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Breast Health Esteem to Motivate Breast Health Behavioral Intentions: An Application of the Terror Management Health Model

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Breast Health Esteem to Motivate Breast Health Behavioral Intentions:

An Application of the Terror Management Health Model

by

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Dedication

To Alex. Always. You are everything.

To my mom. To Pauline. To all the women in my family. To your strength and tenacity.

To my dad, Patrick, and Peter.

To my family and friends, near and far, here and gone.

To myself.

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Abstract

Breast cancer is a pervasive disease affecting millions of people, and a family history of the disease can put individuals at a significantly higher risk of developing breast cancer over the course of one's lifetime. In turn, women with a family history often perceive themselves as more susceptible to breast cancer. Further, women who have lost family members to breast cancer likely associate the disease itself with death to a greater extent. In addition to this increased risk perception, women with a family history might intertwine breast health with feelings of esteem. It follows that those feelings of esteem should facilitate intentions to engage in those behaviors, especially when mortality is salient. This overarching hypothesis was informed by the terror management health model (TMHM) and was tested in two preregistered studies. In the first study, I found that women who lost family to breast cancer did associate the disease with death to a greater extent, while women with any family history of the disease perceived themselves as more susceptible than those without family history. Despite a lack of support for the explicit hypotheses, I employed a serial mediation approach and found that, where women felt more susceptible to breast cancer as a result of any level of family history, the extent to which they associated breast cancer with death predicted heightened breast health esteem, which translated into increased intentions to engage in breast health behaviors. In the second study, I employed a traditional terror management paradigm where mortality was made salient (compared to a neutral control), with the expectation that family history would moderate the effects of mortality salience on esteem factors to mediate intentions. The explicit hypothesis was not supported, and no effects of mortality salience emerged – however, the same serial mediation effects of family

history on breast health intentions through susceptibility perception, death association, and breast health esteem successfully replicated. Generally, these results indicate that women with a family history consistently feel more susceptible to breast cancer and associate the disease with death, which also imbues breast health with a sense of meaning from which esteem can be drawn, which then contributes to critical adaptive behavioral intentions.

Introduction

Breast cancer is the second-most commonly diagnosed cancer in women (behind skin cancer) and the second leading cause of cancer-related death (behind lung cancer; American Cancer Society, 2021a). The average woman has a roughly 1 in 8 chance of being diagnosed with breast cancer at some point in their lifetime, and a 1 in 39 chance of dying as a result of the disease. Further, prior large-scale research has found that around 15% of people report some family history of breast cancer (Brewer et al., 2017), and roughly 8% of people report having a first-degree relative with a history of the disease (Ramsey et al., 2006). Additionally, familial genetic factors – such as the **Br**east **Ca**ncer (BRCA) mutation – can increase lifetime breast cancer risk sixfold (National Cancer Institute [NCI], 2020), and thus make some families inherently more familiar with the disease than others.

In witnessing and understanding the very real repercussions of a potentially deadly disease within one's own family sphere, it follows that individuals could be more inclined to adopt adaptive health behaviors as a result of seeing their own risk of eventual diagnosis as higher than average and thus perceiving one's self as more susceptible (e.g., Ghanouni et al., 2020; Hailey, Carter, & Burnett, 2000; Norman & Brain, 2005). Additionally, it may be the case that family history not only instigates perceptions of susceptibility, but also perceptions associated with the severity of the disease itself. Intuitively, having a family member die of

breast cancer would lead someone to see the disease as more threatening compared to someone without that same brush with death.

In addition to seeing one's self as more susceptible to a disease perceived as deadlier, family history may also influence the personal importance of adaptive health behaviors. That is, family history might not only motivate adaptive behaviors through increased risk perception, but might also lead those with a family history to place more value on such behaviors so as to avoid the pain and struggles experienced by family members affected by disease. The personal importance placed upon engagement in healthy behaviors could occur to the extent that engaging in them could bolster feelings of self-esteem. This may be especially the case for breast cancer due to its nature as a highly visible disease, with a remarkable degree of cultural implications above and beyond other forms of cancer. From Breast Cancer Awareness Month to pink ribbons to tongue-in-cheek t-shirts, (e.g., "Feel Your Hooters" with an owl emblazoned on the bosom) breast cancer is a disease not only intertwined with personal risk and family history, but with what it can mean to be a woman (e.g., Courtney & Goldenberg, 2021; Duerringer, 2013; Sulik, 2010). To that point, breast health behaviors for prevention and detection of breast cancer might not only be important to a woman's health, but to their self-esteem.

Cancer is, of course, associated with death (Arndt et al., 2007; Moser et al., 2014). Terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986) posits that the awareness of death instigates a need for psychological defenses to – aptly – manage the terror of mortality. The terror management health model (TMHM; Goldenberg & Arndt, 2008) applies TMT and its dual-process system of psychological defenses (Pyszczynski, Solomon, & Greenberg, 1999) to health behaviors to explain health-related responses to existential threats like cancer. Importantly, the TMHM notes that, while the conscious awareness of death can activate

immediate responses aimed at reducing one's perceived risk, non-conscious death awareness instead leads individuals to make health-related decisions based not on what is actually healthy, but on factors that serve to bolster self-esteem. Through this lens, and considering that women with a family history could potentially consider breast health behaviors a component of their sense of self, it follows that reminders of death should heighten reliance on those breast health behaviors as a means of bolstering esteem to manage terror, which could lead to subsequent intentions to engage in those behaviors.

Prior health-based research has established the role of family history in terms of risk perceptions and willingness to engage in breast screenings. Prior TMHM-based research has also established that existential threat can motivate breast screening intentions when screenings are related to feelings of esteem (e.g., Morris et al., 2013). However, no prior research has investigated the extent to which family history of breast cancer connects health behaviors themselves with an individual's esteem, or the ways death awareness might lead to differential responses between those with and without a family history. Following the framework of the TMHM, the present research aimed to elucidate the role of family history and associated risk perceptions in the extent to which breast health behaviors constitute a source of esteem. Further, the present research examined the impacts of family history and breast health esteem on behavioral intentions in response to death awareness.

