe (Cavalera & Pepe, 2014). Alternatively, shame might decrease offenders' belief that they are deserving of good outcomes, such as proper self-care, by leading to decreases in two variables that have previously been associated with favorable health behaviors (see Fisher & Exline, 2010): self-esteem and self-forgiveness (e.g., McGee &

Williams, 2000; Webb et al., 2006).

In Study 1, I also found some evidence suggesting that apologies facilitated offenders' perceived relationship with the victim, in that offering an apology marginally increased perceived forgiveness from one's victim compared to ruminating. Contrary to expectations, perceived forgiveness was not associated with changes in intended health behaviors, either directly or through a reduction in negative emotions. It is possible that imagining receiving forgiveness may not matter as much for offenders' intentions to engage in healthful behaviors as actually receiving forgiveness. In fact, this study suffered from an important methodological limitation: because offenders did not deliver their apology to their victim, the victim did not have an opportunity to actually forgive them. It is also possible that perceived forgiveness was not the most suitable mediator to explain the anticipated effect of apologizing on offenders' intended health behaviors. Previous research that found connections between interpersonal relationships and health behaviors assessed broader indicators of the health of people's social networks rather than the health of a single relationship, including perceived social support—the expectation that one will receive help and support from others in times of need (e.g., Harvey & Alexander, 2012; Reblin & Uchino, 2008). Thus, an interpersonal pathway from apologies to (intended) health behaviors may still exist, yet this study may not be equipped to detect it because of the methodology employed.

Study 1 had several other limitations, including that it remains unclear whether the observed benefits of the apology intervention in this study can be attributed to the psychological experience of apologizing. It is also possible, for instance, that these effects can merely be attributed to writing about one's hurtful behavior, without the intent to communicate one's thoughts and feelings about the offense to the victim. As much previous research has shown,

such expressive writing about one's thoughts and feelings about distressing situations, including interpersonal offenses one committed, has consequences for variables relevant to the present research, including decreased negative emotion and improved physical health outcomes (see Pennebaker, 1993; 1997; 2012). It is therefore important to emphasize the interpersonal apology component of the intervention and render it more realistic, for example, by asking offenders to write an apology that they will actually deliver to their victim.

Another limitation of this study was that it only measured offenders' intentions to engage in healthful behaviors. Since previous research has found small to moderate correlations between intended and actual health behaviors (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011), it remains unclear whether apologizing might also influence offenders' actual health behaviors.

A final limitation is that the self-distraction condition might not have been truly neutral and might thus have impeded my ability to detect significant differences between the apology condition and the control condition. As a recent meta-analysis found, self-distraction decreases people's negative emotions in response to upsetting events (Webb, Miles, & Sheeran, 2012). This might explain, perhaps, why the apology condition did not significantly decrease guilt compared to the self-distraction condition. Additional data analyses indeed revealed that both the apology and self-distraction condition decreased participants' guilt from pre-intervention to post-intervention. The apology condition, however, still decreased guilt to a larger extent than the self-distraction condition.

3.0 STUDY 2: APOLOGIES AND ENGAGEMENT IN FAVORABLE HEALTH BEHAVIORS

Study 2 shared the same goals as the preceding study with six changes that addressed the limitations of Study 1. First, it removed the mediators that were tested in Study 1 that did not explain the link between intervention condition and intended health behaviors (i.e., self-punishment and perceived victim forgiveness) and replaced them with other plausible mediators: two facets of emotion regulation (the ability to control one's impulses and to engage in goal-directed behavior despite the presence of negative emotions), state self-esteem, state self-forgiveness, and perceived social support. Second, it attempted to make the apology experience more realistic by having participants in the apology condition falsely believe that they would deliver their apology at the end of the study (as in Schumann & Orehek, 2017). Third, it measured offenders' actual health behaviors during a one-week follow-up. Fourth, it replaced the self-distraction condition with a neutral, no-task, condition. Fifth, it recruited participants who had done something deeply hurtful and/or regrettable to another person anytime in the past to attract offenders for whom apologizing may be especially beneficial, given that this study attempted to influence people's actual behaviors over the course of one week and would likely require a stronger intervention to accomplish this.

Finally, it tested whether apologizing influenced offenders' real-world apology behavior during a one-week follow-up. Offering a real apology can have many beneficial outcomes that

are unlikely to be attained by writing an apology and not delivering it, including greater likelihood of reconciliation between victim and offender (e.g., Fehr et al., 2010). Thus, exploring whether completing a brief apology intervention influences the likelihood of offering a real-world apology may suggest one way to increase offenders' willingness to apologize to their victims. I predicted that the apology condition would increase the likelihood of offering a real apology to one's victim compared to the rumination and control conditions. In support of this prediction, research has previously found that reflecting on possible reparative behaviors, including apologies, increased offenders' likelihood of actually apologizing to their victim during a two-week follow-up (Exline et al., 2011). Moreover, offenders tend to underestimate apologies' positive consequences, such as their potential to decrease negative emotions, and overestimate their negative consequences, such as feeling distressed (Leunissen et al., 2014). Experiencing some of an apology's benefits during the study, such as decreased guilt and shame, might decrease these barriers to offering an apology and increase offenders' willingness to apologize.

3.1 PARTICIPANTS AND EXPERIMENTAL DESIGN

Six hundred and seven participants (308 males, 297 females, 2 participants who identified with a different gender) from the United States completed the initial part of the study (Part 1) through Amazon's Mechanical Turk in exchange for $2. I contacted participants seven days after the completion of Part 1 for an opportunity to participate in a follow-up (Part 2). Three hundred and ninety-nine participants completed Part 2 later in exchange for an additional $1. Participants were between 19 and 88 years old (M = 35.38, SD = 10.78) and came from 43 different states.

Most were born in the United States (*n* = 597), while the remaining were born in China (*n* = 2), India (*n* = 2), the Philippines (*n* = 2), Albania (*n* = 1), Brazil (*n* = 1), Canada (*n* = 1), Cuba (*n* = 1), the Dominican Republic (*n* =1), Germany (*n* = 1), Ghana (*n* = 1), Guyana (*n* =1), the United Kingdom (*n* = 1), and Venezuela (*n* = 1). Regarding race, most participants were Caucasian (*n* = 484), followed by African American (*n* = 70), Asian (*n* = 42), American Indian or Alaskan Native (*n* = 9), and Native Hawaiian or Pacific Islander (*n* = 2). Most participants identified as Christian (*n* = 308), followed by agnostic (*n* = 117), atheist (*n* = 112), something else, with an option to clarify in an open-ended question (*n* = 35), Buddhist (*n* = 16), Jewish (*n* = 9), Hindu (*n* = 6), Muslim (*n* = 3), and Sikh (*n* = 1).

Participants were eligible if they (a) had done something deeply hurtful and/or regrettable to another person; (b) had not yet apologized to this person; and (c) still felt guilt, shame, and regret for what they did. Participants answered questions about these criteria at the beginning of the study and were directed to the end of the study if they did not meet one or more of them.

3.2 MATERIALS AND PROCEDURE

The procedures of Part 1 were similar to those used in Study 1. Participants first answered background questions about their offense. Next, they were randomly assigned to an intervention condition (apology vs. rumination vs. control) and completed measures of their current levels of guilt, shame, emotion regulation, self-esteem, self-forgiveness, and perceived social support. Finally, they completed a measure of their intended health behaviors and answered demographic questions.[4]

One week after completing Part 1, participants received an email inviting them to

complete Part 2 of the study. Participants had a 24-hour timeframe to complete Part 2 and were first asked whether they had apologized to the person they hurt since completing Part 1. They were then asked a number of follow-up questions about their decision to apologize or not. Finally, they completed a number of measures about their health behaviors over the past week.

3.2.1 Part 1.

Offense characteristics. Participants answered the same four questions about their offense as in Study 1, with the addition of the following questions: "How long ago did the offense happen?" (*During the past week/During the past month/During the past three months/During the past six months/During the past year/Longer than a year ago*) and "How close did you feel to the person you hurt at the time that the offense happened?".

Intervention. Participants in the apology condition read the following: "We would now like you to write an email to the person that you hurt. Please use this email to address the offense that you committed against them and to genuinely apologize to them. Please say what feels most natural and right to you, saying whatever it is that you would like to say to them about this event. At the end of the study, we will ask you to log in to your email account and send the email to this person." Participants in the rumination condition were asked to: "Please describe the ways in which your offense harmed the other person and how it may continue to negatively affect him or her now." Participants in the control condition were not asked to do anything and directly moved on to answer the questions below. Participants in the apology and rumination conditions were given at least three minutes to complete the intervention and were encouraged to take as much time as they needed after the three minutes had passed.

Guilt and shame. To assess levels of guilt and shame, participants completed the same

State Shame and Guilt Scale (Marschall et al., 1994) used in Study 1 (Cronbach's α_{Guilt} = .79; Cronbach's α_{Shame} = .90).

Emotion regulation: impulse control. As one measure of emotion regulation, participants completed the Impulse control subscale from the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004). This subscale measures people's ability to refrain from impulsive action when experiencing negative emotions. All items were prefaced by "After thinking about my offense, I now feel as if…" and example items include "I have difficulty controlling my behaviors" and "I am out of control." 7-point Likert scale from *Strongly Disagree* to *Strongly Agree*. Cronbach's alpha was .89.

Emotion regulation: difficulties engaging in goal-directed behavior. As an additional measure of emotion regulation, participants completed the Difficulties engaging in goal-directed behavior subscale from the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004). This subscale measures the ability to concentrate and accomplish tasks when experiencing negative emotions. All items were prefaced by "After thinking about my offense, I now feel as if…" and example items include "I have difficulty focusing on other things" and "I have difficulty getting work done." 7-point Likert scale from *Strongly Disagree* to *Strongly Agree*. Cronbach's alpha was .91.

State self-esteem. To assess their state self-esteem, participants completed an adapted version of the Rosenberg self-esteem scale (Rosenberg, 1965). The scale includes 10 items meant to assess global perceptions of self-esteem. Example items include "I feel that I have a number of good qualities" and "I take a positive attitude toward myself", and all items were prefaced by "After thinking about my offense, …" to measure participants' state (rather than global) self-esteem. Participants indicated their agreement with these items on a 7-point Likert

scale from *Strongly Disagree* to *Strongly Agree* (Cronbach's α = .94).

State self-forgiveness. Participants completed the State Self-Forgiveness Scales (Wohl, DeShea, & Wahkinney, 2008), which is a 17-item measure designed to measure self-forgiving feelings, actions, and beliefs related to a specific offense (e.g., "As I consider what I did that was wrong, I show myself acceptance") on a 7-point Likert scale from *Strongly Disagree* to *Strongly Agree*. Cronbach's alpha was .96.

Perceived social support. To assess perceptions of social support, participants completed the short form, 12-item Interpersonal Support Evaluation List (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). This scale includes three subscales (appraisal, belonging, and tangible social support) that can either be analyzed separately or as a total perceived social support score by averaging across all twelve items (e.g., Merz et al., 2014). Example items include "When I need suggestions on how to deal with a personal problem, I know someone I can turn to" (appraisal), "If I wanted to have lunch with someone, I could easily find someone to join me" (belonging), and "If I was stranded 10 miles from home, there is someone I could call who could come and get me" (tangible). Because I was interested in overall perceptions of social support in this study, I used the total score in the analyses reported below (Cronbach's α = .91).

Intended health behaviors. Finally, participants answered the same questions about their intended health behaviors as in Study 1. Cronbach's alpha was .82.

3.2.2 Part 2.

Apology. Participants were first asked whether they had apologized to the person they hurt since completing the first part of the study (*Yes*/*No*). If they answered "yes", they were asked why they had apologized. Specifically, they rated their agreement with the following statements using a

Likert Scale from 1 (*Completely disagree*) to 7 (*Completely agree*): "To repair my relationship with the other person," "To relieve my own guilt about the offense," "To relieve the pain this person feels because of the offense," "To do the right thing so that I can forgive myself for the offense," and "It just seems like what I should do."

If they answered "no", they were asked why they had not apologized and rated their agreement with the following statements using a Likert Scale from 1 (*Completely disagree*) to 7 (*Completely agree*): "Apologizing wouldn't help repair my relationship with this person," "Apologizing wouldn't help me feel less guilty about the offense," "Apologizing wouldn't help relieve the pain this person feels because of the offense," "Apologizing wouldn't help me forgive myself for the offense," "I did not have an opportunity to apologize," and "Too much time has passed since the offense."

Health behaviors. Participants answered questions about multiple aspects of their health behaviors: general health behaviors, dietary choices, physical exercise, and cigarette smoking. First, they answered the same general, eight questions that I used to measure their intended health behaviors in Part 1 of the study, except they answered them about the past week. For example, instead of indicating whether they were intending to "Eat a balanced diet" from now on, they were asked whether they "Ate a balanced diet" since they had completed Part 1 of the study. As in Part 1, they answered these questions on a Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Cronbach's alpha was .84.

Further, I adapted an existing health behavior measure relevant to cardiovascular health by Lee and Cubbin (2002). This measure consists of several parts and asks participants about their dietary habits, physical exercise, and cigarette smoking behavior.

To assess dietary habits, participants were asked to indicate how often they consumed

specific foods since they had completed Part 1 of the study. The foods were fresh fruits; green salad or raw vegetables; cooked vegetables; fast food (e.g., hamburgers, hot dogs, sausage, pizza); fried foods (e.g., French fries, potato chips); and sugary foods (e.g., cookies, doughnuts, cake, muffins, candy, chocolate). After Lee and Cubin, I scored participants' responses by assigning the first three items a value of "1" if they had been consumed once and a value of "2" if they had been consumed more than once. I assigned the last three items a value of "-1" if they had been consumed once and a value of "-2" if they had been consumed more than once. I assigned items not consumed a value of "0". Then, I summed these values, resulting in a dietary habits score ranging from -6 to 6.

To assess physical exercise, participants were asked to indicate how many times they had participated in any sports or exercise that had made them sweat or breathe harder for at least 20 minutes at a time since they completed Part 1 of the Study.

To assess cigarette smoking behavior, participants were asked on how many of the past seven days they had smoked at least one cigarette. They were also asked approximately how many cigarettes they had smoked during the past seven days. After reviewing participants' responses, I chose to only analyze their responses on the first question, because of a number of outliers on the second question that seemed highly implausible (e.g., 900 cigarettes, which would amount to approximately 140 cigarettes, or seven packs of cigarettes, per day). To be consistent with the other health behavior variables, I recoded participants' responses so that higher values would reflect more desirable health behaviors (i.e., a "0" became a "7" to reflect that the participant had not smoked for seven days).

3.3 RESULTS

One participant completed Part 1 of the study twice. She was assigned to the control condition both times, wrote about the same offense, and her answers on the questionnaires were very similar. I therefore averaged across her answers and included her in the analyses as a single participant. Another participant completed Part 2 twice. He answered all scales similarly and I therefore averaged across his answers and included him in the analyses as a single participant. Two participants completed Part 2 of the study, but I could not match their responses to any responses in Part 1. I therefore dropped these two participants from analyses. Finally, I dropped the responses of six participants for not following instructions. These participants either did not apologize, did not ruminate, or did not describe an offense when asked to do so. Two were in the apology condition, three in the rumination condition, and one in the control condition. Correlations among and descriptive statistics of all continuous variables are displayed in Tables 5 and 6.

3.3.1 Offense Characteristics.

Participants reported a variety of offenses, including betrayal of trust (48.4%), acts of selfishness (25.3%), ending a relationship (23.5%), infidelity (19.5%), insults (16.8%), fights or arguments (14%), rejection or exclusion (13%), failed obligations (12.1%), damage to, or loss of, physical property (4.5%), physical violence (2%), or something else (2.5%). Offenses ranged in severity between 1 (*Not severe at all*) and 7 (*Extremely severe*), with a mean of 5.51 (*SD* = 1.17). Offenses were predominantly committed against people that participants felt fairly close to at the time of the offense (*M* = 4.87, *SD* = 1.76), mainly against friends (36.6%) and romantic partners

(36.6%), followed by family members (15.6%), work colleagues (5.7%), acquaintances (3.8%), strangers (.5%), and others (1.2%).

3.3.2 Data Analytic Plan.

Study 2 had three aims, namely, to test whether the apology intervention (vs. rumination and control) influenced offenders' (1) intended health behaviors immediately after the intervention, (2) actual health behaviors at a one-week follow-up, and (3) real apology behavior at a one-week follow-up. To test these aims, I analyzed the data of Study 2 in a series of steps, each outlined below. Supplementary analyses of the data are reported in Appendix B.

3.3.3 The Effect of Intervention Condition on Intended Health Behaviors.

To test the first aim, I used a fully saturated structural equation model whereby I dummy-coded participants' intervention condition into two variables and used the apology condition as the comparison condition. I then tested for potential indirect effects from intervention condition to intended health behaviors by testing the two dummy-coded intervention variables as predictors of guilt and shame. I tested guilt and shame, in turn, as predictors of emotion regulation, self-esteem, and self-forgiveness, which I then tested as predictors of participants' intended health behaviors. I also tested the two dummy-coded intervention variables as predictors of perceived social support, which I then tested as a predictor of guilt and shame, subsequent emotion regulation, self-esteem, and self-forgiveness, and then intended health behaviors.

In these analyses, I allowed the two dummy-coded intervention condition variables to covary. I also allowed the residuals between self-esteem and self-forgiveness to covary, as these

two variables tend to be positively correlated (Strelan, 2007), and between self-esteem and self-forgiveness and the two emotion regulation variables, as self-esteem has been associated with better emotion regulation (e.g., Gross & John, 2003) and self-forgiveness can be thought of as a form of adaptive emotion regulation (e.g., Da Silva et al., 2016; Enright, 1996).

The normalized estimate of Mardia's coefficient indicated deviations from normality (z = 4.70, $p < .001$) and I therefore used scaled maximum likelihood estimators corrected for non-normality to interpret all results reported below (Satorra & Bentler, 1988). The results of the tested model are displayed in Figure 3 and the variance-covariance matrix is displayed in Table 7.

Apologizing did not have a total effect on intended health behaviors compared to the rumination condition (B = .10, z = 1.24, p = .22), but led to marginally worse intended health behaviors compared to the control condition (B = .16, z = 1.87, p = .06). Apologizing also did not influence guilt ($B_{\text{Apology versus Rumination}}$ = .07, z = .72, p = .47; $B_{\text{Apology versus Control}}$ = .03, z = .36, p = .72), shame ($B_{\text{Apology versus Rumination}}$ = .03, z = .29, p = .77; $B_{\text{Apology versus Control}}$ = .01, z = .11, p = .91), or perceived social support ($B_{\text{Apology versus Rumination}}$ = -.03, z = -.40, p = .69; $B_{\text{Apology versus Control}}$ = -.07, z = -1.08, p = .28) compared to the other conditions. Perceived social support also was not associated with guilt (B = -.03, z = -.62, p = .54), but was associated with decreased shame (B = -.28, z = -3.92, $p < .001$).

Guilt was associated with better impulse control (B = .24, z = 3.76, $p < .001$), was not associated with difficulty engaging in goal-directed behavior (B = .02, z = .22, p = .83) or self-esteem (B = .08, z = 1.17, p = .24), and was associated with decreased self-forgiveness (B = -.19, z = -2.77, p = .01). Shame was associated with poorer impulse control (B = -.72, z = 12.44, $p <$ .001), greater difficulty engaging in goal-directed behavior (B = .71, z = 10.31, $p < .001$),

decreased self-esteem (B = -.55, z = -8.81, p < .001), and decreased self-forgiveness (B = -.60, z = -10.23, p < .001).

Perceived social support was also associated with these variables independently of guilt and shame, such that it was associated with better impulse control (B = .43, z = 5.96, p < .001), less difficulty engaging in goal-directed behavior (B = -.43, z = -5.28, p < .001), greater self-esteem (B = .87, z = 10.99, p < .001), and greater self-forgiveness (B = .71, z = 4.54, p < .001). Intervention condition also influenced two of these mediators independently of guilt, shame, and perceived social support, such that apologizing led to greater difficulty engaging in goal-directed behavior (B = -.42, z = -3.52, p < .001) and greater self-forgiveness (B = -.26, z = -2.35, p = .02) compared to the control condition, but not the rumination condition (B = .13, z = 1.11, p = .27; B = -.03, z = -.32, p = .75). Intervention condition did not influence impulse control ($B_{\text{Apology versus Rumination}}$ = .04, z = .39, p = .70; $B_{\text{Apology versus Control}}$ = .13, z = 1.26, p = .21) or self-esteem ($B_{\text{Apology versus Rumination}}$ = .06, z = .56, p = .58; $B_{\text{Apology versus Control}}$ = .06, z = .58, p = .56).