Family History, Risk Perception, and Health Behavioral Intentions

As noted in the outset, a woman at an average risk level has a 12% chance of developing breast cancer at some point in their lifetime (American Cancer Society, 2021). Family history is a predictor of breast cancer risk, especially among women with genetic mutations (Centers for Disease Control and Prevention [CDC], 2020), whereby family history increases women's risk

level and lifetime chances of diagnosis. Above and beyond actual risk, family history plays a crucial role in how women subjectively perceive their own breast cancer risk, as well as the lengths to which those women are willing to go to reduce that risk.

In terms of risk perception, the role of family history in willingness to adopt adaptive health behaviors has already been well-established across a variety of health issues. From heart disease (Hunt et al., 2000) to colorectal cancer (Palmer et al., 2007) to breast cancer (e.g., Ghanouni et al., 2020; Hailey, Carter, & Burnett, 2000; Norman & Brain, 2005), having a family history of a disease can serve to increase the extent to which individuals feel that they are susceptible to that disease. Increased perceptions of susceptibility in those with family histories can also produce important behavioral outcomes. In relation to breast cancer, prior research has found that those with a family history, especially those with an affected first-degree relative, perceive themselves as more susceptible and, in turn, report increased intentions to engage in screening behaviors (Hailey et al., 2000). Norman and Brain (2005) also found that heightened perceived susceptibility as a function of family history predicted breast self-examination (BSE) behaviors (especially among women who reported overscreening). Ghanouni and colleagues (2020) uncovered that women at high risk of breast cancer due to family history and other factors were significantly more willing to undergo more frequent cancer screenings, including BSEs and mammograms. This evidence indicates that risk level attributable to family history does have a distinct and generally positive impact on intentions to engage in risk mitigation behaviors.

Critically, more severe family history (e.g., high risk; as influenced by genetic mutations such as BRCA) is a known contributor to more intense breast cancer risk mitigation behaviors. Having had a family member with breast cancer has been shown to increase uptake of genetic testing and risk-reducing strategies like prophylactic mastectomy and oophorectomy (Howard,

Balneaves, & Bottorff, 2009). Additionally, having had a family member die of breast cancer (especially one's mother) is a robust predictor of future engagement in risk-reducing surgeries (Hesse-Biber, 2014).

The present research, though, aimed to investigate a novel role of family history in health-related responses and intentions above and beyond the impact of susceptibility perceptions. In addition to increased perceptions of susceptibility, those with a family history of breast cancer also might place more personal significance on health behaviors aimed at lessening risk through controllable factors. To some degree, this notion has been alluded to in prior research on other health issues. Hunt and colleagues (2000) found that those with a family history of heart disease also ascribed more importance to the 'lifestyle' factors which could impact future risk. Additionally, the researchers found that, especially among a younger cohort, family history influenced endorsement of health-promoting behaviors like refraining from smoking and engaging in exercise. Those who had a family history and endorsed such practices were also significantly less likely to be smokers, which has a well-documented positive impact on heart disease risk reduction. Another study investigated the role of family history on attitudes toward colorectal cancer screening (Palmer et al., 2007). Importantly, those who were already being appropriately screened for colorectal cancer not only perceived their risk as higher, but also believed that undergoing screening was an important subjective norm, and perceived greater personal benefits of and fewer barriers to screening. Though not the focal point of Palmer and colleagues' (2007) studies, their results do point to the notion of a relationship between family history, risk perception, and the extent to which individuals at higher risk due to family history might place more value on screening behaviors.

Further, and as mentioned in the outset, breast cancer is a highly visible disease in the cultural landscape. Social media trends encourage women to "Feel it on the First" – a plea to engage in monthly BSEs; while t-shirts, wristbands, and bumper stickers implore women and men alike to "Save the Ta-Tas." To some degree, the level of cultural import placed on breast health behaviors (most of which are heteronormatively sexualized and objectifying; e.g., Gibson, Lee, & Crabb, 2014; Sulik, 2010) imbues such behaviors with a level of subjective normativity (paralleling Palmer and colleagues; 2007), insofar as the awareness symbolized by pink ribbons might lead women to believe that certain breast health behaviors are the culturally-prescribed thing to do.

It is, then, surprising that no studies have investigated whether women invest feelings of esteem in engagement in breast health behaviors, especially among those women at elevated risk due to family history. There is a litany of health behaviors known to be effective in reducing breast cancer risk, from exercising to eating a healthy diet to regularly undergoing appropriate screenings (Mahoney et al., 2008). Indeed, these are "lifestyle" factors in which women might invest, which, as Hunt and colleagues found (2000), could lead to behavioral outcomes effective for risk reduction. Additionally, engaging in "lifestyle" breast health behaviors could contribute positively to self-esteem. For example, women who report regular engagement in BSEs report higher self-esteem compared to women who do not regularly perform BSEs (Cope, 1992). Further, and critically, higher self-esteem contributes to greater functional health and vice versa, where maintaining functional health feeds back into higher self-esteem longitudinally (Reitzes & Mutran, 2006).

Overall, family history certainly influences susceptibility perception and has a distinct impact on uptake of preventative strategies like BSEs, mammograms, and surgical intervention

as a function of perceived susceptibility. As has been shown in previous research, family history can also play a role in the extent to which prevention and detection measures are viewed as important to one's lifestyle, considered normative, and could potentially connect with feelings of esteem. When it comes to breast cancer, too, the 'lifestyle' factors (i.e., diet/exercise, BSEs/screenings) contributing to prevention and detection are made culturally visible in awareness campaigns (albeit sometimes tongue-in-cheek). And yet, little research has investigated the extent to which women might deem breast cancer prevention and detection measures part of their own sense of self, especially when considering the critical role of family history. Additionally, little research has focused on the psychological impact of breast cancer family history in terms of its severity as a bystander – that is, in line with Padmasee and colleagues (2020), some women may feel like breast cancer is a more concerning risk, perhaps to the point where it constitutes a greater existential threat in itself. In turn, the framework of the TMHM provides a method of investigating the ways in which women might hinge components of self-esteem on engagement in breast health practices, and the potential to positively impact health outcomes, especially in response to an awareness of death.

The TMHM, Breast Cancer, and Esteem

Despite the deadliness of breast cancer (1 in 39 women diagnosed die as a result), the disease itself is seldom presented as deadly in breast cancer awareness communications and campaigns (Duerringer, 2013). However, familial experiences with breast cancer shape women's perceptions of the disease, especially when one's family history is involves the death of a family member (which leads women to characterize their experiences with breast cancer as "traumatic"; Padamsee et al., 2020). Those women who do characterize family breast cancer experiences as traumatic are more willing and likely to engage in more aggressive risk-reduction strategies (e.g.,

increased surveillance and surgical intervention). From a terror management perspective, this makes sense – the awareness of death, and potentially the way that family history serves to create associations between a disease and mortality, can certainly motivate adaptive risk mitigation behaviors. This may be especially the case under circumstances where health behaviors relate to feelings of esteem.

As noted in the outset, the TMHM borrows from TMT, which borrows from the works of Becker (1973). TMT explains that the uniquely human ability to recognize imminent mortality provokes psychological defenses aimed at mitigating daily terror associated with that recognition. A dual-process system characterizes these defenses. First, when death is situated in conscious awareness, individuals are motivated to more directly reduce their perceived vulnerability to mortality. In terms of health behavior, these *proximal* defenses manifest as, for example, safe-sun behaviors to reduce the risk of skin cancer (Routledge, Arndt, & Goldenberg, 2004) or immediate intentions to engage in more exercise behaviors (Arndt, Schimel, & Goldenberg, 2003). Additionally, proximal defenses might also manifest as denial (Cooper, Goldenberg, & Arndt, 2010) or avoidance (e.g., avoiding cancer screening; Arndt, Routledge, & Goldenberg, 2006). Both avoidance and denial reduce perceived risk, but in a maladaptive manner. Subsequently, once death has faded from conscious awareness either as a function of proximal defense activation (e.g., Arndt, Routledge, & Goldenberg, 2006; Arndt, Schimel, & Goldenberg, 2003) or through more subliminal death thought activation (Arndt et al., 1997), *distal* defenses are activated.

Distal defenses, unlike proximal defenses, do not rely on engagement with health to mitigate risk. Instead, they are influenced by the variables through which individuals derive a sense of meaning from the world around them, where adoption of health behaviors is contingent

on a connection between those behaviors and feelings of esteem. That is, individuals will be more likely to engage in adaptive health behaviors when those behaviors relate to feelings of esteem under conditions where death is not conscious, but still salient. For example, when individuals hinge components of self-esteem on smoking cigarettes, non-conscious death awareness, paradoxically, increases positive attitudes toward and intentions to smoke more cigarettes (Hansen, Winzeler, & Topolinski, 2010). Similar effects are observed in the context of tanning behaviors. Though conscious death awareness can lead to decreased tanning intentions to reduce skin cancer risk (Routledge et al., 2004), non-conscious death awareness can lead women who place personal value on attaining beauty standards to report tanning intentions matching with salient beauty standards (e.g., pale versus bronzed, with decreased or increased intentions respectively; Cox et al., 2009).

A critical distinction in distal defensiveness in response to non-conscious mortality awareness rests upon esteem contingencies. For example, while individuals respond to conscious death awareness with increased exercise intentions, only those for whom exercise is a contingency of self-esteem report increased exercise intentions when that awareness recedes from consciousness (Arndt, Schimel, & Goldenberg, 2003). Indeed, TMT notes that non-conscious mortality salience increases the extent to which individuals strive to bolster components of self-esteem (Pyszczynski et al., 2004). As such, components of self-esteem which might differ from person to person serve to inform the extent to which behaviors or intentions could be exacerbated under the duress of mortality awareness.

In applying components of self-esteem to breast cancer and breast health behaviors, some TMHM research has found that tangential sources of self-esteem can impact future intentions to engage in BSEs specifically. In a study connecting breast cancer and cultural perspectives on

women's bodies, Morris and colleagues (2013) found that women who objectify themselves to a greater extent responded to a combination of mortality salience and an objectifying message (i.e., a *Sports Illustrated Swimsuit Issue*, compared to an issue of the magazine with soccer phenom Mia Hamm on the cover) with increased willingness to perform BSEs. Additionally, framing health behaviors to appeal to esteem factors can produce a loop in which behaviors presented as empowering lead women who engage in such behaviors to feel empowered themselves. Cooper and colleagues (2011) found that, when framing BSEs as an empowering action in which to engage, the awareness of death (compared to a control) led women to report feeling more empowered after performing a breast exam on a realistic torso model. In their second study, the researchers surveyed women at a mammography clinic (where thoughts of death were likely already salient, as measured by an implicit death thought accessibility task). They found that the degree to which death thoughts were salient in conjunction with empowerment framing led women to report greater BSE intentions in the future.

Self-esteem related to health behaviors can contribute to further engagement in the behavior itself when death is non-consciously accessible. Morris and colleagues (2019) found that, when individuals were primed with death in a laboratory setting, they not only reported having engaged in more exercise behaviors over a two-week period, but also that those increases in exercise led to increases in the extent to which they considered fitness a contingency of self-esteem. In their second study, the researchers also found that making death non-consciously accessible in conjunction with identity-relevant factors (i.e., envisioning a prototypically unhealthy smoker) led smokers to report decreases in the extent to which they considered cigarette smoking a component of their identities, which facilitated increases in attempts to quit.