Of the mediators, self-esteem was associated with better intended health behaviors (B = .11, z = 3.20, p = .001), while impulse control (B = .03, z = .63, p = .53), difficulty engaging in goal-directed behavior (B = .05, z = 1.26, p = .21), and self-forgiveness (B = .05, z = 1.63, p = .10) were not associated with intended health behaviors. Guilt, moreover, was independently associated with better intended health behaviors (B = .16, z = 3.26, p = .001), while shame (B = -.01, z = -.31, p = .76) and perceived social support (B = .10, z = 1.86, p = .10) did not have independent associations with intended health behaviors.

Potential indirect effects from intervention condition to intended health behaviors were assessed through 95% bootstrapped confidence intervals based on 1,000 samples and ranged between [.00001] and [.021]. No evidence was found for any indirect effects between

intervention condition and intended health behaviors, as all confidence intervals contained the value zero. Indeed, intervention condition did not influence guilt, shame, and perceived social support, and even though it influenced difficulty engaging in goal-directed behavior and self-forgiveness, these variables were not associated with intended health behaviors. After taking into account the tested mediators, there was no effect of apologizing on intended health behaviors compared to the rumination condition (B = .10, z = 1.30, p = .19). However, apologizing led to worse intended health behaviors compared to the control condition (B = .19, z = 2.57, p = .01).

3.3.4 Missing Diagnostics for Part 2 of the Study.

To gain an understanding of the participants who chose to complete Part 2 of the study, I tested for potential differences between participants who completed both parts of the study and participants who only completed the first part on the following variables: experimental condition, participant gender, offense timing, offense severity, and closeness with the victim. I conducted chi-square tests for all categorical variables (experimental condition; gender; offense timing) and independent sample t-tests for continuous variables (offense severity; closeness with the victim).

The only variable that (marginally) differed between participants who completed both parts versus only the first part was experimental condition, χ^2 (2) = 5.42, p = .07. Participants in the apology condition (n_{Complete} = 143; n_{Missing} = 54) were 56% more likely to complete Part 2 compared to participants in the rumination condition (n_{Complete} = 126; n_{Missing} = 74; B = .44, χ^2 (1) = 4.15, p = .04, exp(B) = 1.56, 95% CI exp(B) [1.02, 2.38]) and 54% more likely to complete Part 2 compared to participants in the control condition (n_{Complete} = 129; n_{Missing} = 75; B = .43, χ^2 (1) = 4.00, p = .05, exp(B) = 1.54, 95% CI exp(B) [1.01, 2.35).

No differences between participants who completed both parts versus the first part were

found for participant gender (χ^2 (1) = 1.31, p = .25), offense timing (χ^2 (3) = .53, p = .91), offense severity (t(599) = -1.15, p = .25), and closeness with the victim (t(599) = -.0004, p = 1.00).

3.3.5 The Effect of Intervention Condition on Actual Health Behaviors.

To test for a potential effect of intervention condition on participants' actual health behaviors during the one-week follow-up, I repeated the above analyses, except that I replaced the outcome of intended health behaviors with a latent factor representing participants' actual health behaviors with the four health behavior measures (general health behaviors; diet; physical exercise; cigarette smoking) as indicators.[5] I chose to create this latent factor because I was interested in the potential effect of intervention condition on health behaviors in a general sense rather than on specific health behaviors. Because the health behavior factor was endogenous, I fixed the factor loading of the first indicator (general health behaviors) to "1" (Kaplan, 2009).

The normalized estimate of Mardia's coefficient suggested deviations from normality (z = 2.78, p = .01) and I therefore used scaled maximum likelihood estimators corrected for non-normality to interpret the results reported below (Satorra & Bentler, 1988). There was no evidence that the observed and model covariance matrices differed (*Satorra-Bentler* χ^2 (29) = 30.55, p = .39) and fit indices suggested good fit: Comparative Fit Index = .999; Goodness of Fit Index = .99; Root Mean-Square Error of Approximation = .01, 90% CI [.00, .04]; Standardized Root Mean Square Residual = .03. Moreover, the health behavior factor appeared to be well-identified ($\beta_{\text{General health behaviors}}$ = .97, B = 1.00, R^2 = .94; β_{Diet} = .46, B = 1.29, p < .001, R^2 = .21; $\beta_{\text{Physical Exercise}}$ = .57, B = 1.51, p < .001, R^2 = .32; $\beta_{\text{Cigarette Smoking}}$ = .10, B = .35, p = .04, R^2 = .01). I therefore proceeded with testing the proposed model. The results are displayed in Figure 4 and the variance-covariance matrix in Table 8.

Apologizing did not have a total effect on participants' health behaviors compared to the rumination condition (B = .10, z = .99, p = .32), but led to marginally worse health behaviors compared to the control condition (B = .18, z = 1.68, p = .09). Apologizing did not lead to changes in participants' guilt ($B_{\text{Apology versus Rumination}}$ = .08, z = .68, p = .50; $B_{\text{Apology versus Control}}$ = -.01, z = -.12, p = .90), shame ($B_{\text{Apology versus Rumination}}$ = .01, z = .10, p = .92; $B_{\text{Apology versus Control}}$ = -.08, z = -.55, p = .58) and perceived social support ($B_{\text{Apology versus Rumination}}$ = .03, z = .34, p = .73; $B_{\text{Apology versus Control}}$ = -.02, z = -.20, p = .84) compared to the other conditions. Perceived social support, further, was not associated with guilt (B = .01, z = .11, p = .91), but was associated with decreased shame (B = -.25, z = -2.84, p = .01).

Guilt was associated with better impulse control (B = .21, z = 2.69, p = .01), was not associated with difficulty engaging in goal-directed behavior (B = .08, z = .74, p = .46) and self-esteem (B = -.003, z = -.04, p = .97), and was associated with decreased self-forgiveness (B = -.30, z = -3.39, p < .001). Shame was associated with poorer impulse control (B = -.71, z = 10.22, p < .001), greater difficulty engaging in goal-directed behavior (B = .69, z = 7.74, p < .001), decreased self-esteem (B = -.43, z = -5.67, p < .001), and decreased self-forgiveness (B = -.56, z = -7.57, p < .001).

Perceived social support was also associated with these variables independently of guilt and shame. Specifically, it was associated with better impulse control (B = .44, z = 5.50, p < .001), less difficulty engaging in goal-directed behavior (B = -.42, z = -4.41, p < .001), greater self-esteem (B = .89, z = 9.30, p < .001), and greater self-forgiveness (B = .33, z = 3.82, p < .001). Intervention condition influenced three of these mediators independently of guilt, shame, and perceived social support. First, apologizing led to marginally worse impulse control compared to the rumination condition (B = .24, z = 1.90, p = .06) but not compared to the control

condition (B = .17, z = 1.36, p = .17). Second, apologizing led to marginally greater difficulty engaging in goal-directed behavior compared to the rumination condition (B = -.27, z = -1.89, p = .06) and greater difficulty engaging in goal-directed behavior compared to the control condition (B = -.37, z = -2.54, p = .01). Third, apologizing led to marginally greater self-forgiveness compared to the control condition (B = -.26, z = -1.96, p = .05), but not compared to the rumination condition (B = .06, z = .45, p = .65). Intervention condition did not influence self-esteem ($B_{\text{Apology versus Rumination}}$ = .03, z = .25, p = .80; $B_{\text{Apology versus Control}}$ = -.09, z = -.64, p = .52).

Of the tested mediators, impulse control, self-forgiveness, and self-esteem were associated with health behaviors, such that, surprisingly, better impulse control was associated with poorer health behaviors (B = -.13, z = -2.27, p = .02). Self-esteem, further, was associated with better health behaviors (B = .17, z = 3.52, p < .001), while self-forgiveness was associated with marginally better health behaviors (B = .09, z = 1.83, p = .07). Difficulty engaging in goal-directed behavior was not associated with health behaviors (B = -.06, z = -1.31, p = .19). Finally, guilt (B = .04, z = .50, p = .62), shame (B = .09, z = 1.39, p = .17), and perceived social support (B = .03, z = .38, p = .70) did not have independent associations with health behaviors. After taking into account all tested mediators, there was no effect of apologizing on health behaviors compared to the rumination condition (B = .10, z = 1.06, p = .29). However, apologizing led to worse health behaviors compared to the control condition (B = .22, z = 2.34, p = .02).

No evidence was found for any indirect effects from intervention condition to health behaviors. Potential indirect effects were assessed through 95% bootstrapped confidence intervals based on 1,000 samples, ranged between [.00000004] and [.0312], and all contained the value zero in their confidence intervals. Indeed, while impulse control and self-forgiveness were influenced by intervention condition and were associated with health behaviors, these effects

were only marginally significant, possibly explaining why they were not found to be reliable mediators to explain the anticipated effect of intervention condition on health behaviors.

3.3.6 The Effect of Intervention Condition on Real-World Apologies.

Of the 398 participants who completed Part 2 of the study, 99 reported that they had apologized to their victim ($n_{\text{Apology}} = 49$; $n_{\text{Rumination}} = 25$; $n_{\text{Control}} = 25$) during the one-week follow-up while 299 reported that they had not apologized to their victim ($n_{\text{Apology}} = 94$; $n_{\text{Rumination}} = 101$; $n_{\text{Control}} = 104$). Participants who had apologized indicated they had done so to relieve the pain their victim felt because of the offense ($M = 5.79$, $SD = 1.30$), to repair their relationship with their victim ($M = 5.78$, $SD = 1.27$), to do the right thing so that they could forgive themselves ($M = 5.61$, $SD = 1.49$), because it seemed like what they should do ($M = 5.51$, $SD = 1.59$), to relieve their own guilt about the offense ($M = 5.29$, $SD = 1.55$), and, to a lesser extent, to look good to others ($M = 2.70$, $SD = 1.88$). Participants who had not apologized indicated it was because they believed too much time had passed since the offense ($M = 5.55$, $SD = 1.61$), they did not have an opportunity to apologize ($M = 5.12$, $SD = 2.02$), apologizing would not help repair their relationship with their victim ($M = 5.04$, $SD = 1.55$), apologizing would not help relieve the pain their victim experienced because of the offense ($M = 4.65$, $SD = 1.63$), apologizing would not help them feel less guilty about the offense ($M = 4.44$, $SD = 1.67$), and apologizing would not help them forgive themselves for the offense ($M = 4.39$, $SD = 1.67$).

To test for the effect of intervention condition on participants' real-world apology behavior at the one-week follow-up, I first calculated the total effect of intervention condition on real-world apology behavior using binary logistic regression. Then, I calculated the effects of intervention condition on the sequence of tested mediators using ordinary least squares

regression (all effects mirrored those found in the structural equation modeling analyses involving participants' actual health behaviors). Finally, I calculated the associations between the mediators and apology behavior after controlling for intervention condition using binary logistic regression. I tested the significance of potential indirect effects using a z-statistic calculated by following the steps outlined by Iacobucci (2012) to combine results from ordinary least squares and logistic regression analyses.[6]

The likelihood of offering an apology was significantly predicted by intervention condition (χ^2 (2) = 98.87, p < .001, Negelkerke R^2 = .04). Participants in the apology condition (% $_{\text{Apologized}}$ = 52.13) were twice as likely to offer an apology during the one-week follow-up compared to participants in the rumination condition (% $_{\text{Apologized}}$ = 24.75; B = .75, χ^2 (1) = 6.85, p = .01, exp(B) = 2.11, 95% CI exp(B) [1.21, 3.68]) as well as participants in the control condition (% $_{\text{Apologized}}$ = 24.04; B = .77, χ^2 (1) = 7.43, p = .01, exp(B) = 2.17, 95% CI exp(B) [1.24, 3.78]). There was no difference in likelihood of apologizing between the rumination and control condition (B = -.03, χ^2 (1) = .01, p = .93, exp(B) = .97, 95% CI exp(B) [.52, 1.80]).

Of the mediators, impulse control was associated with likelihood of apologizing, such that the likelihood of apologizing doubled with each unit increase in impulse control (B = .70, χ^2 (1) = 15.51, p < .001, exp(B) = 2.04, 95% CI exp(B) [1.42, 2.83]). Moreover, perceived social support was independently associated with likelihood of apologizing, such that the likelihood of apologizing decreased by 48% for each unit increase in perceived social support (B = -.66, χ^2 (1) = 7.29, p = .01, exp(B) = .52, 95% CI exp(B) [.32, .83]).

Guilt (B = .07, χ^2 (1) = .09, p = .77, exp(B) = 1.07, 95% CI exp(B) [.68, 1.68]) and shame (B = -.21, χ^2 (1) = 1.10, p = .29, exp(B) = .81, 95% CI exp(B) [.55, 1.20]) did not have independent associations with likelihood of apologizing. Similarly, difficulty engaging in goal-

directed behavior (B = -.23, χ^2 (1) = 2.08, p = .15, exp(B) = .80, 95% CI exp(B) [.59, 1.09]), self-esteem (B = .07, χ^2 (1) = .23, p = .63, exp(B) = 1.07, 95% CI exp(B) [.81, 1.41]), and self-forgiveness (B = .10, χ^2 (1) = .55, p = .46, exp(B) = 1.11, 95% CI exp(B) [.84, 1.46]) were not associated with likelihood of apologizing. After controlling for the tested mediators, intervention condition still predicted likelihood of apologizing ($B_{\text{Apology versus Rumination}}$ = .70, χ^2 (1) = 5.27, p = .02, exp(B) = 2.01, 95% CI exp(B) [1.11, 3.66]; $B_{\text{Apology versus Control}}$ = .82, χ^2 (1) = 6.97, p = .01, exp(B) = 2.27, 95% CI exp(B) [1.24, 4.16]). Because intervention condition did not significantly influence any of the tested mediators, no evidence was found for indirect effects from intervention condition to real-world apology behavior.

3.4 DISCUSSION

Study 2 tested whether a brief apology intervention (vs. rumination or control) would improve offenders' intended and actual health behaviors and if it would increase offenders' likelihood of offering a real apology to their victim. Most of my predictions were not supported by the findings of this study, with no evidence suggesting that the apology intervention influenced offenders' intended or actual health behaviors, either directly or indirectly. Given the results of Study 1, it was surprising that this study did not find an indirect effect of apologies on intended health behaviors through shame reduction. Indeed, the current findings were inconsistent with previous research that found an effect of apologies on guilt and shame reduction (Carpenter et al., 2014; Meek et al., 1995; Witvliet et al., 2002; 2011) and with research that found negative associations between shame and health behaviors (Dearing et al., 2005; Ianni et al., 2010; Sanfter et al., 1995).

One factor that might have decreased the effectiveness of the apology intervention is my attempt to make participants' apology experience more realistic by asking them to email their apology to their victim after Part 1 of the study. Doing so may have shifted participants' focus to *expecting* to deliver an apology. As previously noted, Leunissen and colleagues (2014) found that expecting to deliver an apology raises feelings of distress by leading people to exaggerate the potential negative consequences of apologizing and discount the potential positive consequences of apologizing. It is therefore possible that participants focused on expecting to deliver their apology later and the possible (predominantly negative) consequences of doing so. This may have decreased the benefits participants in Study 1 experienced after writing an apology that they did not expect to deliver.

One finding in this study provides suggestive evidence for this possibility. Compared to the control condition, participants in the apology condition self-reported greater "difficulties in engaging in goal-directed behavior" (see page 43). This variable included items such as "I have difficulty concentrating" and "I have difficulty thinking about anything else" (referring to the offense). It is thus possible that this difficulty concentrating in the apology condition reflected a preoccupation with the anticipated negative consequences of apologizing.

Despite the absence of an effect of apologizing on offenders' intended or actual health behaviors, this study did find that writing a brief apology increased participants' likelihood of offering an actual apology to their victims one week after the intervention. Writing a brief "practice" apology might later decrease the feelings of distress and humiliation that offenders expect to experience while offering an apology to their victim, which may sometimes prevent them from apologizing (Leunissen et al., 2014). This finding is promising, as it is well-established that apologizing is an effective reconciliation strategy. For instance, offering an

apology helps victims empathize with their offenders (e.g., Barkat, 2002; McCullough et al., 1997) and view them more positively (e.g., Darby & Schlenker, 1989; Hareli & Eisikovits, 2006; Hodgins & Liebeskind, 2003). As such, it helps victims forgive their offenders and, as a result, makes reconciliation between them more likely (Darby & Schlenker, 1982; Exline et al., 2007; Fehr et al., 2010; McCullough et al., 1997; Schumann, 2012;). The results of this study suggest that one way to increase the likelihood of receiving these benefits is to ask offenders to write a brief apology.

4.0 STUDY 3: APOLOGIES AND CARDIOVASCULAR REACTIVITY AND RECOVERY

Studies 1 and 2 yielded inconsistent results on the effect of intervention condition on intended health behaviors. It is possible that the null findings in Study 2 might have resulted from the different instructions in the apology intervention (as discussed above), but it is also possible that apologies do not reliably affect offenders' intended or actual health behaviors. Study 3 therefore attempted to replicate the findings of Study 1, using the same apology instructions as Study 1. Moreover, Study 3 tested whether apologies also impacted offenders' cardiovascular reactivity while apologizing and cardiovascular recovery after apologizing. Finally, like Study 2, it tested the effects of intervention condition on participants' real-world apology behavior, this time at a four-week follow-up to allow them more opportunities to deliver an apology.

4.1 PARTICIPANTS AND EXPERIMENTAL DESIGN

One hundred and thirteen students (47 males, 84 females, 1 missing) at the University of Pittsburgh completed the study in return for course credit.[7] Participants were between 17 and 42 years of age (M = 18.82, SD = 2.36). Most were born in the United States (n = 110), followed by China (n = 8), India (n = 5), Germany (n = 2), Brazil (n = 1), Jamaica (n = 1), Japan (n = 1), Nigeria (n = 1), the Philippines (n = 1), Sweden (n = 1), and Vietnam (n = 1), and most were

Caucasian (*n* = 94), followed by Asian (*n* = 70), Asian (*n* = 34), and African American (*n* = 3). Regarding religion, most participants were Christian (*n* = 63), followed by atheist (*n* = 17), agnostic (*n* = 15), something else, with an option to clarify in an open-ended question (*n* = 11), Hindu (*n* = 9), Jewish (*n* = 9), and Buddhist (*n* = 7).

Participants were eligible to participate if they had hurt or caused a problem for another person within the past 14 days; had not apologized to this person; and regretted what they did. Because this study measured aspects of cardiovascular function, additional eligibility criteria were that participants must not have a history of cardiovascular disease and must not be hypertensive (defined as systolic blood pressure at, or above, 150mmHg and/or diastolic blood pressure at, or above, 90mmHg). The time frame of 14 days was established based on the results of a pilot study (see Appendix C for a description of the study and data analyses).

4.2 MATERIALS AND PROCEDURE

Before visiting the laboratory, all participants completed a number of premeasures online that are thought to be relevant for their cardiovascular reactivity and recovery, including their trait anger (Buss & Perry, 1992; e.g., "I sometimes feel like a powder keg ready to explode") and hostility (Buss & Perry, 1992; e.g., "I am suspicious of overly friendly strangers").[8] These variables are important to measure when assessing cardiovascular function, because they may influence participants' tendency toward cardiovascular reactivity (e.g., Suls & Wan, 1993; Vella & Friedman, 2009). Participants also filled out a series of questions about their medical history and current medication use. I used participants' answers on these questions to exclude their data from analyses involving cardiovascular reactivity and recovery if they indicated that they had a history

of cardiovascular disease and/or were using medications known to alter cardiovascular variables, such as beta-blockers. This online portion was set up as a separate study and participants received credit for it regardless of whether they chose to sign up for the laboratory portion.