Given evidence from TMHM studies on both breast health and esteem, and in line with theorizing that women with a family history might hinge components of self-esteem on breast health, it would follow that the extent to which breast health behaviors are associated with self-esteem would serve as an important mechanism through which health behavior intentions could be exacerbated when death is non-consciously accessible. In this context, it makes sense that family history could serve a dual purpose. First, family history in its more severe forms may constitute a death reminder. But, it could also serve as a source of identity-relevant esteem factor to be expounded upon in the context of experimental TMHM research. Priming death in conjunction with family history may produce interesting effects. In the same way priming a prototypically unhealthy smoker with thoughts of death influenced smokers to decrease the esteem contingencies related to cigarette use when death was salient (Morris et al., 2019), a family history of breast cancer may interact with mortality salience to increase esteem contingencies associated with breast health behaviors, especially the aforementioned 'lifestyle' behaviors like screenings, diet, and exercise (and indeed, exercise-based self-esteem contingencies are an established construct in TMHM research; e.g., Arndt et al., 2003; Morris et al., 2019). Consistent with Morris and colleagues (2019), the extent to which breast health behaviors are a contingency of a person's self-esteem should facilitate intentions to engage in that health behavior in response to mortality awareness.

Further, no TMHM studies have investigated the role of family history in general. The role of family history in susceptibility perceptions is well-established. It makes sense, too, that having witnessed the death of a family member as a result of a breast cancer diagnosis would influence the way women see the disease as an existential threat through the degree they connect it with death. Given the combination of susceptibility perceptions and the potential for breast

cancer to be perceived as an especially existential threat, it would likely be the case that those with family history would not only invest more esteem in health behaviors, but might also perceive a given disease as more threatening and allocate even more esteem in such behaviors as a result of death awareness.

Study Overviews

In tying together research on family history, death awareness, and self-esteem contingencies, it follows that women with a family history of breast cancer might react differently to explicitly existential threat in the context of the disease. Despite the fact that prior research has found that women with a family history do, indeed, perceive themselves as more susceptible and engage in more breast health behaviors, the notion that engagement in those health behaviors could be intertwined with a sense of self has remained an uninvestigated avenue. Women with a family history of breast cancer may also differ in the extent to which they associate the disease with existential threat, which could produce differential levels of individual esteem placed in health-related behaviors. Further, should populations of women with a breast cancer family history invest feelings of self in engagement in breast health behaviors, it would follow that the awareness of death should heighten investment in that source of esteem as a means of managing terror.

Generally, the overarching goal of the present research is to determine the extent to which women, and especially women with a family history of breast cancer who might feel susceptible and existentially threatened, consider engagement in breast health behaviors as a source of identity or esteem, and whether that increase in esteem also impacts intentions to engage in such behaviors in the future. Further, where those behaviors are relevant to one's esteem, making the threat of death salient should lead to further investment of self in those behaviors, and thus, increased intentions to engage in them. In this line of investigation, I predicted that women with a family history would feel more threatened by breast cancer in terms

of their own risk perceptions: they should see themselves as more susceptible and potentially view breast cancer as more threatening, where they might associate the disease with death to a greater extent. Where women do see their risk as higher, they could invest more feelings of esteem in breast health behaviors, which should influence intentions to engage in those behaviors. In turn, and to the extent that women with a family history do hinge components of esteem on breast health behaviors, the salience of death should heighten breast health esteem, which should further heighten intentions to engage in breast health behaviors.

Methods

Pilot Testing

All pilot testing, prescreening, and subsequent study materials were approved by the institutional review board. Additionally, all data, study materials, and analyses were preregistered on the Open Science Framework (osf.io/z87mf) and are freely available.

A first step to this dissertation was to determine the extent to which family history plays a role in the perception of existential threat associated with health problems. That is, I wanted to first establish whether family history influences the extent to which health problems, including breast cancer, are associated with death. Data were collected from 626 undergraduate students (M_{age} = 20.59, SD_{age} = 3.90; see Table 1 for demographics) who were first presented with an informed consent and then asked to rate the association of health problems with death 5-point Likert scale ranging from 1 ("does not make me think about death at all") to 5 ("makes me think about death a lot")[1].

Across all reported genders, these data presented an ordered pattern of results in terms of the extent to which breast cancer was associated with death based on family history, $F(2, 623) = 9.85$, $p < .001$, $\eta_p^2 = .031$. LSD pairwise comparisons indicated that breast cancer-death associations did not differ between individuals without a family history (N = 411, M = 3.77, SD = 1.18) and individuals with a family history in which a family member survived ((N = 133, M =3.90, SD = 1.01; p = .24). However, those with a family history in which a family member

[1] In this pilot study, 24 health issues were assessed, including but not limited to breast cancer, testicular cancer, lung cancer, skin cancer, asthma, and dental problems (the last two of which have been used as control conditions in other terror management literature; e.g. Arndt et al., 2003; 2007). However, breast cancer is the health issue of interest in this dissertation and as such, the other health problems will not be mentioned further.

died as a result of breast cancer (N = 82, M = 4.37, SD = .85) associated breast cancer with death to a greater extent than both those without a family history ($p < .001$) and those with a family history with survival ($p = .003$).

Analyzing only women, I observed the same pattern of results, $F(2, 453) = 7.71$, $p < .001$, $\eta_p^2 = .033$. Breast cancer-death associations did not differ for those without a family history (N = 283, M =3.90, SD = 1.12) and those whose family member survived ((N = 107, M =4.02, SD = .96; $p = .30$). Women with a family history in which a family member died as a result of breast cancer (N = 66, M =4.45, SD = .75) associated breast cancer with death to a greater extent than both those without a family history ($p < .001$) and those whose family member survived (p = .008). See Table 2 for sample sizes, means, and standard deviations.

These findings align with studies from Padmasee and colleagues (2020), where women with a close family history involving death perceived breast cancer as more traumatic, which may imply that family history can influence perceptions of existential threat associated with the disease. This information was used to guide mortality salience priming materials in the present research. First, in Study 1, having had a family member die of breast cancer implies increased death salience, which should impact perceptions of susceptibility and the extent to which breast cancer would be associated with death. As such, I used the same question from pilot testing in which women were asked about how much breast cancer made them think about death in both studies. Additionally, in Study 2, given that breast cancer is associated with death to a differential degree depending on family history, rather than prime breast cancer alone as an existential threat (e.g., Morris et al., 2013), death itself was made explicit so as to make existential threat uniform across family history groups, with family history expected to serve as a moderating variable.

These data were used to inform the way family history-related questions were approached in the current study. All family history questions asked individuals to state whether they had a family history of breast cancer, and whether they had a death in the family caused by breast cancer. Further, 34.34% of respondents reported a family history of breast cancer, and 13.10% reported the death of a family member due to breast cancer. These data were synthesized with information from Brewer and colleagues (2017) and Ramsey and colleagues (2006) to inform prescreen sample sizes. I oversampled in prescreening by a degree of at least 20% to attain a reasonable number of participants with both a family history and with a family history where a family member died of breast cancer.

Prescreening

A shortcoming in existing TMHM literature concerns the samples that have been used for research on breast cancer. Undergraduate student samples have often been studied in prior research, but the use of convenience samples is problematic due to the fact that younger women are simply not as vulnerable to breast cancer, and risk increases with age (Howlader et al., 2019). Additionally, doctors typically recommend that women of average risk level begin mammogram screenings at age 40 (American Cancer Society, 2021b). As such, women over age 40 were the specific target group for the purposes of the present studies. Integrating the data from the pilot studies, established work on hereditary breast cancer incidence, and reported rates of breast cancer family history/deaths in family, I recruited 2,500 participants via the Prolific online survey platform to attain a sufficiently large pool of potential participants.

The one-minute prescreen posting was available to Prolific workers who indicated in preliminary screening through the survey platform that they 1) lived in the United States; 2) were assigned female at birth; 3) indicated cisgender woman as their gender identity; and 4) were

between 40 and 100 years of age. Participants were paid $.016 for their participation in the prescreen survey.

In the prescreen survey, participants were presented with an informed consent. Then, participants were asked whether they had a family history of breast cancer using the same question from pilot testing (i.e., "Do you have a family history of breast cancer," with responses "No," "Yes, and those diagnosed with breast cancer survived," and "Yes, and at least one person diagnosed with breast cancer passed away as a result of the disease.")[2]. Lastly, participants were asked if they had ever been diagnosed with breast cancer themselves. Prolific Worker ID numbers were also collected through the Prolific platform for the purposes of inviting specific workers back to participate in the main studies. Worker ID numbers and locations have been redacted from open data for the sake of participant anonymity and confidentiality.

Including incomplete data, a total of 2,519 participants responded to the Prolific posting. After removing incomplete responses, the total sample for inclusion consideration in both Studies 1 and 2 amounted to 2,497. Each participant was assigned a unique identifying number. Then, those who reported having had breast cancer themselves (n = 82) were excluded for a sample of 2,415 cisgender American women between 40 and 100 without any personal history of breast cancer. I then assigned a new unique identifier to each participant and divided them into three groups based on family history (no family history, n = 1,657; family history/survived, n = 435; family history/dead, n = 323). From there, each participant within each group was assigned

[2] Also in this section, participants who responded that they had some sort of family history were asked to indicate their relationship to the person/people diagnosed with breast cancer (i.e., first-degree, second-degree, or further-removed family member). Participants who indicated that a family member had passed away from breast cancer were also asked to indicate how long it had been since their most recent family member passed away. These items were preregistered, but sample sizes were too small to make meaningful conclusions. Please see Limitations section for further discussion of these items.

another unique identifying number for the group, ranging from one up through the total number of participants in that given family history group.

In order to balance the family groups in the main studies, a random number generator (using the "random" package in R) was used to select participants with corresponding ID numbers for inclusion. Participants could be randomly selected to participate in either Study 1 or Study 2, but not both. Three random number generation RMarkdown documents (see Appendix A) reflect the R code used, as well as the random numbers output by the code via RMarkdown. The "random" package had a shortcoming in that it did output random numbers with replacement, lending to the potential for duplicates. In the event of duplicates, the next available ID number either immediately before (heads) or immediately after (tails) the given number was selected instead based on a coin flip. Based on that random selection, individual participants were recruited for participation for either Study 1 or Study 2 via the Prolific platform using their Prolific Worker IDs.

Study 1

Purpose and Hypotheses

Study 1 was geared to explicitly study differences in perceptions of breast cancer susceptibility, the association between breast cancer and death, and breast health esteem contingencies among women with and without a family history of the disease. Specifically, I investigated the extent to which family history impacts perceived susceptibility, and how breast health esteem contingencies might be facilitated by susceptibility perceptions. Further, I investigated the mediating roles of perceived susceptibility and breast health esteem contingencies on breast health intentions.

Hypothesis 1. I hypothesized that women with a family history would report increased perceptions of breast cancer susceptibility, mirroring prior health-based research (e.g., Ghanouni et al., 2020; Hailey, Carter, & Burnett, 2000; Norman & Brain, 2005) compared to those without a family history, especially if a family member has died from the disease due to the fact that death in the family can increase susceptibility perceptions (e.g., Hesse-Biber, 2014).

*Hypothesis 2***.** Second, I hypothesized that women with a family history (especially when a family member died as a result of breast cancer) would report higher breast health esteem compared to women without a family history, given the theorized relationship between family history and esteem contingencies (e.g., Hunt et al., 2007; Morris et al., 2019).

*Hypothesis 3***.** The relationship between family history and intentions will be mediated by perceptions of susceptibility and breast health esteem, such that when participants have a family history of breast cancer (especially when a family member has died from breast cancer), relative to no family history, perceptions of susceptibility and breast health esteem will serially mediate the effects of family history on intentions.

Exploratory Analyses. Expounding upon the potential interplay between susceptibility perceptions and associations between breast cancer and death, I also preregistered exploratory analyses in an update to the original preregistration. First, I aimed to replicate the findings from the Pilot Study. I anticipated that women who lost a family member to breast cancer should associate the disease with death to a greater extent than the two other family history groups. I also preregistered exploratory analyses that combined perceptions of susceptibility and breast cancer-death associations. Generally, these exploratory analyses were geared toward more explicit investigation of the death association variable as an additional pathway through which breast health esteem could be facilitated, and in turn facilitate breast health intentions in

combination with susceptibility perceptions. As such, I report three additional models: one in which death association replaced the susceptibility perception variable in the explicitly hypothesized serial mediation model, one in which the death association variable preceded the susceptibility perception variable as mediators for esteem and intentions, and one in which the susceptibility perception variable preceded the death association variable as mediators for esteem and intentions.