Laboratory sessions were limited to the afternoon, because previous research has suggested the presence of circadian fluctuations in cardiovascular parameters (e.g., Millar-Craig, Bishop, & Raftery, 1978). Sessions began on the hour between 12.00 p.m. and 4.00 p.m. and lasted up to one hour. Participants were asked to refrain from exercising, drinking alcohol, and taking anti-inflammatory medications for at least 24 hours before the study. Participants' adherence to these criteria as well as to the offense-specific criteria (must have committed an offense within the past 14 days; not have apologized; and regret what they did) were confirmed upon arrival. If participants did not meet one or more of these, their appointment was cancelled or rescheduled. Because of the relative difficulty of recruiting eligible participants for this study, these criteria were eventually relaxed to not having drunk alcohol for at least 12 hours before the study (only if participants had consumed no more than two servings of alcohol) and not having exercised for at least 4 hours before the study.

After giving consent, the experimenter assessed participants' height and weight in order to calculate their body mass index (BMI). Participants were then seated in a quiet room and were separated from the experimenter by a room divider. They first answered a number of questions about their offense.[9] They were asked to answer these and all later questions on paper because writing should minimize movement in participants' non-dominant arm (which is important for blood pressure assessment) compared to using both hands to type on a keyboard. Participants then completed the apology (vs. rumination or self-distraction) intervention, followed by measures of their negative emotions, self-punishment, and perceived forgiveness from the

victim. Finally, they answered questions about their intended health behaviors. Because data collection for this study started simultaneously with Study 1, the additional mediators that were tested in Study 2 (i.e., emotion regulation, self-esteem, self-forgiveness, and perceived social support) were not included in this study.

The physiology protocol consisted of three periods: (a) a resting baseline period, lasting 8 minutes; (b) the apology (vs. rumination or self-distraction) exercise, lasting 5 minutes; and (c) a recovery period, lasting 8 minutes. This protocol started after completion of the offense characteristic questions, but before the apology, rumination, or self-distraction exercise. The experimenter applied the cuff of an automated blood pressure monitor (a Dinamap oscillometric monitor) on participants' non-dominant arm to measure blood pressure and heart rate, which were both measured every 60 seconds through each of the protocol's periods. During the baseline and recovery periods, participants were given the opportunity to look through a picture book of non-arousing, positively valenced nature images (e.g., sunsets). After the end of the recovery period, they completed the questionnaires about their guilt, shame, self-punishment, and intended health behaviors.

Offense characteristics. Participants answered the same questions about their offense as in Study 1 (e.g., an open-ended question asking them to describe their offense).

Intervention. Participants read the same instructions used in Study 1, except in the rumination condition, where they read the same instructions as in Study 2 in order to match the length of the instructions within each intervention condition (i.e., "Please describe the ways in which your offense harmed the other person and how it may continue to negatively affect him or her now."). Participants were given five minutes to complete the intervention and were asked to stop writing once the five minutes were over to standardize the time of the physiology protocol

across participants. As in Study 1, participants in the apology condition were asked to rate the quality of their own apology (see Appendix D for supplementary analyses regarding apology quality).

Guilt and shame. Participants completed the same State Shame and Guilt Scale (Marschall et al., 1994) used in Study 1. Cronbach's α was .78 for guilt and .83 for shame.

Self-punishment. Next, they completed the same subscale of the Differentiated Process Scale of Self-Forgiveness (Woodyatt & Wenzel, 2013a) as in Study 1, measuring offenders' tendency to condemn and punish themselves. Cronbach's α was .85.

Perceived victim forgiveness. Participants rated their agreement with the same three items as in Study 1 to assess perceived forgiveness from their victim. Cronbach's α was .81.

Intended health behaviors. Finally, participants answered the same questions about their intended health behaviors as in Study 1. Cronbach's α was .74.

Real-world apology at a four-week follow-up. To assess the potential influence of intervention condition on real-world apologies, all participants received the following email exactly four weeks after their laboratory visit. "Dear participant, four weeks ago, you participated in a research study named 'The Interpersonal Offenses Study'. In this study, we asked you to reflect on an offense that you committed against another person. As part of the study, you agreed to be contacted through email at this time to answer one brief question. Specifically, we would like to learn whether you have apologized to the person that you hurt since you left our laboratory. We would appreciate it if you would respond to this email, simply stating "yes" or "no" to this question. Thank you in advance."

4.3 RESULTS

4.3.1 Offense Characteristics.

Participants reported committing offenses that involved fights or arguments (28.6%), insults (15.9%), betrayal of the victim's trust (14.3%), acts of selfishness (14.3%), rejection or exclusion (4%), physical violence (1.6%), damage to, or loss of physical property (1.6%), ending a relationship (1.6%), something else (1.6%), infidelity (.8%), and not following through on an obligation (.8%). Offenses were predominantly committed against friends (41.3%), family members (20.6%), romantic partners (13.5%), work colleagues (4.8%), acquaintances (3.2%), and strangers (1.6%). Finally, offenses ranged in severity between 1 (*Not severe at all*) and 7 (*Extremely severe*), with a mean of 3.55 (*SD* = 1.24).

4.3.2 Data Analytic Plan.

Study 3 had four aims, namely, to test whether the apology (vs. rumination and self-distraction) intervention influenced offenders' (1) intended health behaviors after the intervention, (2) cardiovascular reactivity during the intervention (3) cardiovascular recovery after the intervention, and (4) real-world apology behavior at a four-week follow-up. To test these aims, I analyzed the collected data using a series of analyses, each outlined below. Correlations between, and descriptive statistics of, all continuous variables are displayed in Tables 9 and 10 and supplementary analyses of the data are reported in Appendix D.

4.3.3 The Effect of Intervention Condition on Intended Health Behaviors.

To test the first aim, I repeated the analyses reported in Study 1 and used a fully saturated structural equation model and maximum likelihood estimators to test for direct and indirect effects of intervention condition on intended health behaviors. The variance-covariance matrix is displayed in Table 11 and results of the tested model are displayed in Figure 5.

Apologizing did not have a total effect on intended health behaviors compared to rumination (B = .01, z = .06, p = .95) or self-distraction (B = .11, z = .62, p = .53). Apologizing also did not influence guilt and shame compared to rumination (B_{Guilt} = -.01, z = -.04, p = .97; B_{Shame} = .005, z = .02, p = .98) or self-distraction (B_{Guilt} = -.10, z = -.49, p = .62; B_{Shame} = .05, z = .29, p = .77). Further, apologizing did not influence perceived victim forgiveness compared to rumination (B = .16, z = .41, p = .68), but led to lower perceived victim forgiveness compared to self-distraction (B = .86, z = 2.16, p = .03). Perceived victim forgiveness, in turn, was associated with decreased guilt (B = -.21, z = 4.55, p < .001) and shame (B = -.19, z = 4.57, p < .001). Both guilt (B = .32, z = 3.57, p <. 001) and shame (B = .64, z = 6.75, p < .001) were associated with increased self-punishment. Perceived victim forgiveness was not associated with self-punishment independently from guilt and shame (B = -.05, z = -1.27, p = 20), and intervention condition did not have independent effects on self-punishment ($B_{\text{Apology versus Rumination}}$ = .08, z = .59, p = .55; $B_{\text{Apology versus Distraction}}$ = -.01, z = -.07, p = .94). Self-punishment was not associated with intended health behaviors (B = -.11, z = -.97, p = .33). However, guilt was independently associated with better intended health behaviors (B = .24, z = 2.07, p = .04), whereas shame (B = -.12, z = -.88, p = .38) and perceived victim forgiveness (B = -.01, z = -.24, p = .81) did not have independent associations with intended health behaviors.

Indirect effects from intervention condition to intended health behaviors were each

assessed through 95% bootstrapped confidence intervals based on 1,000 samples. Based on the above findings, it was possible that apologizing might have indirectly improved intended health behaviors by decreasing perceived victim forgiveness and subsequently increasing guilt compared to the self-distraction condition. This indirect effect, however, was not significantly different from zero (indirect effect = -.0426; 95% CI [-.1312, .0055]). There was no evidence for any other indirect effects from apologizing to intended health behaviors; all remaining indirect effects ranged between [.00028] and [.0115] and contained the value zero in their confidence intervals. After controlling for all tested mediators, apologizing still did not influence intended health behaviors compared to both rumination (B = .02, z = .97, p = .33) and self-distraction (B = .15, z = .82, p = .41). Thus, there was no evidence that the apology intervention influenced participants' intended health behaviors, either directly or indirectly through the tested mediators.

4.3.4 The Effect of Intervention Condition on Cardiovascular Reactivity and Recovery.

Prior to analyses, I first excluded the data of six participants. Four of them had indicated that they currently suffered, or had suffered, from a heart condition (hypertension, a heart attack, and valve problems) and/or had undergone a cardiovascular procedure (heart balloon angioplasty), while two of them had unreliable cardiovascular readings during their laboratory visit due to persistent coughing and failure to rest their cuffed arm throughout the duration of the recording protocol.

I calculated composite scores for participants' heart rate (HR)[10], systolic blood pressure (SBP), and diastolic blood pressure (DBP) by averaging across their minute-by-minute values during each period (i.e., baseline, intervention exercise, and recovery). To create cardiovascular reactivity indices for each of these variables (HR, SBP, and DBP), I then calculated standardized

residuals using linear regression to predict the intervention exercise average from the baseline average (after Stewart, Janicki, & Kamarck, 2006). By doing so, these residuals represented the change in each cardiovascular variable from baseline to intervention exercise, controlling for baseline values. Similarly, to create cardiovascular recovery indices, I calculated standardized residuals using linear regression to predict the recovery average from the intervention exercise average and the baseline average (after Stewart et al., 2006).

Each of these reactivity and recovery indices was then tested as an outcome in a separate linear regression model. I focused on each of these indices in isolation (rather than conducting multivariate analyses or using latent reactivity and recovery factors in a structural equation model), because emotionally engaging in psychological tasks such as the present apology intervention may influence each of these variables in the same direction, but not necessarily to the same degree. On the one hand, a meta-analysis on reactivity effects showed that a range of negative emotions that should likely increase in the apology and/or rumination conditions—including embarrassment, sadness, and anxiety—all led to greater SBP, DBP, and HR (Kreibig, 2010). On the other hand, however, the intervention condition may be most likely to lead to reliable changes in blood pressure and to a lesser extent to changes in HR. This is because HR is multiply determined by sympathetic and parasympathetic nervous system influences, which can be independent, co-active, or reciprocal across the two autonomic branches and depending on the particular behavioral state of the individual (Berntson, Cacioppo, & Quigley, 1993). Importantly, HR itself is ambiguous with respect to these complex autonomic influences. In general, blood pressure effects are more sensitive to sympathetic influences on beta- and alpha-adrenergic receptors located on the heart and vasculature, respectively (Cacioppo, Tassinary, & Berntson, 2007; Mohrman & Heller, 2010). Parasympathetic influences on BP are less evident because

with only a few exceptions, systemic blood vessels are less sensitive to cholinergic outflow, and because the parasympathetic branch does not exert strong effects on cardiac contractility and hence blood pressure. Since effortful psychological tasks are thought to engage the sympathetic nervous system (Cacioppo et al., 2007), this suggests that changes in blood pressure (and especially SBP) may be more plausibly impacted and reliably influenced by the experimental manipulations used in the present study.

In each regression model, I used two dummy-coded intervention condition variables (with the apology intervention serving as the reference condition) as predictors, while controlling for participants' age, gender, BMI, race, time of day that the laboratory visit took place, trait anger, and trait hostility.[11] Prior to analyses, I tested for potential interactions between intervention condition and each of the covariates and found no evidence for such interactions. Descriptive statistics of, and correlations between, HR, SBP, and DBP per intervention condition are shown in Table 13, while the unstandardized beta weights for these analyses are displayed in Table 14.

Across intervention conditions, all cardiovascular parameters increased significantly from baseline to intervention exercise (F (1, 106) $_{HR}$ = 181.78, p < .001; F (1, 106) $_{SBP}$ = 16.38, p < .001; F (1, 106) $_{DBP}$ = 42.05, p < .001). HR did not remain elevated during the recovery period compared to baseline (F (1, 106) $_{HR}$ = .28, p = .60), while SBP (F (1, 106) = 22.23, p < .001) and DBP (F (1, 106) = 14.67, p < .001) decreased during the recovery period compared to baseline.

The effect of intervention condition on cardiovascular reactivity. Apologizing did not influence HR reactivity compared to rumination (B = -.26, t(95) = -1.01, p = .32, 95% CI [-.77, .25]) or self-distraction (B = .08, t(95) = .29, p = .77, 95% CI [-.44, .59]). Apologizing, however, led to marginally higher SBP reactivity compared to rumination (B = -.42, t(95) = -1.76, p = .08,

95% CI [-.90, .05]) and self-distraction (*B* = -.47, *t*(95) = -1.96, *p* = .05, 95% CI [-.95, .01]; see Figure 6). Intervention condition accounted for 3.1% of the variance in SBP reactivity. Finally, apologizing did not influence DBP reactivity compared to rumination (*B* = -.35, *t*(95) = -1.40, *p* = .17, 95% CI [-.84, .15]) or self-distraction (*B* = -.27, *t*(95) = -1.10, *p* = .28, 95% CI [-.77, .22]).

The effect of intervention condition on cardiovascular recovery. Apologizing led to better HR recovery compared to rumination (*B* = .69, *t*(95) = 2.78, *p* = .01, 95% CI [.20, 1.19]; see Figure 7), but not self-distraction (*B* = .02, *t*(95) = .09, *p* = .93, 95% CI [-.47, .52]). Intervention condition accounted for 9.1% of the variance in HR recovery. Apologizing did not influence SBP recovery compared to rumination (*B* = -.18, *t*(95) = -.69, *p* = .49, 95% CI [-.68, .33]), but led to marginally worse SBP recovery compared to self-distraction (*B* = -.44, *t*(95) = -1.74, *p* = .09, 95% CI [-.94, .06]; see Figure 8). Intervention condition accounted for 2.9% of the variance in SBP recovery. Finally, apologizing did not influence DBP recovery compared to rumination (*B* = -.16, *t*(95) = -.61, *p* = .54, 95% CI [-.68, .36]) or self-distraction (*B* = -.38, *t*(95) = -1.44, *p* = .15, 95% CI [-.89, .14]).

4.3.5 The Effect of Intervention Condition on Real-World Apology Behavior.

Of the 132 participants who visited the laboratory, 87 (65.91%) responded to the email asking them about their real-world apology behavior during the four-week follow-up. Forty-nine participants reported that they had apologized to their victim (n_{Apology} = 15; $n_{\text{Rumination}}$ = 23; $n_{\text{Self-Distraction}}$ = 11) during the four-week follow-up, while 38 reported that they had not apologized to their victim (n_{Apology} = 17; $n_{\text{Rumination}}$ = 7; $n_{\text{Self-Distraction}}$ = 14).

To test whether these participants might have differed in important ways from the participants who had chosen not to respond to the email, I tested for potential differences

between the two groups of participants based on the following variables: experimental condition, participant gender, and offense severity. I conducted chi-square tests for the two categorical variables (experimental condition and gender) and an independent sample t-test for the continuous variable (offense severity). No differences were found between participants with complete and missing data in their experimental condition (χ^2 (2) = 2.63, p = .27), their gender (χ^2 (1) = 1.54, p = .22), or the severity of their offense (t(111) = 1.79, p = .59).

To test for the effect of intervention condition on participants' real-world apology behavior at the four-week follow-up, I conducted a series of ordinary least square and binary logistic regression analyses (after Iacobucci, 2012). I first calculated the total effect of intervention condition on apology behavior using binary logistic regression. To assess for potential indirect effects from intervention condition to real-world apology behavior, I then calculated the effects of intervention condition on the tested mediators using ordinary least squares regression (all effects were similar to those reported for the analyses on participants' intended health behaviors). Then, I calculated the associations between the tested mediators and apology behavior after controlling for intervention condition using binary logistic regression. Finally, I tested the significance of potential indirect effects by calculating a z-statistic (see Iacobucci, 2012) to combine results from ordinary least squares and logistic regression.

The likelihood of offering an apology was significantly predicted by intervention condition (χ^2 (2) = 8.08, p = .02, Negelkerke R^2 = .12). Participants in the apology condition (% $_{\text{Apologized}}$ = 46.88) were 26.9% *less* likely to offer an apology compared to participants in the rumination condition (% $_{\text{Apologized}}$ = 76.67%; B = -1.32, χ^2 (1) = 5.54, p = .02, exp(B) = .27, 95% CI exp(B) [.09, .80]). No differences in likelihood of offering an apology were found between the apology and self-distraction conditions (% $_{\text{Apologized}}$ = 44%; B = .12, χ^2 (1) = .05, p = .83,

exp(*B*) = 1.12, 95% CI exp(*B*) [.39, 3.20]). A separate analysis, further, showed that participants in the rumination condition were 76.1% more likely to offer an apology than participants in the self-distraction condition (*B* = -1.43, χ^2 (1) = 5.87, *p* = .02, exp(*B*) = .24, 95% CI exp(*B*) [.08, .76]).

None of the mediators were associated with likelihood of apologizing at follow-up (B_{Guilt} = -.41, χ^2 (1) = 1.05, *p* = .31, exp(*B*) = .67, 95% CI exp(*B*) [.31, 1.45]; B_{Shame} = -.52, χ^2 (1) = 1.24, *p* = .27, exp(*B*) = .59, 95% CI exp(*B*) [.24, 1.49]; $B_{\text{Perceived Victim Forgiveness}}$ = -.17, χ^2 (1) = .83, *p* = .36, exp(*B*) = .84, 95% CI exp(*B*) [.59, 1.22]; $B_{\text{Self-Punishment}}$ = .24, χ^2 (1) = .36, *p* = .55, exp(*B*) = 1.27, 95% CI exp(*B*) [.58, 2.82]). Moreover, after controlling for the tested mediators, participants in the apology condition were still less likely to offer an apology during follow-up compared to participants in the rumination condition (*B* = -2.07, χ^2 (1) = 9.60, *p* = .002, exp(*B*) = .13, 95% CI exp(*B*) [.03, .47]), but not the self-distraction condition (*B* = -.18, χ^2 (1) = .09, *p* = .77, exp(*B*) = .83, 95% CI exp(*B*) [.25, 2.82]). As such, there was no evidence for any indirect effects between intervention condition and likelihood of offering an apology at the four-week follow-up.

4.4 DISCUSSION

Like the previous studies, Study 3 tested whether writing a brief apology (vs. rumination or self-distraction) would improve offenders' intended health behaviors. Like Study 2, it also tested whether writing a brief apology would increase offenders' likelihood of offering a real apology to their victim. Finally, it tested whether writing a brief apology (vs. rumination or self-distraction) would influence offenders' cardiovascular reactivity while writing an apology, as

well as their cardiovascular recovery afterward. I had anticipated that apologizing would likely lead to greater cardiovascular reactivity compared to self-distraction because offering an apology may lead offenders to focus on the potential negative consequences of apologizing (e.g., being rejected; Leunissen et al., 2014), but not rumination. I had also anticipated that apologizing would lead to better cardiovascular recovery compared to both rumination and self-distraction.

Most of my predictions were not supported by the findings of this study. Concerning intended health behaviors, I found no evidence to suggest that the apology intervention influenced offenders' intended behaviors, either directly or indirectly through negative emotion reduction and/or perceived victim forgiveness. This went against the findings of Study 1, but not Study 2, which also did not yield evidence for direct or indirect effects of apologizing on intended health behaviors. In fact, the current results were inconsistent with ample previous research: while this study found no effect of apologizing on guilt and shame and found that apologizing decreased perceived victim forgiveness compared to self-distraction, multiple studies previously found that apologizing decreased guilt and shame (Carpenter et al., 2014; Meek et al., 1995; Witvliet et al., 2002; 2011) and increased perceived victim forgiveness (Witvliet et al., 2002).

Concerning likelihood of offering a real-world apology, this study found that the apology intervention decreased participants' likelihood of offering a real-world apology compared to rumination, but not self-distraction. In fact, additional analyses revealed that rumination increased the likelihood of offering a real-world apology compared to both the apology and self-distraction conditions. This goes against the findings of Study 2 in two ways. First, in Study 2 the apology intervention increased the likelihood of offering an apology compared to both rumination and control. Second, in Study 2 no difference was found between the rumination and

the control conditions in likelihood of offering a real-world apology.