Power Analysis and Participants

Participants for Study 1 were all cisgender American women aged 40 and over who had been invited back after completing the prescreening phase. Preliminary power analyses for a small-to-medium effect size for three groups (those without a family history, those with a family history where the family member survived, and those with a family history where the family member died) and five covariates, and prior research using serial mediation (Schoemann, Boulton, & Short, 2017), suggested a sample size of 225 participants.

Procedure

I report all measures, manipulations, and exclusions in this study. All materials were administered online. A total of 225 responses were collected from Prolific survey platform workers who had been invited back after the prescreening phase in exchange for $0.83. Participants were first provided with an informed consent and told that they were taking part in a study involving the effect of certain personality traits on reactions to information regarding health behaviors and feelings associated with them. All participants successfully completed all measures and attention checks (e.g., "Please select the color described in the instructions above – 'Pink') for a final sample of 225 participants. Materials are detailed below in order of presentation.

Demographics. Participants were first presented with a section asking them to detail demographic information. Participants reported their ages (M_{age} = 52.38, SD_{age} = 9.26, $skewness_{age}$ = .66, [SE = .16], $kurtosis_{age}$ = -.18, [SE = .32]), gender identity (all cisgender women, n = 225), racial/ethnic identity, sexual orientation, whether they had health insurance, their annual income, and their level of education (see Table 3 for details on these demographics.) Items pertaining to breast cancer family history status (including relationship to the person diagnosed and time since death of a family member), past BSE behaviors, and whether individuals had been diagnosed with breast cancer themselves were also presented in this section. Reported past BSE behaviors served as a covariate in subsequent analyses in order to isolate the role of family history, rather than prior behavior, as a factor underlying breast health-related behavioral intentions. In line with the preregistration plan, racial/ethnic identity, health insurance status, and education level (SES), along with past BSE behaviors, were included as covariates due to established differences in breast cancer screening and mortality rates attributable to those demographic variables.[3] See Appendix B.

Perceived Breast Cancer Susceptibility. The susceptibility measure was a visual-analog 0-100 scale (see Gurmankin Levy et al., 2006) where participants were asked to indicate what they thought their lifetime chance of breast cancer is, from "0%, no chance of breast cancer" to "100%, definitely will get breast cancer" (M = 39.04, SD = 22.21, skewness = .12 [SE = .16], kurtosis = -.83 [SE = .32]). For subsequent analyses, the susceptibility variable was standardized

[3] In addition to the education level variable, self-reported household income was included in the preregistration plan to serve as an additional component to the SES covariate. However, the income variable involved participants simply typing in their estimated household income. Participants were inconsistent in the manner in which they typed their answers (e.g., inclusion of commas and other punctuation; 80000 versus 80,000 versus $80,000.00), and many did not type anything or input the value "0," culminating in skewed data and assumptions of missingness. The missingness issue reduced the viable sample size to 152. For that reason, only education level was used as a proxy for the socioeconomic status (SES) covariate in proceeding analyses.

so as to best coalesce with the other Likert-style variables in the remainder of the study (*M* = .00, *SD* = 1.00, skewness = .12 [*SE* = .16], kurtosis = -.83 [*SE* = .32]). See Appendix C.

Breast Health Information. In line with other TMT studies on breast cancer, additional context was provided to participants to form a cohesive narrative. Prior TMHM-breast health studies (e.g., Morris et al., 2013) presented participants with an instructional brochure on how to correctly perform a BSE. Previous studies on breast cancer intentions focus almost exclusively on BSEs and mammograms, which does not encompass the variety of behaviors that can help reduce breast cancer risk. Given that the current studies aimed to investigate a comprehensive array of breast health behavior, participants were presented with an infographic detailing the role of BSEs, mammograms, clinical breast screenings, and diet and exercise in breast health. See Appendix D.

Breast Health Esteem. Breast health esteem was operationalized using measures adapted from Arndt and colleagues (2003) and Morris and colleagues (2019). Participants were presented with three items ($\alpha = .90$) asking them to rate their level of agreement on the degree to which they derive feelings of esteem from taking care of their breast health (e.g., "Taking care of my breast health is an important part of who I am") on 7-point Likert-style scales (ranging from 'strongly disagree' to 'strongly agree'). The three items were averaged to create a composite breast health esteem score (*M* = 4.49, *SD* = 1.54, skewness = -.13 [*SE* = .16], kurtosis = -.71 [*SE* = .32]) such that higher scores indicate more feelings of esteem related to engagement in breast health behaviors. See Appendix E for items and Table 4 for items, correlations, and descriptive statistics.

Breast Health Intentions. In line with the infographic presented to participants earlier in the study, intentions for each behavior were assessed independently using measures adapted

from Morris and colleagues (2013). Participants were presented with three items per behavior for a total of 15 items ($\alpha = .87$), and asked to indicate the likelihood that they would engage in that particular behavior in the future, in the three months, and in the next week on a 7-point Likert-style scale (ranging from 'not at all likely' to 'extremely likely'). In line with the preregistration plan, the 15-item scale was used to create a mean composite breast health intention score, such that higher scores indicated greater intentions to engage in breast health behaviors over the course of time. See Appendix F for items and Table 5 for items, correlations, and descriptive statistics.

Breast Cancer-Death Association. Mirroring the prescreen data, participants were asked to rate the extent to which they associated breast cancer with death (*M* = 4.47, *SD* = 1.83, skewness = -.35 [*SE* = .16], kurtosis = -.81 [*SE* = .32]) on a 7-point Likert scale ranging from 1 ("does not make me think about death at all*"*) to 7 ("makes me think about death a lot.*"*) See Appendix G.