Regarding the first contradictory finding, one possible explanation is the different instructions used for the apology intervention across the two studies, with the instructions in Study 2 having participants falsely believe that they would be emailing their written apology to their victim. Even though participants were informed that they would not actually be asked to email their apology after they wrote it, they had already consented to emailing their written apology to their victim and it is therefore plausible that they may have been planning on following the study's instructions. As previous research suggests, people tend to remember their unfinished tasks in much greater detail than their finished tasks and tend to think about them more often (e.g., Förster, Liberman, & Higgins, 2005; Zeigarnik, 1927). These thoughts about their already written but not delivered apology, in turn, might have prompted them to actually apologize.

Regarding the second contradictory finding, a possible explanation is the difference in the control conditions used across the two studies, with Study 2 using a truly neutral control condition and the present study using a self-distraction task as the control condition. Participants in the control condition of Study 2 and in the rumination conditions across both studies might have been experiencing negative emotions and/or decreased positive emotions about their offense and may therefore have been motivated to find a way to positively influence their emotions (e.g., through offering an apology). The same, however, might not have been true for participants in the self-distraction condition of the present study, as some evidence exists to suggest that self-distraction might decrease one's negative emotions and/or increase one's positive emotions (see Discussion under Study 1). This might have contributed to the difference in likelihood of offering a real-world apology between the rumination and control condition

observed in the current study, but not Study 2.

Concerning cardiovascular function, I found—consistent with my expectations—that apologizing led to better recovery compared to rumination (as measured through HR). I also found—against my expectations—that apologizing led to marginally greater reactivity compared to both rumination and self-distraction (as measured through SBP) and marginally worse recovery compared to self-distraction (as measured through SBP). Based on these mixed findings, there appears to be no reliable evidence to support my prediction that apologizing would lead to patterns of autonomic activity that might be favorable in the long-term (in fact, the present findings suggest that the opposite might be as plausible). Moreover, even though apologizing positively influenced HR recovery, this was true only when its effects were compared to rumination, but not self-distraction. As such, there is no evidence to suggest that apologizing may be more beneficial than simply distracting oneself from one's offense.

However, it should also be noted that this study was limited in its ability to test the effects of apologizing on cardiovascular function, with the most important limitation being that it was likely underpowered. As power analyses based on previous research (Da Silva et al., 2016) suggested, a minimum of 50 participants per cell were needed to reliably detect the anticipated effects of apologizing on cardiovascular parameters, yet this study contained approximately 30 participants per cell. As such, more research is needed to further our understanding about the potential effects of apologizing on cardiovascular function.

Another limitation is that this study was limited in its ability to distinguish the autonomic origins of the observed changes in HR and BP. This is important because more insight into the relative contributions of the sympathetic and parasympathetic nervous systems might have helped to explain the seemingly contradictory effects of apologizing on HR and SBP recovery

(i.e., with apologizing leading to better HR recovery compared to rumination, but as much delayed SBP recovery as rumination). It is possible, for example, that having apologized might not have led to immediate decreases in sympathetic activation, but that it might already have led to increases in parasympathetic activation. Since SBP is mostly under the control of cardiovascular parameters directly influenced by sympathetic (but not parasympathetic) activation, while HR is influenced by both sympathetic and parasympathetic activation, this might have simultaneously manifested as improved HR recovery and delayed SBP recovery. More comprehensive measures of cardiovascular function that could shed light on underlying autonomic processes are represented, for example, by pre-ejection period and high-frequency heart rate variability, since these are almost exclusively determined by sympathetic and parasympathetic activation, respectively (Cacioppo et al., 2007).

Finally, this study might have been limited in its ability to detect reliable differences in cardiovascular recovery between the three intervention conditions because participants in all conditions were presented with positively valenced pictures during the recovery period. Looking at these pictures might have served as a positive distraction and, as such, might have reduced participants' negative emotions across all conditions. To the extent that negative emotions about one's offense influenced participants' cardiovascular recovery, looking at these pictures might have positively influenced cardiovascular recovery across conditions and might thus have minimized potential differences between intervention conditions.

5.0 GENERAL DISCUSSION

The present research tested the effects of an apology intervention on offenders' (intended) health behaviors (Studies 1-3), their cardiovascular reactivity and recovery (Study 3), and their real-world apology behavior (Studies 2 and 3) compared to rumination and several control conditions. Importantly, the current set of studies tested plausible pathways through which apologies were expected to exert these effects.

I predicted that the apology intervention would positively influence offenders' (intended) health behaviors and cardiovascular function by reducing their negative emotions about the offense, both directly as well as indirectly by increasing their perceived forgiveness from their victim. Moreover, I predicted that the apology intervention would increase the likelihood of offering a real-world apology to one's victim, in part by allowing offenders to experience some of the benefits of apologizing during the study, including a decrease in their negative emotions.

In testing these predictions, the present research had several advantages, such as the inclusion of a large number of participants (N_{Total} = 1,046) and multiple replication attempts of the effect of apologies on intended health behaviors. It also attempted to infer the potential effect of apologizing on offenders' outcomes putatively linked to cardiovascular health by simultaneously considering intended health behaviors, actual health behaviors, and cardiovascular stress physiology.

Three studies provided either inconclusive or no evidence for my predictions. Regarding

offenders' health behaviors, Study 1 found that apologizing indirectly improved offenders' intended health behaviors by decreasing their feelings of shame. However, Studies 2 and 3 found no evidence for the predicted benefits of apologizing for offenders' intended health behaviors or actual health behaviors (either directly, through shame, or through other pathways).

Regarding cardiovascular function, Study 3 provided mixed evidence for the predicted benefits of apologizing for offenders' cardiovascular reactivity and recovery and found that apologizing might have both potentially beneficial and potentially detrimental effects on cardiovascular reactivity and recovery, depending on the specific cardiovascular parameter under consideration (i.e., with potentially beneficial effects on HR recovery, but potentially detrimental effects on SBP reactivity and recovery). Importantly, even the potentially beneficial effects of apologizing on HR recovery only applied when its effects were compared to those of ruminating. Therefore, there is no evidence to suggest that apologizing may be more beneficial than simply distracting oneself from one's negative actions.

Regarding offenders' likelihood of offering a real-world apology, Studies 2 and 3 yielded findings that directly opposed each other. While Study 2 found that the apology intervention increased offenders' likelihood of offering a real apology to their victim (compared to both rumination and control, which did not yield differences in likelihood of offering a real apology), Study 3 found that the apology intervention *decreased* offenders' likelihood of offering a real apology to their victim (compared to rumination, but not self-distraction, with rumination also increasing the likelihood of offering a real apology compared to self-distraction). As mentioned in the Discussion of Study 3, one possible explanation for these contradictory findings might be the different instructions used for the apology intervention across these two studies.

In addition to these contradictory findings, another contradictory association appeared to

exist across the three studies. While Study 1 found a negative association between shame and intended health behaviors and no association between guilt and intended health behaviors, Studies 2 and 3 found no association between shame and intended health behaviors and a positive association between guilt and intended health behaviors. The negative association between shame and intended health behaviors found in Study 1 is in line with previous research, which has consistently demonstrated associations between shame and several unhealthful behaviors, in part perhaps because the intensity of discomfort caused by feelings of shame may prompt attempts to down-regulate this emotion through increased use of alcohol, cigarettes, and drugs (e.g., Dearing et al., 2005; Ianni et al., 2010).

Guilt, on the other hand, appears to have inconsistent associations with health behaviors, with previous studies showing both negative, positive, and no associations between guilt and health behaviors (e.g., Bybee et al., 1996; Dearing et al., 2005). Guilt seems especially likely to have positive associations with healthful behaviors when measured as a trait tendency, such as when individuals tend to experience, or anticipate experiencing, guilt about a specific unhealthy behavior (e.g., Eyler & Vest, 2002; Sukhdial & Boush, 2004; Quiles, Kinnunen, & Bybee, 2002). For instance, individuals who feel or expect to feel guilty about eating unhealthful foods appear especially likely to steer away from such foods. Additionally, it seems that difficulty with down-regulating guilt, rather than the experience of guilt itself, might be especially predictive of unhealthy behaviors (Bybee et al., 1996). It remains unclear, however, why guilt about a specific offense might at least sometimes be associated with better intended (but not actual, see Study 2) health behaviors. Since guilt involves feelings of discomfort about one's actions and therefore orients people toward self-improvement (Tangney & Dearing, 2002), it is possible, perhaps, that guilt about an offense might translate to a general attitude toward self-improvement and may

thus positively influence one's intended self-care and associated intended health behaviors.

One finding that was fairly consistent across studies, however, was the presence of a suppression effect when testing the influence of intervention condition on intended and actual health behaviors (see MacKinnon, Krul, & Lockwood, 2000). Specifically, Studies 1 and 2 found that the effect of apologizing versus control on these variables increased in magnitude when controlling (vs. not) for the tested mediators, with apologizing leading to *worse* intended and actual health behaviors compared to the control condition. This typically occurs when an independent variable has both positive and negative effects on a dependent variable through different mediators (MacKinnon, Krul, & Lockwood, 2000). When calculating the total effect of the independent variable on the dependent variable, these contradictory effects cancel each other out, resulting in a small and often non-significant total effect. Yet, when statistically controlling for mediators that influence the dependent variable in one direction (e.g., positively), a negative effect of the independent variable on the dependent variable is revealed. This suggests that apologizing may have both positive and negative effects on health behaviors. This seems plausible, because although apologizing has documented benefits for offenders' self-concept restoration (e.g., guilt and shame reduction; Witvliet et al., 2001; 2002), a recent line of work suggests that such benefits may also follow for offenders who refuse to apologize. Specifically, two studies showed that refusing to apologize increased offenders' self-esteem, integrity, and power as much as offering an apology compared to a control condition (Okimoto, Wenzel, & Hedrick, 2013). This suggests that boundary conditions might exist to determine whether apologies have a positive, negative, or no effect on offenders' restoration and potentially resulting health behaviors.

It is possible, for instance, that offering an apology might not have beneficial outcomes,

and possibly could have detrimental outcomes when doing so does not feel like the right or most appropriate course of action. As available data suggest, offenders tend to regret offering an apology when they view their apology as insincere, undeserved, or premature (Exline et al., 2007). In these cases, choosing not to apologize might be more beneficial for offenders than offering an apology, for example by bolstering their feelings of integrity and self-worth. Participants might have been particularly likely to experience these attitudes toward apologizing given that they were randomly assigned to be instructed to apologize (rather than apologize spontaneously).

It is also possible that the consequences of offering an apology may depend on how well the apology is received by the victim. Previous research has found that offenders tend to experience regret after offering an apology that was rejected by the victim (Exline et al., 2007). Moreover, an experimental study found that imagining offering an apology that was accepted by one's victim led to lower guilt and shame than an apology that was rejected (Witvliet et al., 2002). These findings suggest that apologies met with forgiveness should be more likely to have beneficial consequences for offenders than apologies met with unforgiveness.

Apologizing, further, might be mainly beneficial for public offenses that one's victim is aware of (e.g., insulting one's romantic partner during an argument) than for private offenses that have happened unbeknownst to the victim (e.g., having a clandestine romantic affair). Even though apologizing can be risky and can further damage an offenders' social image (Ohtsubo et al., 2012), individuals are likely to suffer severe social consequences for committing public offenses that are unlikely to follow from committing private offenses, including their victim's vengefulness and broader social exclusion (e.g., Shnabel & Nadler, 2008). As such, offering an apology for a public offense has the potential to be more beneficial than offering an apology for

a private offense. Since the current studies included a mix of public and private offenses, it is possible that the potentially beneficial effects of offering an apology for public offenses were dampened by the inclusion of private offenses. Even though the public versus private nature of offenses seems to be a plausible moderator, I could not test for this in my analyses because it was sometimes unclear whether participants' offenses were known to the victim (e.g., some participants described that they cheated on their significant other, but did not comment on whether their significant other knew or suspected about the cheating).

When we specifically consider offenders' (intended) health behaviors as an outcome of apologizing, there is another reason to believe that apologizing for public offenses might be especially important. Public offenses tend to primarily increase offenders' shame rather than their guilt by directing their attention to how they may be negatively judged by others (Combs, Campbell, Jackson, & Smith, 2010; Smith et al., 2002; Wolf, Cohen, Panter & Insko, 2011). Because shame, but not guilt, has consistently been associated with a variety of unhealthful behaviors (e.g., Bybee et al., 1996; Dearing et al., 2005; Sanfter et al., 1995), decreasing shame by apologizing for public offenses may be most likely to lead to positive changes in health behaviors.

Finally, research has shown that offenses with severe consequences (Hall & Fincham, 2008) and for which offenders feel personally responsible (Fisher & Exline, 2006; Hall & Fincham, 2008; Smith & Ellsworth, 1985) are associated with greater guilt and shame. Although this suggests that intervention condition might be more likely to benefit offenders' restoration and consequent health behaviors for offenses of higher (vs. lower) severity, supplementary analyses that tested offense severity as a potential moderator did not provide evidence for this (see Appendices A, B, and D).

5.1 CONTRIBUTIONS, LIMITATIONS, AND FUTURE DIRECTIONS

The present research was the first to test the potential effect of apologizing on offenders' health behaviors, as well as relevant psychological processes that might explain such an effect, and it was one of the first to test the potential effects of apologizing on offenders' cardiovascular function (see Da Silva et al., 2016). This scarcity of previous research on offenders' cardiovascular risk is surprising, given the presence of past research suggesting that individuals appear to offend others on a regular basis (Schumann, 2014). Such offenses might increase two known correlates of CVD risk that might be decreased through an apology, namely the persistent experience of negative emotions and damage to social relationships (e.g., Cohen et al., 2001; DeSteno et al., 2013; Fisher & Exline, 2010; Woodyatt & Wenzel, 2013b). Although the current studies do not provide clear evidence for the health benefits of apologizing, these studies take an important step towards examining these potential benefits and revealing that the health consequences of apologizing are likely complex.

The present research also had a number of shortcomings, with the most important being that participants were not asked to directly apologize to their victim. This likely limited my ability to find evidence for perceived forgiveness effects of apologizing and may have weakened my ability to find consistent evidence for guilt and shame reduction effects of apologizing. In hindsight, it appears unlikely that writing an apology without delivering it would meaningfully impact one's perceived reconciliation with the victim. In fact, the vast majority of studies that have previously found evidence for the benefits of apologizing asked participants to imagine delivering their apology or recall times that they had apologized or not (Carpenter et al., 2014; Meek et al., 1995; Witvliet et al., 2002; 2011).

Another limitation of the present research is that it investigated apologies in an

experimental setting, which might not fully reflect real-world conflict and apology situations. For at least some of my participants, offering an apology may have felt insincere, undeserved or premature. These participants may therefore not have chosen to offer an apology to their victim in real life, possibly making the results of the present studies less applicable to real-world conflict. In an attempt to address this concern, I chose not to provide participants with specific instructions on how to apologize, instead leaving this up to their personal preferences. Future research, however, could also ask participants to indicate the extent to which an apology feels appropriate at the time of the study and test whether this feeling of appropriateness moderates the effect of the apology intervention on the studied outcomes.

Another limitation of the present research is that it focused on offenders' negative emotions to the potential neglect of positive emotions. I chose to focus on the experience of guilt and shame in particular because they are the most commonly studied emotions in the context of interpersonal offenses (e.g., Baumeister et al., 1994; Fisher & Exline, 2010; Leith & Baumeister, 1990), possibly because of their obvious connection to hurting others. Yet, apologies can also increase positive affective states, including hope and gratitude (Witvliet et al., 2002). Positive and negative affective states seem to have independent effects when it comes to cardiovascular health outcomes (Davidson, Mostofsky, & Whang, 2010; Steptoe et al., 2005), raising the possibility that apologies might influence offenders' health outcomes through a positive affect pathway that is independent of the negative affect pathway considered in this research. The present research can therefore be broadened by also considering the role of positive emotions in offenders' apology process.

The present research, finally, was also limited by the way I chose to study the potential effect of apologies on correlates of cardiovascular risk. I focused on cardiovascular reactivity and

recovery because this allowed me to study the causal effect of apologies on cardiovascular function and might therefore offer important preliminary insights about the predictive value of apologizing on cardiovascular stress physiology. Yet, although heightened reactivity and slower recovery in response to challenges predict poorer cardiovascular health prospectively (e.g., preclinical atherosclerosis; Chida & Steptoe, 2010), their explanatory power is small and they may not represent the most plausible pathway to disease development and progression. This is not surprising given that atherosclerosis stems from multiple risk factors and develops over the span of many decades. Reactivity to a single offense is thus unlikely to start or markedly speed up this complex process of atherogenesis, although its effects may accumulate over time if a person shows exaggerated cardiovascular responses to his or her offenses, and does so often. Cardiovascular reactivity to events is indeed a largely trait-like, individual difference variable and appears to covary with greater negative emotional reactions to such events (e.g., Feldman et al., 1999). The results of this research may therefore be especially relevant for people who have a high tendency to show reactivity, offend others often, and do not constructively resolve their offenses.

Future research could therefore explore additional pathways that might exist independently of reactivity and recovery and that might link apologies to cardiovascular health. For example, the frequent experience of negative emotions is predictive of future atherosclerotic CVD (e.g., DeSteno et al., 2013). While the field's understanding of the exact mechanisms linking the experience of negative emotions to CVD is incomplete, it seems plausible that such emotions may, for instance, activate the central nervous system and the sympathetic-adrenal-medullary axis in ways that induce arterial pathophysiology over time. Rather than inducing cardiovascular reactivity and impairing cardiovascular recovery, it is possible that persistent

feelings of guilt and shame for unresolved offenses might influence biological markers of (pre)clinical atherosclerosis at baseline. Future research, for example, could study how chronic feelings of guilt and shame about old unresolved offenses may relate to individuals' blood pressure values at baseline, as well as to other such markers, including high density and low density lipoprotein cholesterol values. Or, it could study how the trait-like tendency to anticipate guilt and shame might relate to such baseline markers. In the present dataset, there was some evidence to suggest that the tendency to experience both guilt and shame was associated with lower systolic blood pressure at baseline. It is possible that individuals who know they are prone to experiencing these emotions may avoid engagement in actions that they anticipate will lead to feelings of guilt and shame, including hurting others (see Cohen et al., 2011). Thus, several possibilities could be explored in future work regarding the potential health consequences of hurting others.

5.2 CONCLUSION

The present research tested the potential effects of offering an apology on offenders' health behaviors and cardiovascular function. The findings of three studies were inconclusive, suggesting that offering an apology might have both positive and negative consequences for offenders' health outcomes. Despite the inconclusive findings presented here, it is my hope that this research will contribute to the growing dialogue on the link between offense resolution and offenders' health.

6.0 FOOTNOTES

[1] Other than the study by Da Silva and colleagues (2016), one more study has previously attempted to test the effect of apologies on cardiovascular function (Witvliet et al., 2002). I chose not to discuss this study in the Introduction, because limitations of the research design make it difficult to draw meaningful conclusions about the findings. As a measure of cardiovascular function, this study assessed offenders' heart rate during and after offering an apology. No differences were found in participants' heart rate compared to other conditions. The study, however, used a within-subjects design, with each imagery condition only lasting 16 seconds and each recovery period only lasting 8 seconds. This short time frame may not have been sufficient to allow for detailed imagery of delivering an apology. Moreover, cardiovascular effects often last substantially longer than a few seconds (e.g., Kamarck et al., 1992), suggesting that participants' heart rate during one condition may not only have been influenced by the imagery of that condition, but by that of one or more preceding conditions.

[2] Participants first completed measures of their trait anger (Buss & Perry, 1992), hostility (Buss & Perry, 1992), and self-compassion (Neff, 2003) for exploratory purposes as well as to control for their potential associations with the variables in the proposed model. I will therefore not discuss these further, except to state that these individual difference variables did not moderate the associations presented in the main text and that controlling for them did not alter the pattern and/or statistical significance of the presented findings in any of my analyses (see

Figure 2).

[3] Participants also completed the other two subscales of the Differentiated Process Scale of Self-Forgiveness (Woodyatt & Wenzel, 2013a): the genuine self-forgiveness subscale (measuring participants' efforts to self-forgive in the past and present, e.g., "I have spent time working through my guilt") and the pseudo self-forgiveness subscale (measuring denial of responsibility and victim blaming, e.g., "I feel like the other person was really to blame for what I did"). I decided not to use these subscales in the presented analyses, because I did not expect them to represent plausible mechanisms linking guilt and shame reduction to intended health behaviors.

[4] Before completing any of the measures listed, participants first completed measures about their social network characteristics (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997), loneliness (Peplau & Cutrona, 1980), depressive symptomatology (Radloff, 1977), and tendency toward social desirability (Stober, 2001). I included these measures to test them as potential moderators in each analysis reported in the main text. Please see Appendix B for the results. Controlling for these variables did not change the reported findings on intended health behaviors. Controlling for these variables rendered all significant associations in the tested model for actual health behaviors non-significant. Finally, controlling for these variables did not change the reported findings on real-world apologies.

[5] It is also conceivable that intervention condition might have influenced participants' health behaviors by influencing their intended health behaviors through all proposed mediators. I tested this possibility, but found poor model fit because intended health behaviors were correlated with the health behavior latent factor. I decided against implementing this model modification, because participants' intended health behaviors were measured a week before their actual health

behaviors and would thus not theoretically belong to the same latent factor.

[6] For consistency with the analyses above, I could also have tested my model with structural equation modeling using either arbitrary generalized least squares as the estimation method or generalized least squares and robust estimators to correct for the non-normal distribution of the binary outcome variable (i.e., apology vs. no apology). However, such an analysis would assume that the underlying distribution of the binary outcome variable is continuous, as traditional structural equation modeling is limited to either continuous outcome variables or categorical outcomes with underlying continuous distributions in the population (Bentler, 2006; Kaplan, 2009). Since this assumption was not met by my data (i.e., participants either did, or did not, apologize), I chose to conduct a binary logistic regression.

[7] Data were originally collected from 132 participants. However, due to an unexpected error, the raw data of 19 consecutive participants went missing before these could be saved on the computer. Six of these participants were in the apology condition, seven were in the rumination condition, and six were in the self-distraction condition. All data for these participants is missing, except for their real-world apology behavior.

[8] Participants also filled out measures about the following characteristics: trait self-compassion (Neff, 2003), proclivity to apologize (Howell, Dopko, Turowski, & Buro, 2011), trait self-forgiveness (Thompson & Snyder, 2003), relational interdependence (Cross, Bacon, & Morris, 2000), guilt and shame proneness (Cohen et al., 2011), physical symptomatology (Cohen & Hoberman, 1983), perceived stress (Cohen, Kamarck, & Mermelstein, 1983), and some general questions about their health behaviors over the past month. I included these measures for exploratory purposes that are not the main focus of the present study.

[9] Participants also filled out a measure about their physical symptomatology (Cohen &

Hoberman, 1983) and answered a number of general questions about their health behaviors since the occurrence of their offense. These measures were included for exploratory purposes that were not the focus of this paper. After the intervention, participants also filled out measures of their current levels of empathy for their victim, their current tendency to ruminate about their offense, two exploratory measures meant to capture their feelings of lightness as a proxy for self-forgiveness, the genuine self-forgiveness and pseudo self-forgiveness subscales of the Differentiated Process Scale of Self-Forgiveness (Woodyatt & Wenzel, 2013a), and the same questions about apology comprehensiveness and defensiveness as in Study 1. I included these measures to gain further understanding about the effects of the intervention exercises, but these measures were not the focus of the current study.

[10] I also repeated the reported analyses using heart period (i.e., the average time in milliseconds between heart beats, which is the reciprocal of HR) instead of HR and found similar results to the ones with HR as the outcome variable.

[11] In separate analyses, I also controlled for experimenter (myself vs. a trained female experimenter) and semester of data collection. Since the results did not qualitatively differ when controlling versus not controlling for these variables, I chose to present simplified analyses without these variables. In another set of separate analyses, I tested the sensitivity of the findings presented below by excluding participants who reported regularly taking medications known to affect cardiovascular function (e.g., methylphenidate; $n = 4$). Excluding these participants did not influence the patterns and statistical significance of the findings presented in the main text and I therefore retained these participants for added statistical power.

APPENDIX A

SUPPLEMENTARY ANALYSES STUDY 1

A.1 MODERATION BY PRE-INTERVENTION LEVELS OF GUILT, SHAME, AND PERCEIVED VICTIM FORGIVENESS

I conducted supplementary analyses to test whether the effects of the intervention condition on guilt, shame, and perceived victim forgiveness would be moderated by participants' pre-intervention levels of these variables. I reasoned that apologies may be especially effective in decreasing offenders' negative emotions and restoring their perceived relationship with the victim to the extent that the offense gave rise to negative emotions and perceived damage to their relationship in the first place. I found limited support for these predictions.

Specifically, I found that (a) the effect of apology versus rumination on shame was moderated by pre-intervention levels of shame (B = .18, z = 2.96, p = .003) and that (b) the effect of apology versus self-distraction on perceived victim forgiveness was moderated by pre-intervention levels of perceived forgiveness (B = .14, z = 2.23, p = .03).

Regarding shame, apologizing reduced shame compared to ruminating at low (B = .26, z = 3.25, p = .001), average (B = .43, z = 6.25, p < .001), and high (B = .61, z = 5.95, p < .001) levels of pre-intervention shame. Thus, apologizing decreased shame at all levels of pre-

intervention shame, but did so especially to the extent that participants already experienced much shame.

Regarding perceived victim forgiveness, I found no differences between apologizing and self-distraction on perceived victim forgiveness at low (B = -.12, z = -1.42, p = .16) and average (B = .02, z = .31, p = .76) levels of pre-intervention perceived forgiveness. However, at high levels of pre-intervention perceived forgiveness, apologizing led to marginally lower perceived victim forgiveness compared to self-distraction (B = .16, z = 1.70, p = .09). It is possible that when one's relationship with the victim already feels repaired (as indicated by high levels of perceived victim forgiveness), offering an apology may not facilitate repairing the relationship any further, but may increase one's focus on their hurtful actions and thus decrease perceived forgiveness.

Because analyses yielded limited support for moderation, I chose to present simplified analyses while controlling for pre-intervention guilt, shame, and perceived victim forgiveness.

A.2 MODERATION BY OFFENSE SEVERITY

I also conducted a separate set of analyses to test whether self-rated offense severity moderated any of the pathways in the tested model (Figure 2). Moderation by offense severity may be plausible, because severe offenses tend to generate stronger negative emotions than less severe offenses (Riek, 2010). This suggests that apologies might be especially effective in decreasing guilt and shame, and thus in improving intended health behaviors, for offenses of higher rather than lower severity.

Three pathways in the model were moderated by offense severity: the effect of apology

versus self-distraction on post-intervention levels of guilt (B = .16, z = 2.00, p = .05), the effect of apology versus rumination on post-intervention levels of shame (B = .15, z = 2.04, p = .04), and the effect of apology versus self-distraction on post-intervention levels of shame (B = .18, z = 2.69, p = .01).

For offenses of *high* severity, apologizing led to lower guilt compared to self-distraction (B = .30, z = 2.60, p = .01), led to lower shame compared to rumination (B = .60, z = 6.14, p < .001), and led to lower shame compared to self-distraction (B = .38, z = 3.86, p < .001). For offenses of *average* severity, apologizing led to marginally lower guilt compared to self-distraction (B = .14, z = 1.83, p = .07), led to lower shame compared to rumination (B = .45, z = 6.70, p < .001), and led to lower shame compared to self-distraction (B = .20, z = 2.99, p = .002). For offenses of *low* severity, apologizing did not influence guilt compared to self-distraction (B = -.01, z = -12, p = .90), led to lower shame compared to rumination (B = .30, z = 3.05, p = .002), and did not influence shame compared to self-distraction (B = .02, z = .23, p = .82).

These findings suggest that the indirect effect of apologizing versus self-distraction on improved intended health behaviors through decreased shame that was reported in the main text may only apply to offenses of average and high severity, but not low severity. However, 95% bootstrapped confidence intervals of these indirect effects at high, average, and low levels of severity based on 1,000 samples all contained the value zero: indirect effect $_{\text{High Severity}}$ = -.1523, 95% CI [-.4656, .0290]; indirect effect $_{\text{Average Severity}}$ = -.0852, 95% CI [-.2603, .0188]; indirect effect $_{\text{Low Severity}}$ = -.0088, 95% CI [-.1356, .0935]. Controlling for offense severity did not alter the statistical significance and pattern of the findings presented in the main text.

A.3 MODERATION BY GENDER

Next, I tested whether participants' gender moderated any of the associations in the model shown in Figure 2. When testing for moderation by gender, I excluded the responses of two participants who did not identify as either man or woman. Moderation by gender could be plausible, as women are more likely to perceive their own behavior as offensive than men (Schumann & Ross, 2010). This implies that apologies might be more effective in decreasing guilt and shame, and thus lead to better intended health behaviors, for women compared to men.

Two pathways were moderated by participants' gender: the effect of apologizing versus rumination on post-intervention levels of perceived victim forgiveness (B = -.31, z = -2.08, p = .04), such that apologizing increased perceived forgiveness for women (B = -.28, z = -2.40, p = .02), but not men (B = .01, z = .11, p = .91), and the association between post-intervention guilt and self-punishment (B = -.16, z = -2.48, p = .01), such that guilt was associated with increased self-punishment for men (B = .23, z = 2.86, p = .004), but not women (B = .05, z = .67, p = .50). Controlling for gender did not alter the statistical significance and pattern of the findings presented in the main text.

A.4 ASSOCIATIONS BETWEEN APOLOGY QUALITY AND INTENDED HEALTH BEHAVIORS

As a secondary aim, I tested whether the quality or comprehensiveness of offenders' apologies was associated with their intentions to engage in healthful behaviors. In their apology, offenders can admit fault, assume responsibility, acknowledging the harm they caused, explain their actions, express regret, promise to behave better in the future, offer repair, and/or request forgiveness, with apologies containing more of these elements being more comprehensive (Schumann, 2014). Although comprehensive apologies are costly to offenders because admitting fault can further harm their self-image and social relationships (Ohtsubo et al., 2012; Ohtsubo & Watanabe, 2009; Schumann, 2014), such apologies may also benefit their restoration. As previous research has found, offering a comprehensive apology is associated with decreased negative emotions about the offense (Byrne, Barling, & Dupre, 2013) and leads to increased victim forgiveness in experimental settings using imagined offenses (Kirchhoff, Wagner, & Strack, 2012; Scher & Darley, 1997; Schmitt, Gollwitzer, Forster, & Montada, 2004). If reduced negative emotions and (perceived) victim forgiveness are mechanisms through which apologies might improve intended health behaviors, this suggests that more comprehensive apologies might be associated with better intended health behaviors.

To test this possibility, I asked participants in the apology condition to rate their apology's comprehensiveness (using 8 items adapted from Schumann, 2014, e.g., "I expressed remorse about what happened" and "I accepted responsibility for what happened"; Cronbach's α = .76) and defensiveness (using 4 items adapted from Schumann, 2014, e.g., "I justified my behavior" and "I put some of the blame of what happened on the person I hurt"; Cronbach's α =

.75).

To test the associations between apology comprehensiveness, apology defensiveness, and intended health behaviors, I tested the same structural equation model as in my main analyses (Figure 2), except that I treated apology comprehensiveness and defensiveness as predictors, rather than intervention condition. The data deviated from multivariate normality (z = 2.30, p = .02) and I therefore used scaled maximum likelihood estimators corrected for non-normality (Satorra & Bentler, 1988) in interpreting the results of the upcoming analyses.

Neither apology comprehensiveness (B = .07, z = .77, p = .44) nor apology defensiveness (B = -.09, z = -1.52, p = .13) had a total effect on offenders' intended health behaviors. However, **a**pology comprehensiveness was associated with marginally decreased guilt (B = -.13, z = -1.98, p = .05), was not associated with changes in shame (B = -.10, z = -1.61, p = .11), and was associated with marginally greater perceived victim forgiveness (B = .16, z = 1.93, p = .05). Apology defensiveness was associated with marginally decreased guilt (B = -.08, z = -1.72, p = .09), was not associated with changes in shame (B = -.03, z = -.63, p = .53), and was not associated with perceived victim forgiveness (B = -.08, z = -1.39, p = .17). Perceived victim forgiveness, further, was associated with marginally decreased guilt (B = -.13, z = -1.87, p = .07), but was not associated with shame (B = -.02, z = -.23, p = .82).

Guilt, in turn, was not associated with self-punishment (B = .18, z = 1.29, p = .20), whereas shame was associated with increased self-punishment (B = .53, z = 3.78, p < .001). Perceived victim forgiveness and apology quality also had some associations with self-punishment independently of its associations with guilt, shame, and perceived victim forgiveness. While perceived victim forgiveness was associated with marginally decreased self-punishment (B = -.17, z = -1.75, p = .08), apology comprehensiveness was associated with

increased self-punishment (B = .13, z = 2.15, p = .03). Apology defensiveness was not associated with self-punishment (B = -.04, z = -.88, p = .38).

Self-punishment, finally, was not associated with intended health behaviors (B = -.08, z = -.69, p = .49) and neither perceived victim forgiveness (B = .01, z = .13, p = .90), guilt (B = .04, z = .32, p = .75), nor shame (B = -.16, z = -1.11, p = .27) had independent associations with intended health behaviors. Based on these results, there was no evidence for any indirect associations between apology quality and intended health behaviors. Moreover, after taking into all the tested mediators, apology comprehensiveness (B = .06, z = .77, p = .44) and defensiveness (B = -.08, z = -1.60, p = .11) were still not associated with offenders' intended health behaviors.

APPENDIX B

SUPPLEMENTARY ANALYSES STUDY 2

B.1 MODERATION BY OFFENSE SEVERITY

As in Study 1, I conducted separate analyses to test whether self-rated offense severity moderated any of the pathways in the tested models (i.e., from intervention condition to intended health behaviors; actual health behaviors; and real-world apologies). None of the pathways were moderated by offense severity Controlling for offense severity and participants' gender did not alter the pattern and statistical significance of the findings presented in the main text.

B.2 MODERATION BY GENDER

To test whether gender moderated any of the pathways in the tested models (i.e., from intervention condition to intended health behaviors; actual health behaviors; and real-world apologies), I removed two participants who had chosen "other" as their gender identity, because it was unknown what their preferred identity was and a sample size of two was extremely small.

Regarding intended health behaviors, two pathways were moderated by participants'

gender: the pathway between apology versus control on perceived social support (B = -.48, z = -2.06, p = .04) and between self-forgiveness and intended health behaviors (B = -.53, z = -8.12, p < .001). For men, there was no effect of apology on perceived social support compared to the control condition (B = .11, z = .83, p = .41) and there was no association between self-forgiveness and intended health behaviors (B = .07, z = .91, p = .36). For women, apologizing led to higher perceived social support compared to the control condition (B = -.30, z = -2.13, p = .03), but there was no association between self-forgiveness and intended health behaviors (B = -.06, z = 1.00, p = .32). These findings suggest that two indirect pathways from intervention condition and intended health behaviors might exist for women (see Figure 3 and results reported under Study 2), namely, from apology versus control to intended health behaviors through the sequence of perceived social support, shame, and then self-esteem, as well as from intervention condition to intended health behaviors through the sequence of perceived social support and self-esteem. However, neither of these indirect effects differed significantly from zero: indirect effect $_1$ = -.0026, 95% CI [-.0099, .0017); indirect effect $_2$ = -.0158, 95% CI [-.0566, .0086].

Regarding actual health behaviors, the same two pathways as above were moderated by participants' gender, as well as the pathway between participants' shame and health behaviors (B = -.33, Z = -5.36, p < .001). For men, there was no effect of apology on perceived social support compared to the control condition (B = .24, z = 1.47, p = .14), there was a positive association between self-forgiveness and health behaviors (B = .38, z = 3.55, p < .001), and there was no association between shame and health behaviors (B = .16, z = 1.30, p = .19). For women, there was no effect of apology on perceived social support compared to the control condition (B = -.24, z = -1.43, p = .15), no association between self-forgiveness and health behaviors (B = -.01, z = -.13, p = .90), and no association between shame and health behaviors (B = .06, z = .54, p = .59).

Regarding real-world apologies, only the pathway between apology versus control and perceived social support was moderated by participants' gender (B = -.33, t(387) = -2.04, p = .04, 95% *CI* [-.66, -.01]). There was no effect of apology versus control on perceived social support for men (B = -.17, t(189) = -1.42, p = .16, 95% *CI* [-.40, .07]) or women (B = .17, t(195) = 1.44, p = .15, 95% *CI* [-.06, .39]). Controlling for participants' gender did not alter the pattern and statistical significance of the findings presented in the main text for intended health behaviors, actual health behaviors, or real-world apologies.

B.3 MODERATION BY OFFENSE TIMEFRAME

Against expectations, I found no evidence to suggest that apologizing predicted changes in (intended) health behaviors through changes in guilt, shame, perceived social support, and subsequent changes in emotion regulation, self-esteem, and self-forgiveness. However, I specified no particular timeframe for the offense in an attempt to recruit participants with offenses that would be sufficiently severe and, thus, for whom apologizing would be especially beneficial.

The timing of the offense might be important and apologizing might perhaps be more beneficial for relatively recent as opposed to distant offenses. For recent offenses, transgressors might still be in the process of finding a way to make amends for their offenses. Allowing them to apologize might thus be beneficial for decreasing their negative emotions about the offense and remove their inhibitions to actually apologize. For offenses that occurred longer ago, however, transgressors might have already found closure and accepted their negative actions. It is possible that mentally revisiting the offense and asking them to face their victim and apologize

might lead to a renewed increase in feelings of guilt and shame and might thus be as distressing as, for example, ruminating about the offense.

To test this possibility, I repeated the analyses on intended and actual health behaviors that were reported in the main text by using the timing of the offense as a potential moderator between intervention condition and the variables that followed (i.e., guilt, shame, and perceived social support for intended health behaviors and guilt, shame, perceived social support, emotion regulation, self-esteem, and self-forgiveness for actual health behaviors). Timing of the offense was measured by asking participants to choose when the offense had happened from a list of timeframes (*During the past week/During the past month/During the past three months/During the past six months/During the past year/Longer than a year ago*). Because relatively few participants reported an offense in the three most recent categories ($n_{\text{Past week}} = 12$; $n_{\text{Past month}} = 41$; $n_{\text{Past three months}} = 46$), I collapsed them into a single category for offenses that had happened during the past three months ($n_{\text{Three months}} = 99$; $n_{\text{Six months}} = 67$; $n_{\text{One year}} = 110$; $n_{\text{Longer than a year ago}} = 325$). In my analyses, I dummy-coded offense timeframe and used the three-month timeframe as the reference condition, because Studies 1 and 2 involved offenses with a recent timeframe.

Regarding *intended health behaviors*, one pathway was moderated, such that the effect of apology versus control on guilt depended on whether participants' offense was very recent (< 3 months) or older (> 1 year), $B = -.64$, $z = -2.23$, $p = .003$. For offenses that had happened within the past three months, apologizing led to marginally lower guilt compared to the control condition ($B = .51$, $z = 1.93$, $p = .05$). For offenses that had happened longer than a year ago, apologizing did not affect guilt compared to the control condition ($B = -.13$, $z = -1.11$, $p = .27$).

Further, for offenses that had had happened within the past three months, guilt was associated with decreased self-esteem ($B = -.38$, $z = -2.18$, $p = .03$) and decreased self-

forgiveness (B = -.60, z = -3.78, p < 001). Of these two variables, self-esteem was associated with better intended health behaviors (B = .31, z = 4.80, p < .001), while self-forgiveness was not associated with intended health behaviors (B = .03, z = .52, p = .60). After taking into account intervention condition and all tested mediators, however, guilt was also directly associated with better intended health behaviors (B = .39, z = 3.26, p = .001). This suggests that apologizing might indirectly both improve (through decreasing guilt and subsequently increasing self-esteem) and harm (through decreasing guilt) offenders' intended health behaviors compared to control. To test these possibilities, I therefore calculated the following two indirect pathways and tested their significance by calculating 95% bootstrapped confidence intervals for each effect, based on 1,000 samples: (1) from apologizing versus control to intended health behaviors through decreased guilt and subsequently increased self-esteem; and (2) from apologizing versus control to intended health behaviors through decreased guilt. Neither of these indirect effects were statistically significant: indirect effect $_1$ = -.0603 (95% CI [-.1706, .0050]); indirect effect $_2$ = .1973 (95% CI [-.0031, .4692]) Both effects, however, were marginally significant: 90% CI indirect effect $_1$ [-.1444, -.0021]; 90% CI indirect effect $_2$ [.0335, .4244]. Thus, there was some suggestive evidence for both positive and negative effects from intervention condition to intended health behaviors for relatively recent offenses (specifically, offenses that happened within three months prior to the apology intervention) compared to control.