Follow-up Questions. Two final items were presented to participants in order to evaluate issues related to both family history and SES. The first asked participants whether they had ever undergone genetic testing for mutations related to breast cancer risk (with responses "no [*N* = 203]," "yes, but I was negative [*N* = 19]," and "yes, and I was positive for at least one genetic risk factor [*N* = 3]."). The second item asked participants to rate how feasible they thought it might be for them to get a mammogram (*M* = 5.91, *SD* = 1.74, skewness = -1.57 [*SE* = .16], kurtosis = 1.32 [*SE* = .32]) on a 7-point Likert-style scale (ranging from 'not at all feasible' to 'extremely feasible.')[4] See Appendix H.

[4] This specific item was included due to its potential connection with both SES and health insurance status in terms of its impact on intentions to engage in some of the listed behaviors in the dependent breast health intention variable (e.g., "go get a mammogram.") However, the overwhelming majority of women were highly educated and did have health insurance, and this variable was not a preregistered covariate, so it was not included in analyses.

Results

*Hypothesis 1***.** Hypothesis 1 predicted that women with a family history of breast cancer would report higher perceptions of breast cancer susceptibility than those without a family history, especially in cases in which a family member passed away as a result of a breast cancer diagnosis. I investigated this hypothesis using a one-way between-subjects ANCOVA to analyze effects of family history status (no family history; family history/survived; family history/died) on the extent to which women perceived themselves as susceptible to breast cancer when controlling for education level, past BSE behaviors, insurance status, race, and age. There was a significant main effect of family history, $F(2, 223) = 15.40$, $p < .001$, $\eta_p^2 = .13$. Both women whose family member died of breast cancer ($N = 68$, $M = .32$, $SE = .11$) and those whose family member survived breast cancer ($N = 67$, $M = .27$, $SE = .11$) perceived themselves as significantly more susceptible (both *p*s < .001) than those without a family history ($N = 88$, $M = -.42$, $SE = .10$); however, there was no difference between women whose family member died versus survived ($p = 74$). This contrasts the explicit hypothesis involving ordered pairwise susceptibility perceptions, but does provide support to the notion that having any family history increases feelings of susceptibility.

Hypothesis 2. Hypothesis 2 stated that women with a family history of breast cancer (especially if a family member died as a result) would report heightened breast health esteem compared to women without a family history. A one-way between-subjects ANCOVA was employed to analyze effects of family history status (no family history; family history/survived; family history/died) on the extent to which women thought breast health to when controlling for SES, past BSE behaviors, insurance status, race, and age. The hypothesized main effect of family history was not significant, $F(2, 223) = .65$, $p = .53$, $\eta_p^2 = .006$. Family history did not have an

impact on the extent to which women placed feelings of esteem on engagement in breast health behaviors and Hypothesis 2 was not supported.

Hypothesis 3. For my third hypothesis, I anticipated that among women with a breast cancer family history (especially among those women whose family member died), increased susceptibility perceptions would mediate increased breast health esteem, which would in turn mediate increased breast health intentions. I tested this hypothesis using a serial mediation approach from Hayes's (2020) SPSS PROCESS Macro; specifically, Model 6 for serial mediation with two mediators (see Figure 1). Family history was input as the multicategorical predictor variable (no family history = 1, family history/survived = 2, family history/died = 3).[5] Standardized susceptibility perceptions served as the first mediator, breast health esteem as the second mediator, and intentions to engage in breast health behaviors was the dependent outcome variable of interest. Again, age, race, insurance status, SES, and prior BSE behaviors served as control variables. Five thousand bootstrap samples were used to create a 95% confidence interval (CI) to investigate indirect effects, where effects are considered significant if the 95%CI does not include 0.

In this model, two notable effects emerged. First, there was a significant effect of family history on susceptibility perceptions among those with a family history in which a family member survived, $B = .69$, $SE = .15$, 95%CI [.39, .99], as well as among those with a family history in which a family member died, $B = .74$, $SE = .15$, 95%CI [.44, 1.04], compared to those without a family history. This effect parallels the ANCOVA from Hypothesis 1, where both

[5] In the PROCESS Macro for SPSS, multicategorical variables can be classified in different ways (e.g., indicator, sequential, Helmert, etc.) For the purposes of the present studies, and for ease of interpretation, I used the Indicator coding scheme for the mulicategorical family history predictor variable. The group without any breast cancer family history was thus used as the 'reference' or control category, and as such, the other two family history groups were compared to the group without any family history in subsequent comparisons.

family history groups reported heighted perceptions of susceptibility compared to those without a family history. Additionally, there was a direct effect of breast health esteem on breast health intentions, *B* = .23, *SE* = .05, 95%CI [.14, .37]. However, no other direct nor indirect effects were significant. Though there were effects of family history on susceptibility perceptions, and significant association between breast health esteem and intentions, the indirect effects of family history on breast health intentions through susceptibility perceptions and breast health esteem were not significant. Hypothesis 3 was not supported. See Table 6 for effects, SE, and 95%CIs.

Exploratory Analyses

In my preregistration plan, I detailed that exploratory analyses would incorporate associations between death and breast cancer. First, I aimed to replicate the Pilot Study and determine if women with a family history of breast cancer differed in the extent to which they associated the disease with death, especially women who lost a family member. Additionally, I aimed to investigate death association in place of susceptibility perceptions as a mediator, and also employ both death association and susceptibility perception variables as serial mediators on the effects of family history on breast health esteem, and in turn, breast health intentions when controlling for age, race, insurance status, SES, and prior BSE behaviors.

To investigate whether the Pilot Study replicated, I employed the same one-way between-subject ANCOVA to analyze effects of family history on associations between death and breast cancer while continuing to control for SES, past BSE behaviors, insurance status, race, and age. Again, a significant main effect of family history (F[2, 223] = 6.41, p = .002, $\eta_p^2 = .06$), and the anticipated pattern of LSD pairwise comparisons as informed by pilot data, emerged. Breast cancer-death associations did not differ between women without a family history (N = 88, M = 4.22, SD = 1.96) and those whose family member survived ((N = 67, M = 4.23, SD = 1.69; p =

.83), whereas women whose family member died (N = 68, M = 5.12, SD = 1.59) associated breast cancer with death significantly more than both those whose family member survived (p = .004) and those without a family history (p = .001).