Regarding *actual health behaviors*, three pathways were moderated. First, the effect of apology versus control on guilt depended on whether participants' offense had happened within the past three months or the past year, B = -.85, z = -2.10, p = .04. For offenses that had happened within the past three months, apologizing led to marginally lower guilt compared to the control condition (B = .65, z = 1.96, p = .05). For offenses that had happened within the past

year, apologizing did not affect guilt compared to the control condition (B = -.21, z = -.83, p = .41). Second, the effect of apology versus control on guilt depended on whether participants' offense had happened within the past three months or longer than a year ago, B = -.76, z = -2.14, p = .03. For offenses that had happened within the past three months, apologizing led to marginally lower guilt compared to the control condition (B = .65). For offenses that had happened longer than a year ago, apologizing did not affect guilt compared to the control condition (B = -.23, z = -1.24, p = .22). Third, the effect of apology versus rumination on self-forgiveness depended on whether participants' offense had happened within the past three months or within the past year, B = 1.29, z = 2.34, p = .02. For offenses that had happened within the past three months, apologizing did not affect self-forgiveness compared to rumination (B = -.09, z = -.19, p = .85). For offenses that had happened within the past year, apologizing led to lower self-forgiveness compared to rumination (B = 1.11, z = 2.98, p = .003).

These findings suggest two possible indirect effects from intervention condition to health behaviors; one within the three-month timeframe (through guilt) and one within the one-year timeframe (through self-forgiveness). Within the three-month timeframe, guilt was associated with better health behaviors (B = .63, z = 2.84, p = .01), while within the one-year timeframe, self-forgiveness was not associated with health behaviors (B = .08, z = .77, p = .44). I therefore only tested the significance of the indirect effect from apology versus control to health behaviors through guilt within the three-month timeframe by calculating a 95% bootstrapped confidence interval based on 1,000 samples. The indirect effect (.3808) was not significant, (95% CI [-.0140, 1.0277]), but was marginally significant (90% CI [.0201, .8854]). Thus, there was some evidence to suggest that apologizing might lead to worse health behaviors compared to control for offenses that happened recently (specifically, within three months of the apology intervention)

by decreasing offenders' guilt.

Regarding *real-world apologies*, the same three pathways were moderated as for actual health behaviors (please refer to two paragraphs above for details). As for actual health behaviors, this suggests two possible indirect effects from intervention condition to real-world apologies; one indirect effect within the three-month timeframe (through guilt) and one indirect effect within the one-year timeframe (through self-forgiveness). Within the three-month timeframe, guilt was not associated with likelihood of offering an apology (B = -.94, χ^2 (1) = 1.92, p = .17, exp(B) = .39, 95% CI exp(B) [.10, 1.48]), while within the one-year timeframe, self-forgiveness was associated with marginally greater likelihood of offering an apology (B = .66, χ^2 (1) = 2.87, p = .09, exp(B) = 1.94, 95% CI exp(B) [.90, 4.19]). I therefore tested the significance of the indirect effect from apology versus rumination to likelihood of offering an apology through self-forgiveness. To do so, I used the methods outlined by Iacobucci (2012) by calculating a z-statistic from the ordinary least squares regression equation used to predict self-forgiveness from intervention condition as well as from the logistic regression equation to predict likelihood of offering an apology from self-forgiveness and the other mediators after controlling for intervention condition, z = 1.43, p = .15. Thus, changes in self-forgiveness did not mediate the link between apology versus control and likelihood of offering an apology within the one-year timeframe.

Moreover, the total effect of intervention condition on likelihood apologizing was also moderated by the timeframe of the offense. Specifically, the effect of apologizing compared to rumination and control depended on whether the offense had happened within the past three months or longer than a year ago ($B_{\text{Apology versus Rumination}}$ = 1.95, χ^2 (1) = 9.67, p = .002, exp(B) = 7.00, 95% CI exp(B) [2.06, 23.84]; $B_{\text{Apology versus Control}}$ = 1.52, χ^2 (1) = 6.93, p = .01, exp(B) =

4.58, 95% CI exp(*B*) [1.48, 14.22]). For offenses that had happened within the past three months, the apology condition led to a marginally higher likelihood of offering an apology compared to rumination (*B* = 1.36, χ^2 (1) = 3.82, *p* = .05, exp(*B*) = 3.90, 95% CI exp(*B*) [1.00, 15.28]) and to four times the likelihood of offering an apology compared to the control condition (*B* = 1.53, χ^2 (1) = 5.20, *p* = .02, exp(*B*) = 4.62, 95% CI exp(*B*) [1.24, 17.23]). For offenses that happened longer than a year ago, the apology condition led to a marginally higher likelihood of offering an apology compared to rumination (*B* = .88, χ^2 (1) = 2.96, *p* = .09, exp(*B*) = 2.40, 95% CI exp(*B*) [.89, 6.51]), but not the control condition (*B* = .62, χ^2 (1) = 1.63, *p* = .20, exp(*B*) = 1.86, 95% CI exp(*B*) [.72, 4.83]).

B.4 MODERATION BY SOCIAL NETWORK CHARACTERISTICS

Finally, I tested participants' social network characteristics (specifically, their social network size and diversity) and their feelings of loneliness as potential moderators for the effect of intervention condition on perceived social support in each of the three models reported in the main text (i.e., with intended health behaviors, actual health behaviors, and real-world apologies as outcomes). I did this because engaging in a prosocial behavior such as apologizing might be especially effective for increasing perceived social support to the extent that one is currently feeling lonely or less integrated. Neither of these three variables moderated the effect of intervention condition on perceived social support.

APPENDIX C

PILOT STUDY TO ESTABLISH ELIGIBILITY CRITERIA FOR STUDY 3

The goal of the pilot study was to establish an important eligibility criterion for the laboratory study, so that data collection for the laboratory study could proceed as efficiently as possible. Specifically, I wanted to identify a specific timeframe in which participants must have committed an offense to be eligible for the laboratory study. Participants were therefore randomly assigned to one of three conditions, in which they either indicated whether they had committed an interpersonal offense within the past 7, 14, or 30 days. I chose these relatively recent timeframes, because I reasoned that participants may not have been as likely to have offered an apology to their victim compared to offenses that had happened longer ago. If participants had committed an offense, they answered a number of follow-up questions, including whether they had apologized to the person they hurt. By comparing among participants' responses on these questions as predicted by the indicated timeframe, my goal was to identify a population of offenders that was likely to (a) have committed an interpersonal offense, (b) have not apologized to their victim, (c) have low difficulty recalling the offense, (d) experience much regret for the offense, and (e) perceive their offense as severe. I chose the first three criteria to maximize the number of participants that would be eligible for the laboratory

study, while I chose the last two to maximize the relevance of the apology intervention. For example, offering an apology may lead to greater decreases in guilt and shame for participants who experience much rather than little regret for their actions.

C.1 PARTICIPANTS AND EXPERIMENTAL DESIGN

Three hundred participants (160 males; 139 females; 1 who identified with a different gender) from the United States completed our pilot study in exchange for $.25 through Amazon's Mechanical Turk.

Participants were between 19 and 75 years old with a mean age of 34.22 years (*SD* = 10.32) and were from 43 states. Most participants were born in the United States (*n* = 290) or Canada (*n* = 2) and some were born in a different country (*n* = 8). The majority of the participants were Christian (*n* = 105), followed by agnostic (*n* = 88), atheist (*n* = 70), Buddhist (*n* = 3), Hindu (*n* = 3), Jewish (*n* = 2), Muslim (*n* = 1), or identified with a different religion (*n* = 28). Finally, most participants were Caucasian (*n* = 246), followed by Asian (*n* = 27), African American (*n* = 23), American Indian or Alaskan Native (*n* = 2), and Native Hawaiian or Pacific Islander (*n* = 2).

C.2 MATERIALS AND PROCEDURES

Three hundred participants (160 males; 139 females; 1 who identified with a different gender) from the United States completed our pilot study in exchange for $.25 through Amazon's

Mechanical Turk.

Participants were between 19 and 75 years old with a mean age of 34.22 years (*SD* = 10.32) and were from 43 states. Most participants were born in the United States (*n* = 290) or Canada (*n* = 2) and some were born in a different country (*n* = 8). The majority of the participants were Christian (*n* = 105), followed by agnostic (*n* = 88), atheist (*n* = 70), Buddhist (*n* = 3), Hindu (*n* = 3), Jewish (*n* = 2), Muslim (*n* = 1), or identified with a different religion (*n* = 28). Finally, most participants were Caucasian (*n* = 246), followed by Asian (*n* = 27), African American (*n* = 23), American Indian or Alaskan Native (*n* = 2), and Native Hawaiian or Pacific Islander (*n* = 2).

C.3 RESULTS

Descriptive statistics for all analyzed variables are displayed in Table 15. First, I conducted a binary logistic regression to test whether the percentage of participants who had committed an interpersonal offense differed depending on whether the offense had happened within the past 7, 14, or 30 days. Experimental condition was dummy coded into two variables, with the 14-day condition serving as the reference condition. The likelihood of having committed an offense was not significantly predicted by experimental condition (χ^2 (2) = .86, p = .65, Negelkerke R^2 = .004). No significant differences were found in the likelihood of having committed an offense within the past 7 versus 14 days (B = .07, χ^2 (1) = .05, p = .82, exp(B) = 1.07, 95% CI exp(B) [.58; 1.99]) or within the past 30 versus 14 days (B = -.21, χ^2 (1) = .47, p = .49, exp(B) = .81, 95% CI exp(B) [.44; 1.49]).

Next, I looked at participants who reported that they had committed an offense (28.00%

of the overall sample). Most offenses had happened against friends (27.4%) and family members (27.4%), followed by romantic partners (25%), work colleagues (10.7%), strangers (4.8%), acquaintances (2.4%), or someone else (2.4%). Regarding type of offense, most participants classified their offense as an insult (48.8%), fight or argument (34.5%), betrayal of trust (14.3%), rejection of exclusion (11.9%), an act of selfishness (7.1%), infidelity (2.4%), ending a relationship (3.6%), failing an obligation (1.2%), physical violence (1.2%), or something else (2.4%).

I first tested whether the likelihood of having apologized differed based on experimental condition by conducting a binary logistic regression with apology (yes/no) as the outcome variable and experimental condition as the predictor. As in the analyses above, I dummy-coded experimental condition into two variables, with the 14-day condition as the reference condition. Likelihood of having apologized was marginally predicted by experimental condition (χ^2 (2) = 5.47, p = .07, Negelkerke R^2 = .09). Participants in the 7-day versus 14-day condition marginally differed in their likelihood of having apologized, such that participants in the 7-day condition had been 60% more likely to apologize than in the 14-day condition (B = -.93, χ^2 (1) = 2.59, p = .11, exp(B) = .40, 95% CI exp(B) [.13; 1.22]). Participants in the 30-day condition had been 72% more likely to apologize than in the 14-day condition (B = -1.28, χ^2 (1) = 4.67, p = .03, exp(B) = .28, 95% CI exp(B) [.09; .89]).

Finally, I tested for potential differences among difficulty of recalling the offense, perceived severity of the offense, and regret about the offense. I therefore conducted a one-way MANOVA with experimental condition serving as the independent variable and difficulty of recall, perceived severity, and regret as the dependent variables. I chose to conduct a MANOVA rather than univariate analyses because some, if not all, of these variables may be theoretically

related. For example, if a person perceives his or her offense to be severe, (s)he may feel more regret as a result and also be more likely to remember the offense. Analyses showed no significant multivariate differences based on participants' experimental condition, Wilk's $\lambda = .95$, $F(6, 158) = .49$, $p = .64$, $\eta^2_p = .03$. Indeed, univariate tests revealed no significant differences in difficulty of recall ($F(2, 81) = .35$, $p = .70$, $\eta^2_p = .01$), perceived severity ($F(2, 81) = 1.15$, $p = .32$, $\eta^2_p = .03$), and regret ($F(2, 81) = .96$, $p = .39$, $\eta^2_p = .03$) among the experimental conditions. Because neither the multivariate nor the subsequent univariate tests were significant, I did not conduct any follow-up tests (e.g., simple contrasts).

Based on the results of the pilot study, I decided that people would be eligible to participate in the laboratory study if they had committed an offense within the past 14 days. This decision was based on the finding that this group of participants was the least likely to have offered an apology, suggesting that this timeframe may yield a relatively large pool of participants to recruit from for the laboratory study. Since I found no evidence to suggest that the likelihood of having committed an offense differed based on when the offense was committed (7, 14, or 30 days ago), nor that important offense characteristics, such as feelings of regret, differed based on when the offense was committed, these variables did not influence my decision to select the 14-day timeframe as the eligibility criterion for the laboratory study.

APPENDIX D

SUPPLEMENTARY ANALYSES STUDY 3

D.1 MODERATION BY OFFENSE SEVERITY

I separately tested whether self-rated offense severity moderated any of the pathways between intervention condition and intended health behaviors. However, no pathways were moderated by offense severity.

D.2 MODERATION BY GENDER

I also tested whether participants' gender moderated any of the pathways between intervention condition and intended health behaviors. Three pathways were moderated: the pathways between perceived victim forgiveness and shame (B = -.21, z = -2.10, p = .04), between guilt and self-punishment (B = -.23, z = -3.02, p = .03), and between shame and intended health behaviors (B = .50, z = 3.43, p < .001). For men, perceived victim forgiveness was associated with marginally decreased shame (B = -.13, z = -1.92, p = .06); for women, perceived victim forgiveness was associated with decreased shame (B = -.21, z = -4.12, p < .001). For both men (B = .47, z = 4.47,

$p < .001$) and women ($B = .28$, $z = 2.52$, $p = .01$), guilt was associated with increased self-punishment. However, shame was associated with worse intended health behaviors for men ($B = -.62$, $z = -2.45$, $p = .01$), but not women ($B = -.01$, $z = -.05$, $p = .96$).

D.3 ASSOCIATIONS BETWEEN APOLOGY QUALITY AND INTENDED HEALTH BEHAVIORS

As in Study 1, I asked participants in the apology condition to rate their apology's comprehensiveness (Cronbach's $\alpha = .50$) and defensiveness (Cronbach's $\alpha = .72$). I further examined the low reliability of the comprehensiveness items and it appears that one item in particular had inconsistent correlations with other items ("I explained my behavior without attributing it to external factors"), with inter-item correlations between this and other items ranging between -.23 and .45. Even if this item were to be deleted, the scale's reliability would still be below what is considered acceptable, with Cronbach's alpha increasing to .58. I therefore only focused on apology defensiveness in my analyses and used defensiveness to predict intended health behaviors through the same sequence of mediators examined in my main analyses (see Figure 5).

Apology defensiveness had a marginally significant total effect on intended health behaviors, with defensiveness being associated with marginally worse intended health behaviors ($B = -.14$, $z = -1.72$, $p = .09$). Apology defensiveness was not associated with guilt ($B = -.07$, $z = -.78$, $p = .44$), shame ($B = -.07$, $z = -.80$, $p = .43$), or perceived victim forgiveness ($B = -.25$, $z = -1.15$, $p = .25$). Perceived victim forgiveness, however, was associated with decreased guilt ($B = -.37$, $z = -5.50$, $p < .001$) and shame ($B = -.33$, $z = -5.04$, $p < .001$). Guilt, further, was associated

with marginally greater self-punishment (B = .50, z = 1.91, p = .06), while shame was associated with greater self-punishment (B = .57, z = 2.10, p = .04). Apology defensiveness (B = -.04, z = -.37, p = .71) and perceived victim forgiveness (B = -.06, z = -.57, p = .57) did not have independent associations with self-punishment. Self-punishment, in turn, was not associated with intended health behaviors (B = .07, z = .46, p = .65). Shame, however, was independently and negatively associated with intended health behaviors (B = -.47, z = -1.98, p = .05), while guilt (B = .34 z = 1.50, p = .13) and perceived victim forgiveness (B = -.03, z = -.38, p = .70) were not. Based on these results, there was no evidence for any indirect associations between apology defensiveness and intended health behaviors. Moreover, after taking into all mediators, apology defensiveness was not associated with intended health behaviors (B = -.08, z = -1.60, p = .11).

D.4 THE EFFECT OF INTERVENTION CONDITION ON CARDIOVASCULAR RECOVERY THROUGH GUILT, SHAME, AND PERCEIVED VICTIM FORGIVENESS

Next, I conducted a set of exploratory analyses on the effect of intervention condition on cardiovascular recovery. In the Introduction, I reasoned that apologizing might improve cardiovascular recovery by reducing offenders' negative emotions either directly or indirectly by increasing perceived forgiveness from their victim. Even though I measured offenders' negative emotions and perceived victim forgiveness after assessing cardiovascular recovery to obtain a more accurate estimate of cardiovascular recovery, testing a model with negative emotions and perceived forgiveness as mediators might be informative by showing the potential associations between these variables and cardiovascular recovery after controlling for intervention condition.

I therefore explored this possibility by testing a similar, fully saturated path model as in my main analyses in which intervention condition predicted guilt and shame directly and indirectly through perceived victim forgiveness. Guilt, shame, and perceived victim forgiveness, in turn, predicted cardiovascular recovery. In this model, I controlled for participants' age, gender, BMI, race, time of day that the laboratory visit took place, trait anger, and trait hostility. In this model, I did not include self-punishment as a potential mediator, because no obvious reason exists to expect a tendency toward self-punishment to affect cardiovascular function. I allowed the residuals of guilt and shame to covary, as well as the residuals of HR, SBP, and DBP.

The normalized estimate of Mardia's coefficient indicated deviations from multivariate normality (z = 7.23, p < .001) and I therefore used scaled maximum likelihood estimators corrected for non-normality to interpret all results (Satorra & Bentler, 1988). Apologizing had a total effect on HR recovery compared to rumination (B = .66, z = 2.94, p = .003), with apologizing leading to better HR recovery than rumination, but not self-distraction (B = -.09, z = -.39, p = .70). Apologizing did not have a total effect on SBP recovery compared to rumination (B = -.26, z = -1.13, p = .26), but led to marginally worse SBP recovery compared to self-distraction (B = -.38, z = -1.65, p = .10). Apologizing did not have a total effect on DBP recovery compared to rumination (B = -.32, z = -1.38, p = .17), but led to worse DBP recovery compared to self-distraction (B = -.49, z = -2.09, p = .04).

Apologizing did not influence guilt ($B_{\text{Apology vs. Rumination}}$ = .27, z = .71, p = .48; $B_{\text{Apology vs. Self-Distraction}}$ = .59, z = 1.59, p = .11) or shame ($B_{\text{Apology vs. Rumination}}$ = .06, z = .38, p = .70; $B_{\text{Apology vs. Self-Distraction}}$ = -.14, z = -.90, p = .37). Apologizing also did not influence perceived victim forgiveness compared to rumination (B = -.17, z = -1.59, p = .11), but led to marginally greater perceived forgiveness compared to self-distraction (B = -.18, z = -1.64, p = .10). Perceived victim

forgiveness was not associated with guilt (B = .17, z = .50, p = .62) or shame (B = .16, z = 1.12, p = .26). After controlling for intervention condition, guilt was not associated with HR recovery (B = -.01, z = -.23, p = .82), but was associated with worse SBP recovery (B = .12, z = 2.03, p = .04) and worse DBP recovery (B = .19, z = 3.20, p = .001). Shame was not associated with HR recovery (B = -.02, z = -.13, p = .90), SBP recovery (B = .004, z = .03, p = .98), or DBP recovery (B = -.01, z = -.09, p = .93). Perceived victim forgiveness, moreover, was not independently associated with HR recovery (B = .06, z = .29, p = .77), SBP recovery (B = -.02, z = -.08, p = .94), or DBP recovery (B = .12, z = .61, p = .54).

Based on these findings, there was no evidence for any indirect effects of intervention condition on HR recovery, SBP recovery, or DBP recovery. Further, after controlling for all mediators, apologizing still led to better HR recovery compared to rumination (B = .68, z = 2.96, p = .003), but not self-distraction (B = -.07, z = -.31, p = .76). Apologizing also still did not influence SBP recovery compared to rumination (B = -.29, z = -1.27, p = .20), but led to marginally worse SBP recovery compared to self-distraction (B = -.45, z = -1.94, p = .05). Finally, apologizing still did not influence DBP recovery compared to rumination (B = -.35, z = -1.53, p = .13), but led to worse DBP recovery compared to self-distraction (B = -.58, z = -2.52, p = .01).

D.5 MODERATION BY TRAIT WILLINGNESS TO APOLOGIZE, TRAIT SELF-FORGIVENESS, TRAIT RELATIONAL INTERDEPENDENCE, TRAIT GUILT-PRONENESS, AND TRAIT SHAME-PRONENESS

I finally tested whether certain personality variables moderated any of the tested effects in the

main text regarding the effects of intervention condition on intended health behaviors, likelihood of offering a real-world apology, and cardiovascular reactivity and recovery. I specifically tested trait willingness to apologize, trait self-forgiveness, trait relational interdependence (i.e., the extent to which a person defines themselves based on their close relationships with other people), and guilt and shame proneness (measured, respectively, as the tendency to negatively evaluate one's behavior in response to private offenses only known to oneself and the tendency to negatively evaluate oneself in response to public offenses known by others; Cohen et al., 2011).

These variables might be plausible moderators for several reasons. For instance, the apology intervention might be most powerful in reducing negative emotions, increasing victim forgiveness, and increasing real-world apologies for people with a low (vs. high) tendency to apologize for their mistakes, low (vs. high) trait self-forgiveness, high (vs. low) relational interdependence, and high (vs. low) in guilt and shame proneness. For instance, people with a low tendency to apologize for their mistakes might not be accustomed to experiencing the positive consequences of offering an apologize, including a repaired self-concept (Fisher & Exline, 2010), and asking them to complete the apology intervention might therefore be especially beneficial for them. People with low trait self-forgiveness, moreover, should not be quick to unconditionally forgive their mistakes and may need to engage in reparative action before they can experience a reduction in their negative emotions and an increase in perceived forgiveness, including offering an apology. People high in relational interdependence, further, should place much value in maintaining and repairing their social relationships and engaging in an act of relationship repair by offering an apology may therefore be especially likely to decrease negative emotions and increase perceived forgiveness for these people. Finally, people high in guilt and shame proneness may experience a greater reduction in negative emotions and an

increase in perceived forgiveness because they may be more likely to experience guilt and shame in response to their offense in their first place. Because these personality variables might further augment the emotional consequences of offering an apology, they might also have consequences for people's cardiovascular function.

Against expectations, I found no evidence to suggest that any of these variables moderated any of the pathways in the model testing the effect of intervention condition on intended health behaviors (Figure 5). Moreover, I found no evidence to suggest that any of these variables moderated the effect of intervention condition on likelihood of offering a real-world apology. Finally, relational interdependence moderated the effects of apology versus self-distraction on HR reactivity (B = .46, t(92) = 2.10, p = .04, 95% CI [.03, .90]) or SBP recovery (B = .46, t(92) = 2.15, p = .03, 95% CI [.04, .89]).

At *high* levels of relational interdependence, apologizing led to marginally lower HR reactivity compared to self-distraction (B = .62, t(92) = 1.74, p = .09, 95% CI [-.09, 1.33]), but did not influence SBP recovery compared to self-distraction (B = .11, t(92) = .30, p = .76, 95% CI [-.59, .80]). At *average* levels of relational interdependence, apologizing did not lead to differences in HR reactivity (B = .16, t(92) = .62, p = .54, 95% CI [-.35, .68]) or SBP recovery (B = -.36, t(92) = -1.41, p = .16, 95% CI [-.86, .15]) compared to self-distraction. At *low* levels of relational interdependence, apologizing did not influence HR reactivity compared to self-distraction (B = -.30, t(92) = -.94, p = .35, 95% CI [-.94, .34]), but led to worse SBP recovery compared to self-distraction (B = -.82, t(92) = -2.61, p = .01, 95% CI [-1.44, -.20]). Thus, there was some evidence to suggest that apologizing was more beneficial for offenders' cardiovascular function to the extent that were high (vs. low) in relational interdependence.

APPENDIX E

TABLES

Table 1E

Correlations and descriptive statistics of all variables at pre-intervention (Study 1).

Variable	1	2	3	4	5	6	7
1. Guilt	.76***						
2. Shame	.68***	.84***					
3. Self-Punishment	.57***	.77***	.88***				
4. Perceived Victim Forgiveness	-.32***	-.20***	-.26***	.88***			
5. Intended Health Behaviors	.10†	-.06	-.07	-.03	-		
6. Apology Comprehensiveness	.40***	.33**	.36***	-.26**	.20*	-	
7. Apology Defensiveness	-.06	.01	-.13	-.06	-.26**	-.33**	-
M	3.62	2.77	3.31	3.19	3.76	4.66	3.22
SD	.90	1.10	1.59	1.57	.74	1.09	1.47
Range	1-5	1-5	1-7	1-7	1-5	1-7	1-6.75
N	307	307	307	307	307	102	102

Note. Numbers on the diagonal represent correlations between a variable at pre-intervention and itself at post-intervention. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 2E

Correlations and descriptive statistics of all variables at post-intervention (Study 1).

Variable	1	2	3	4	5	6	7
1. Guilt	.76***						
2. Shame	.70***	.84***					
3. Self-Punishment	.66***	.81***	.88***				
4. Perceived Victim Forgiveness	-.36***	-.26***	-.33***	.88***			
5. Intended Health Behaviors	-.003	-.17**	-.11†	-.01	-		
6. Apology Comprehensiveness	.24*	.19†	.33**	-.12	.20*	-	
7. Apology Defensiveness	-.12	-.02	-.09	-.14	-.26**	-.33**	-
M	3.47	2.61	3.28	3.34	3.76	4.66	3.22
SD	1.03	1.19	1.62	1.61	.74	1.09	1.47
Range	1-5	1-5	1-7	1-7	1-5	1-7	1-6.75
N	307	307	307	307	307	102	102

Note. Numbers on the diagonal represent correlations between a variable at pre-intervention and itself at post-intervention. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 3E

Descriptive statistics of all variables, per intervention condition (Study 1).

	Apology		Rumination		Self-Distraction	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
1. Guilt (pre-intervention)	3.59 (.90)	1.60-5	3.82 (.79)	1.80-5	3.56 (.93)	1-5
2. Guilt (post-intervention)	3.23 (.97)	1-5	3.97 (.82)	1.80-5	3.38 (1.06)	1-5
3. Shame (pre-intervention)	2.67 (1.07)	1-5	2.90 (1.10)	1-5	2.74 (1.12)	1-5
4. Shame (post-intervention)	2.26 (1.00)	1-4.40	3.00 (1.25)	1-5	2.58 (1.20)	1-5
5. Self-Punishment (pre-intervention)	3.12 (1.58)	1-7	3.42 (1.52)	1-6.86	3.39 (1.65)	1-7
6. Self-Punishment (post-intervention)	2.97 (1.55)	1.7	3.58 (1.64)	1-7	3.30 (1.63)	1-7
7. Perceived Victim Forgiveness (pre-intervention)	3.39 (1.66)	1-7	3.21 (1.58)	1-7	2.99 (1.47)	1-7
8. Perceived Victim Forgiveness (post-intervention)	3.58 (1.60)	1-7	3.21 (1.67)	1-7	3.24 (1.55)	1-6.67
9. Intended Health Behaviors	3.77 (.73)	1.33-5	3.66 (.83)	1-5	3.86 (.64)	2.5-5

Table 4E

Sample variance-covariance matrix (Study 1).

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Apology vs. Rumination	.22										
2. Apology vs. Distraction	-.11	.23									
3. Guilt (pre)	.06	-.04	.82								
4. Guilt (post)	.15	-.05	.71	1.07							
5. Shame (pre)	.04	-.01	.68	.64	1.21						
6. Shame (post)	.13	-.01	.63	.86	1.10	1.41					
7. Self-Punishment (pre)	.04	.03	.81	.91	1.35	1.45	2.51				
8. Self-Punishment (post)	.10	.01	.83	1.10	1.28	1.56	2.25	2.63			
9. Perceived Victim Forgiveness (pre)	.01	-.07	-.45	-.53	-.35	-.40	-.64	-.73	2.48		
10. Perceived Victim Forgiveness (post)	-.05	-.03	-.45	-.60	-.40	-.50	-.72	-.87	2.23	2.59	
11. Intended Health Behaviors	-.03	.03	.06	-.002	-.05	-.15	-.08	-.13	-.04	-.01	.55

Table 5E

Correlations and descriptive statistics of all continuous variables (Study 2). The correlations between variables 1-8 are based on the full sample of participants that completed Part 1 of the study (N = 601), while correlations involving variables 9-12 are based on the subsample of participants that also completed Part 2 of the study (n = 398).

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Guilt	-											
2. Shame	.72***	-										
3. Impulse Control	-.29***	-.54***	-									
4. Difficulties Engaging in Goal-Directed Behaviors	.40***	.58***	-.81***	-								
5. Self-Esteem	-.28***	-.47***	.46***	-.55***	-							
6. Self-Forgiveness	-.48***	-.60***	.40***	-.49***	.66***	-						
7. Perceived Social Support	-.03	-.17***	.32***	-.28***	.49***	.25***	-					
8. Intended Health Behaviors	.10*	-.03	.09*	-.08	.25***	.14***	.21***	-				
9. Health Behaviors	-.01	-.03	.02	-.12*	.30***	.21***	.14**	.56***	-			
10. Diet	.13*	.04	.01	-.03	.16**	.06	.06	.31***	.44***	-		
11. Physical Exercise	-.02	.01	-.04	-.02	.13*	.09	.09	.33***	.55***	.28***	-	
12. Smoking	-.07	-.05	.01	.001	.08	.06	.001	-.20***	-.10*	-.03	-.02	-
M	3.68	2.84	5.42	5.00	4.91	4.09	3.00	3.68	3.39	.86	1.63	
SD	.86	1.14	1.33	1.51	1.42	1.40	.69	.75	.83	2.26	2.73	
Range	1-5	1-5	1-7	1-7	1-7	1-7	1-4	1-5	1-5	[-6]-6	0-7	
N	601	601	601	601	601	601	601	398	398	398	398	

$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 6E

Descriptive statistics of all variables, per intervention condition (Study 2).

	Apology		Rumination		Control	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
1. Guilt	3.64 (.96)	1-5	3.71 (.87)	1.50-5	3.68 (.83)	1-5
2. Shame	2.82 (1.15)	1-5	2.87 (1.14)	1-5	2.85 (1.13)	1-5
3. Impulse Control	5.38 (1.34)	1.60-7	5.38 (1.38)	1-7	5.46 (1.29)	1-7
4. Difficulty Engaging in Goal-Directed Behavior	3.16 (1.54)	1.60-7	3.10 (1.53)	1-7	2.80 (1.46)	1-7
5. Self-Esteem	4.90 (1.43)	1.10-7	4.92 (1.41)	1-7	4.89 (1.40)	1-7
6. Self-Forgiveness	4.23 (1.52)	1-7	4.14 (1.35)	1-7	3.92 (1.31)	1-7
7. Perceived Social Support	3.03 (.63)	1.33-4	3.00 (.69)	1-4	2.96 (.75)	1-4
8. Intended Health Behaviors	3.60 (.78)	1-5	3.69 (.76)	1-5	3.75 (.70)	1.40-5
9. Health Behaviors	3.30 (.85)	1.38-5	3.39 (.83)	1-5	3.47 (.81)	1.20-5
10. Diet	.77 (2.05)	[-6]-6	.98 (2.62)	[-6]-6	.84 (2.09)	[-5]-6
11. Physical Exercise	2.43 (2.03)	0-7	2.87 (2.09)	0-7	2.92 (2.24)	0-7
12. Smoking	6.19 (2.81)	0-7	6.40 (2.76)	0-7	6.56 (2.60)	0-7

Table 7E

Sample variance-covariance matrix used to test the effect of intervention condition on intended health behaviors (Study 2).

Variable	1	2	3	4	5	6	7	8	9	10
1. Apology vs. Rumination	.22									
2. Apology vs. Control	-.11	.23								
3. Guilt	.01	.000	.78							
4. Shame	.01	.003	.73	1.30						
5. Impulse Control	-.01	.02	-.34	-.81	1.77					
6. Difficulties Engaging in Goal-Directed Behavior	.02	-.07	.54	.99	-1.63	2.28				
7. Self-Esteem	.01	-.01	-.35	-.77	.86	-1.17	2.01			
8. Self-Forgiveness	.02	-.06	-.59	-.96	.74	-1.04	1.32	1.97		
9. Perceived Social Support	.003	-.01	-.02	-.13	.29	-.29	.48	.24	.48	
10. Intended Health Behaviors	.004	.02	.06	-.02	.09	-.09	.26	.15	.11	.56

Table 8E

Sample variance-covariance matrix used to test the effect of intervention condition on actual health behaviors (Study 2).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Apology vs. Rumination	.22												
2. Apology vs. Control	-.10	.22											
3. Guilt	.02	-.01	.78										
4. Shame	.01	-.02	.74	1.29									
5. Impulse Control	.04	.02	-.36	-.81	1.67								
6. Difficulties Engaging in Goal-Directed Behavior	-.02	-.06	.58	1.00	-1.58	2.31							
7. Self-Esteem	.02	-.02	-.32	-.66	.81	-1.15	1.90						
8. Self-Forgiveness	.03	-.05	-.64	-.97	.74	-1.05	1.20	1.91					
9. Perceived Social Support	.01	-.01	.004	-.11	.29	-.28	.47	.22	.47				
10. Health Behaviors	.003	.03	-.01	-.03	.02	-.15	.34	.24	.08	.69			
11. Diet	.04	-.01	.25	.11	.02	-.09	.48	.18	.10	.53	5.09		
12. Physical Exercise	.04	.06	-.04	.03	-.11	-.07	.37	.28	.13	.53	.97	4.53	
13. Smoke-Free	.01	.06	.17	.14	-.03	-.01	-.29	-.23	-.001	.41	.24	.16	7.44

Table 9E

Correlations and descriptive statistics of all self-reported continuous variables (Study 3).

Variable	1	2	3	4	5
1. Guilt	-				
2. Shame	.65***	-			
3. Self-Punishment	.67***	-.75***	-		
4. Perceived Victim Forgiveness	-.41***	-.40***	-.42***	-	
5. Intended Health Behaviors	.09	-.05	-.06	-.01	-
M	2.96	1.81	2.06	3.50	3.96
SD	.90	.83	1.00	1.74	.77
Range	1-5	1-5	1-6.14	1-7	1-7
N	113	113	113	113	113

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 10E

Descriptive statistics of all variables per intervention condition (Study 3).

	Apology		Rumination		Self-Distraction	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
1. Guilt	3.07 (.85)	1.75-5	3.02 (.98)	1-5	2.79 (.87)	1.25-4.75
2. Shame	1.86 (.86)	1-4	1.83 (.85)	1-5	1.75 (.80)	1-4.20
3. Self-Punishment	2.11 (1.14)	1-6.14	2.16 (.95)	1-4.86	1.90 (.91)	1-5.43
4. Perceived Victim Forgiveness	3.17 (1.70)	1-6.67	3.32 (1.59)	1-7	4.02 (1.85)	1-7
5. Intended Health Behaviors	3.92 (.75)	1.80-5	3.93 (.75)	2.20-5.67	4.03 (.83)	2.57-7

Table 11E

Sample variance-covariance matrix used to test the effects of intervention condition on intended health behaviors (Study 3).

Variable	1	2	3	4	5	6	7
1. Apology vs. Rumination	.22						
2. Apology vs. Distraction	-.11	.23					
3. Guilt	.02	-.06	.81				
4. Shame	.01	-.02	.49	.69			
5. Self-Punishment	.03	-.05	.61	.63	1.02		
6. Perceived Victim Forgiveness	-.06	.18	-.65	-.59	-.74	3.07	
7. Intended Health Behaviors	-.01	.02	.06	-.04	-.05	-.01	.60

Table 12E

Correlations between all cardiovascular variables (Study 3).

Variable	1	2	3	4	5	6	7	8	9
1. HR baseline (*bpm*)	-								
2. HR intervention (*bpm*)	.94***	-							
3. HR recovery (*bpm*)	.94***	.94***	-						
4. SBP baseline (*mmHg*)	.01	.03	-.002	-					
5. SBP baseline (*mmHg*)	.04	.10	.04	.94***	-				
6. SBP intervention (*mmHg*)	.02	.06	.03	.95***	.95***	-			
7. DBP baseline (*mmHg*)	-.003	.05	-.02	.47***	.47***	.48***	-		
8. DBP intervention (*mmHg*)	-.01	.09	-.02	.48***	.56***	.53***	.88***	-	
9. DBP recovery (*mmHg*)	-.01	.01	-.02	.42***	.42***	.45***	.87***	.83***	-

Table 13E

Descriptive statistics of all cardiovascular variables, per intervention condition (Study 3).

	Apology		Rumination		Self-Distraction	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
1. HR baseline (*bpm*)	71.45 (10.31)	52.50-99.88	71.31 (10.09)	54.75-94.25	71.89 (11.23)	53.75-94.75
2. HR intervention (*bmp*)	76.66 (11.62)	55.40-107.60	75.75 (10.67)	57.80-103.80	77.69 (11.81)	53.80-103
3. HR recovery (*bmp*)	70.78 (10.88)	51.75-99.13	72.15 (9.99)	55.25-95.38	71.17 (10.43)	48.38-88.13
4. SBP baseline (*mmHg*)	106.82 (9.55)	93.38-128.25	110.56 (11.03)	90.13-134	110.36 (10.47)	93.38-134.50
5. SBP intervention (*mmHg*)	109.16 (11.22)	93-138	111.34 (10.79)	91.40-130.60	111.35 (10.16)	94.40-138.80
6. SBP recovery (*mmHg*)	106.55 (10.23)	92-133.25	108.62 (9.69)	89.88-125.38	108.21 (10.11)	90.13-135.50
7. DBP baseline (*mmHg*)	63.75 (5.74)	52.63-78.50	62.59 (6.52)	53.25-80.38	62.15 (5.19)	55-75.50
8. DBP intervention (*mmHg*)	66.14 (7.10)	53.80-85.60	63.98 (6.81)	54.80-82.40	64.18 (5.58)	56-77.40
9. DBP recovery (*mmHg*)	63.13 (5.82)	51.50-83.88	61.40 (5.34)	54.50-76.13	60.78 (4.60)	53.13-75.38

Table 14E

Unstandardized coefficients from regression models predicting cardiovascular reactivity and recovery (Study 3).

	HR		SBP		DBP	
	Reactivity	Recovery	Reactivity	Recovery	Reactivity	Recovery
	B	*B*	*B*	*B*	*B*	*B*
Apology vs. Rumination	-.26	.69**	-.42†	-.18	-.35	-.16
Apology vs. Distraction	.08	.02	-.47†	-.44†	-.27	-.38
Age	-.07	.01	-.05	.01	-.03	.01
Gender (female)	.01	-.05	-.24	.10	-.34	.30
BMI	.02	-.04	.02	.04	.02	.02
Race (Non-Caucasian)	.24	.19	-.16	.55*	-.22	.09
Time (1 p.m.)	.09	-.09	-.66*	-.02	-.08	.04
Time (2 p.m.)	-.19	-.21	-1.08***	-.16	-.27	.01
Time (3 p.m.)	-.11	.09	-.90**	.23	-.08	-.10
Trait Anger	.05	-.01	-.10	-.03	-.07	-.04
Trait Hostility	-.01	.01	.002	.05	-.05	-.02

Note. For gender, male was the reference condition; for race, Caucasian was the reference condition; for time, 12 p.m. was the reference condition. All continuous variables have been centered.

Table 15E

Descriptive statistics of each outcome variable based on experimental condition (Pilot study, Appendix C).

	Experimental Condition		
	7 days	14 days	30 days
Outcome variable			
	% (*n*)	% (*n*)	% (*n*)
Committed offense	25.7 (26)	27.1 (29)	31.5 (29)
Apologized for the offense	73.1 (19)	51.7 (15)	79.3 (23)
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Difficulty recalling the offense	3.54 (1.84)	3.93 (1.75)	3.79 (1.66)
Perceived severity of the offense	3.96 (1.51)	3.38 (1.40)	3.69 (1.37)
Regret about the offense	2.04 (1.31)	2.31 (1.31)	1.86 (1.09)

APPENDIX F

FIGURES

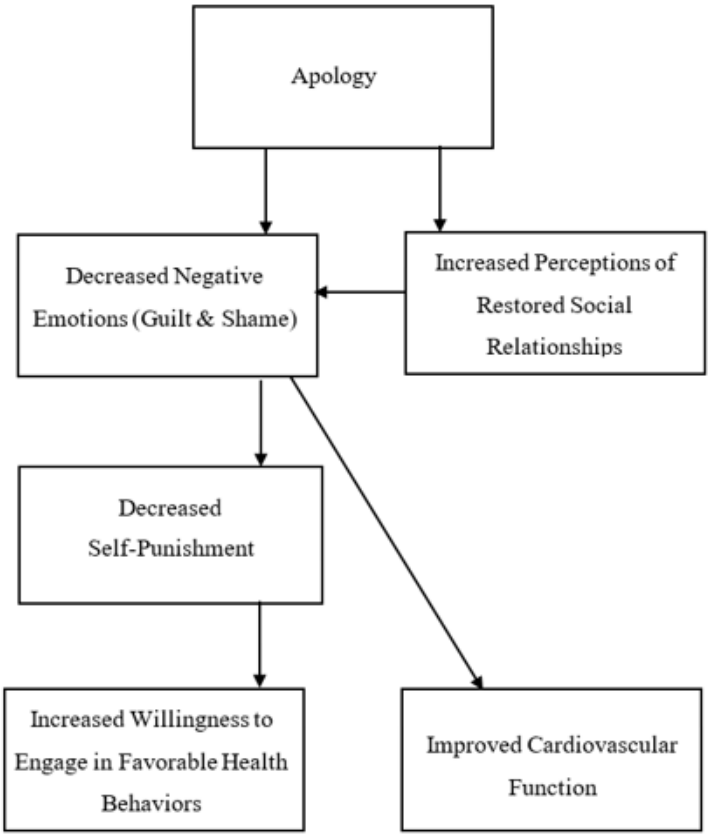

Figure 1F. Proposed theoretical model through which apologies were expected to influence health behaviors and cardiovascular function.

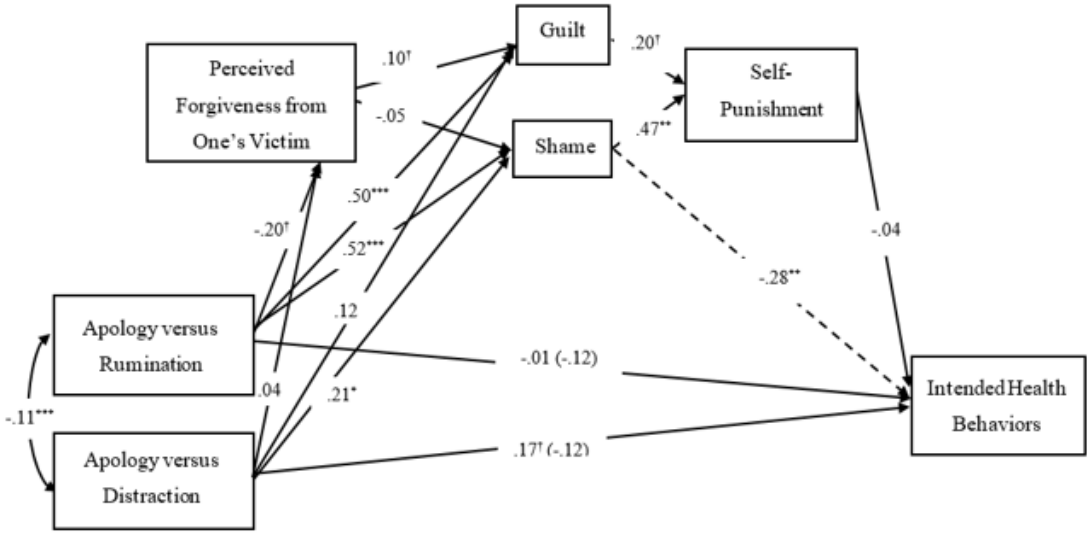

Figure 2F. Path model tested in Study 1. The dashed line represents an unanticipated pathway that mediated the effect between intervention condition and intended health behaviors. †p <.10; *p < .05; **p < .01; ***p < .001.

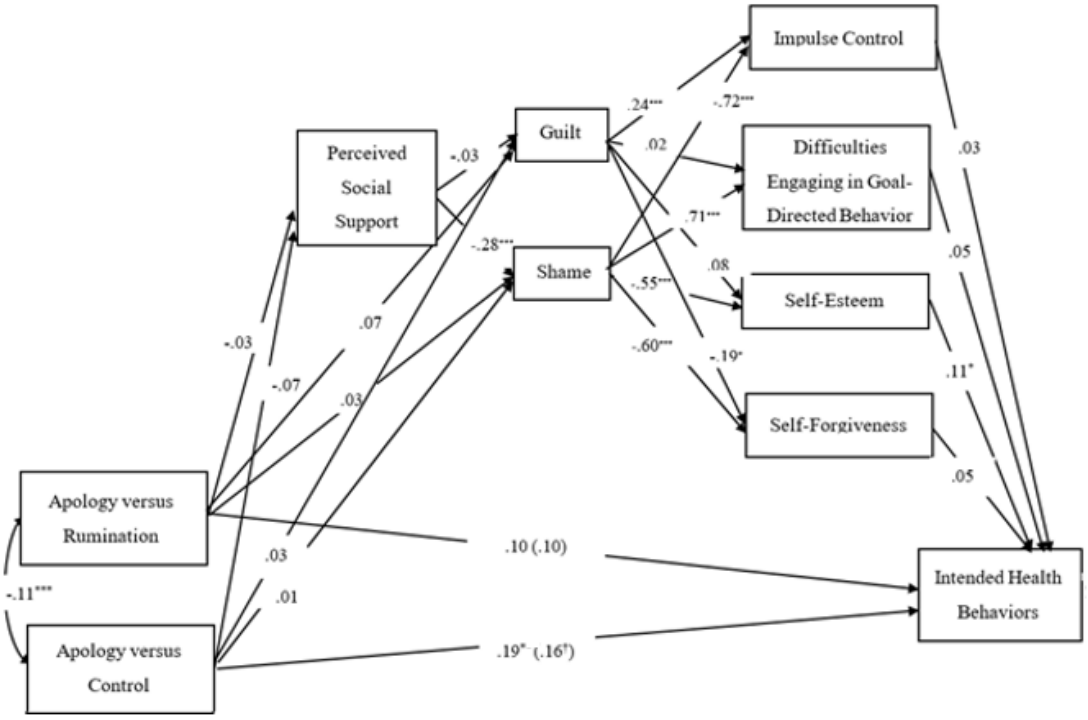

Figure 3F. Structural equation model tested in Study 2 on the effect of intervention condition on intended health behaviors. $^{\dagger}p$ <.10; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

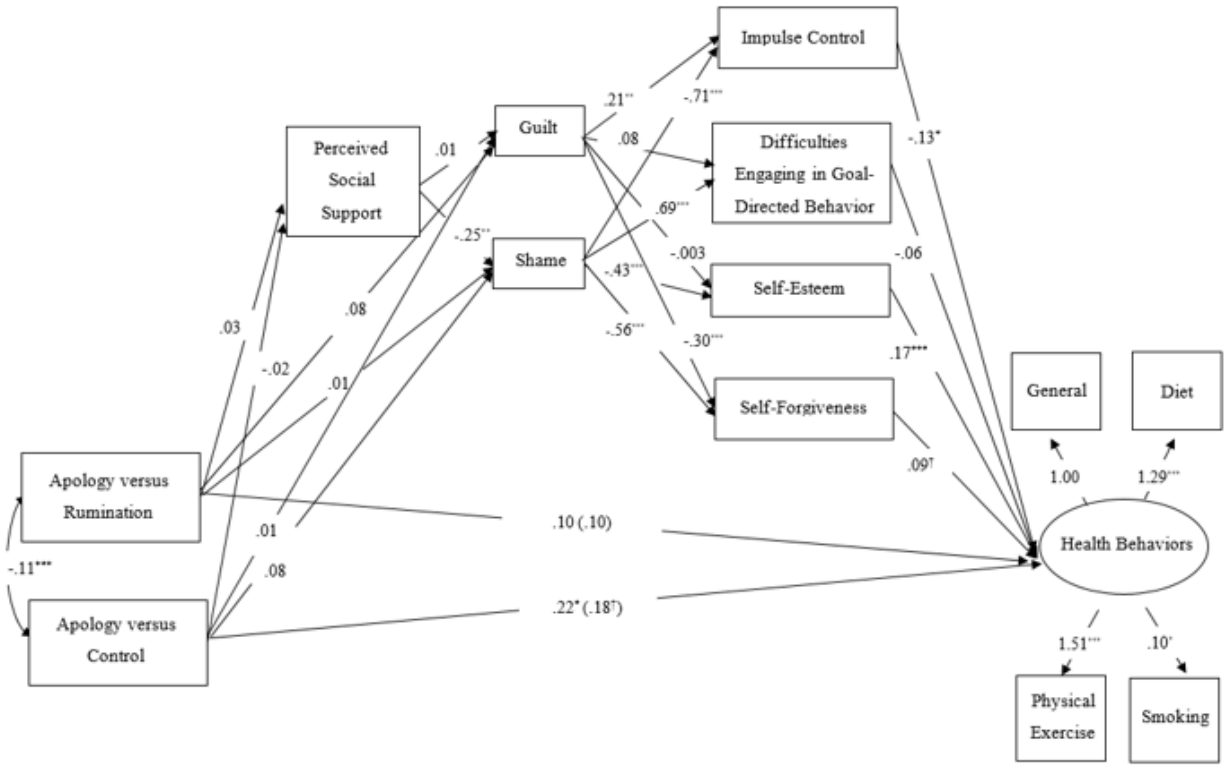

Figure 4F. Structural equation model tested in Study 2 on the effect of intervention condition on health behaviors. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

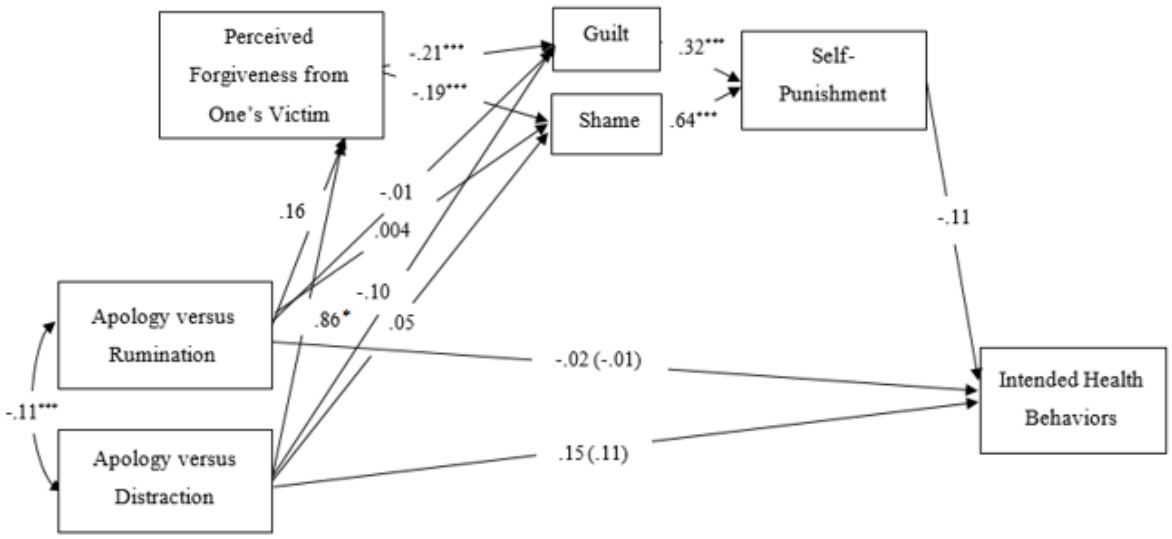

Figure 5F. Path model tested in Study 3 on the effect of intervention condition on intended health behaviors. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

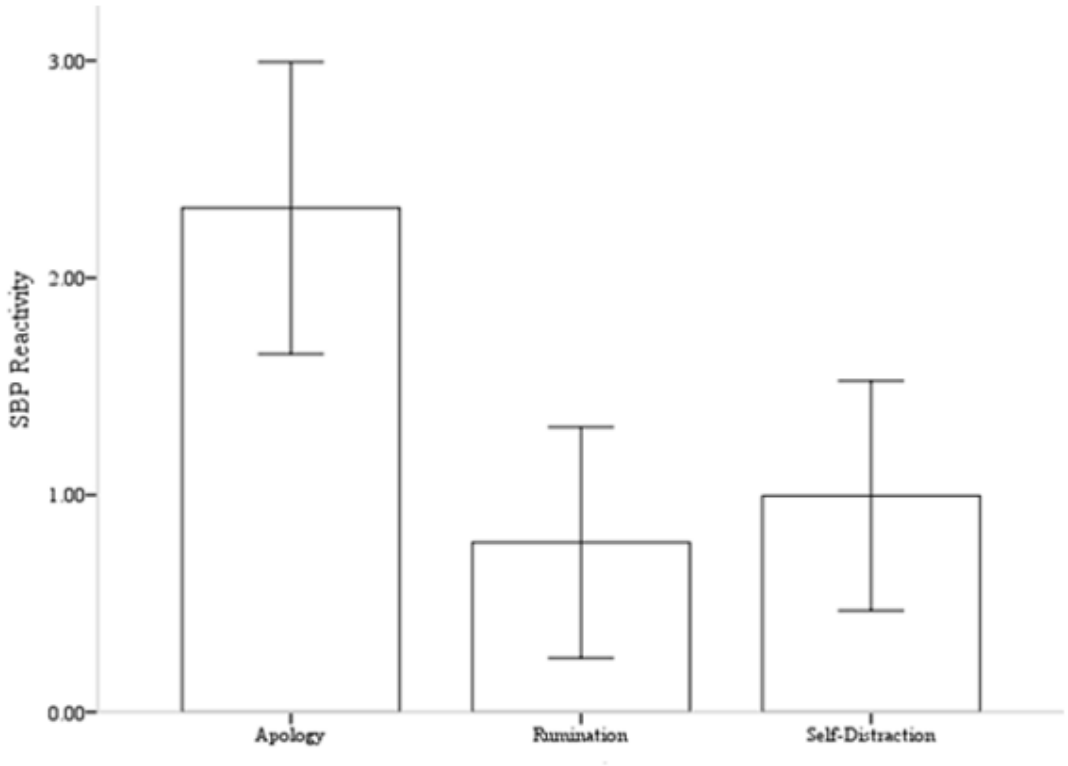

Figure 6F. SBP reactivity in units of mmHg change from baseline, displayed by intervention condition. Standard errors are represented by the error bars.

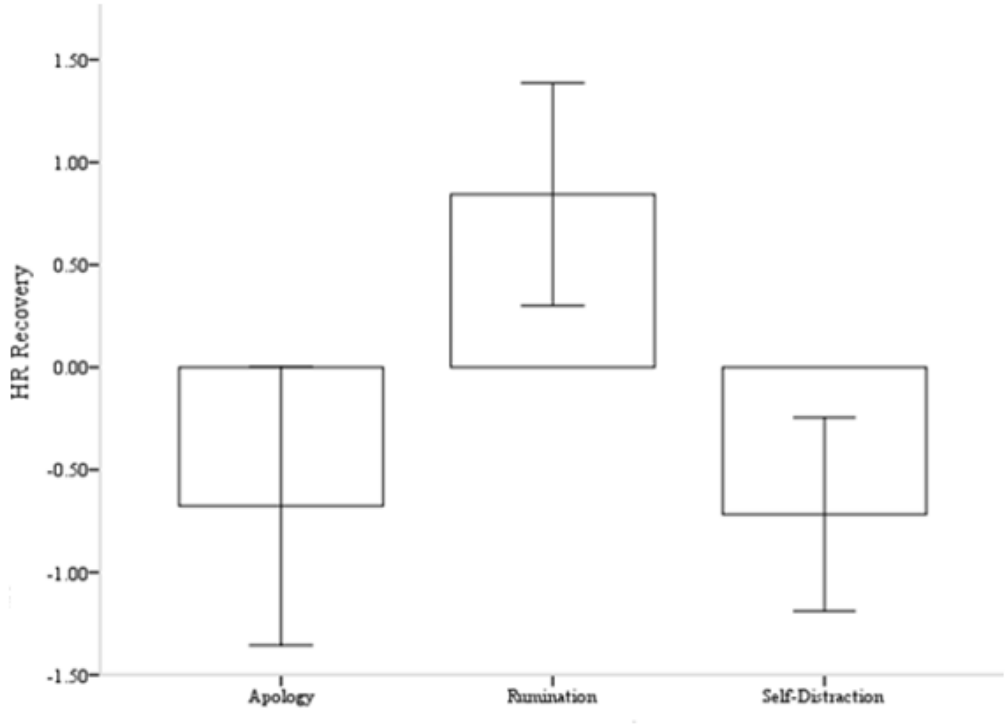

Figure 7F. HR recovery in units of beats per minute change from baseline, displayed by intervention condition. Standard errors are represented by the error bars.

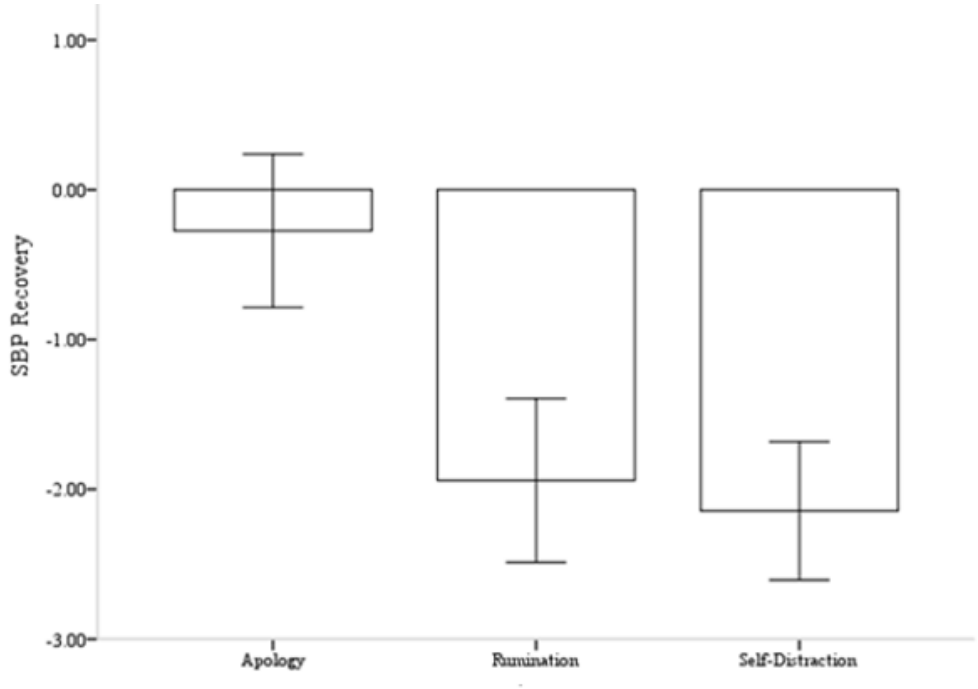

Figure 8F. SBP recovery in units of mmHg change from baseline, displayed by intervention condition. Standard errors are represented by the error bars.

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