Then, I investigated the role of death association in place of the susceptibility perception variable in a PROCESS Model 6 for serial mediation, parallel to the analysis used to test Hypothesis 3. Family history was still used as the predictor, death associations replaced susceptibility perceptions to serve as the first mediator, breast health esteem as the second mediator, and breast health intentions as the outcome variable (see Figure 2). First, there was a significant direct effect of family history on death associations, but only among those with a family history in which a person died, B = .94, SE = .29, 95%CI [.38, 1.51]. This finding reflects the ANCOVA, wherein those whose family member died of breast cancer associated the disease with death to a greater extent than the other groups, who did not differ from each other. Further, there was a significant direct effect of death association on breast health esteem, B = .23, SE = .05, 95%CI [.12, .34] and a direct effect of breast health esteem on breast health intentions, B = .21, SE = .05, 95%CI [.12, 31]. In addition, there was a significant serial indirect effect of family history on intentions through death associations and esteem among those with a family history in which someone died, B = .05, SE = .02, 95%CI [.01, .10]. This indirect effect suggests that, among women whose family member died of breast cancer, associating the disease with death and placing feelings of esteem in breast health behaviors to a greater extent mediates intentions to engage in breast health behaviors. See Table 7 for effects, SE, and 95%CIs.

In the updated preregistration, I also detailed two three-variable serial mediation models employing both the susceptibility perception and death association variables. Two additional PROCESS Model 6 analyses for serial mediation with three mediators were conducted: one with

death association as the first mediator and susceptibility perception as the second, and one with susceptibility perception as the first mediator and death association as the second. In both analyses, breast health esteem served as the third mediator and breast health intentions as the outcome variable of interest, controlling for age, race, insurance status, SES, and prior BSE behaviors (see Figures 3 and 4).

First, death association was input as the first mediator in the model, susceptibility perceptions as the second, and esteem as the third. A few direct effects emerged. There was a significant direct effect of family history on death association only among women whose family member died, B = .95, SE = .29, 95%CI [.38, 1.51]. There were also direct effects of family history on susceptibility perception among women whose family member survived (B = .68, SE = .15, 95%CI [.39, .98] and women whose family member died (B = .63, SE = .15, 95%CI [.33, .93]). Further, there was a direct effect of death association on susceptibility perception, B = .13, SE = .04, 95%CI [.06, .19]. On the breast health esteem variable, there was a direct effect of death association, B = .22, SE = .06, 95%CI [.11, .33]. Lastly, there was a direct effect of breast health esteem on breast health intentions, B = .21, SE = .05, 95%CI [.12, .31]

In line with the prior analysis in which death association and esteem were the only two mediators in the model, the only significant indirect effect was a basic replication of that prior analysis. Among those with a family history in which someone died compared to those without a family history, there was a significant indirect effect of family history on intentions through death associations and breast health esteem, B = .02, SE = .01, 95%CI [.01, .09]. The same effect did not manifest in comparing those whose family member survived to those without a family history. See Table 8.

Next, susceptibility perceptions were input as the first mediator in the model, death association as the second, and esteem as the third. Intuitive direct effects also manifested in this model. First, there was a direct effect of family history on susceptibility perceptions for women whose family member survived (*B* = .69, *SE* = .15, 95%CI [.39, .99]) and women whose family member died (*B* = .74, *SE* = .15, 95%CI [.44, 1.04] compared to women with no family history. There was also a direct effect of family history on death association only among women whose family member died, *B* = 62, *SE* = .29, 95%CI [.04, 1.20], Additionally, there was a direct effect of susceptibility perception on death association, *B* = .44, *SE* = .13, 95%CI [.20, .69]. On the esteem variable, there was a direct effect of death association, *B* = .22, *SE* = .06, 95%CI [.11, .33]. Lastly, there was a direct effect of breast health esteem on breast health intentions, *B* = .21, *SE* = .05, 95%CI [.12, .31].

The same indirect effect from the above two analyses emerged again. Among women with a family history in which someone died compared to those with no family history, there was a significant indirect effect of family history on intentions through death associations and breast health esteem, *B* = .03, *SE* = .02, 95%CI [.00, .07]. Additional indirect effects for the three-mediator model also emerged. In this analysis, the indirect effect of family history through susceptibility, death association, and esteem on breast health intentions was significant for both those with a family history in which a family member survived, *B* = .01, *SE* = .01, 95%CI [.00, .04], as well as those with a death in the family, *B* = .02, *SE* = .01, 95%CI [.00, .04], compared to those without a family history. See Table 9.

Study 1 Discussion

The general goal of Study 1 was to evaluate the differences between those with and without a family history of breast cancer in terms of perceived susceptibility to breast cancer, the

extent to which breast cancer was associated with death, the feelings of esteem women might place on engagement in breast health behaviors, and the facilitative role of those variables in women's intentions to engage in breast health behaviors.

First, and partially supporting Hypothesis 1, women with a family history of breast cancer perceived themselves as more susceptible to the disease compared to those without a family history of breast cancer. Deviating from the hypothesis, though, the survival of family members did not exacerbate susceptibility perceptions; that is, regardless of whether women's family member survived or died from breast cancer, the presence of that family history was enough to increase the extent to which women thought they would get breast cancer at some point in their lives compared to those without any family history at all. This particular finding makes sense in that women who know that breast cancer runs in their families will likely see their lifetime risk as heightened, regardless of the survival status of their family member.

Hypothesis 2 was primarily geared toward investigating assumptions of the TMHM. The aim of this hypothesis was to evaluate whether witnessing an existential threat in the form of familial breast cancer led women to hinge more feelings of esteem on engagement in behaviors which might mitigate their own risk over a lifetime, compared to women without familial experience with breast cancer. That is, women with experiences with breast cancer should see breast health behaviors as more important on a personal level. It follows in the reasoning of the TMHM that, to the extent that health behaviors are viewed as important to one's sense of self or worth, women should be more apt to intend to engage in those behaviors. However, Hypothesis 2 was not supported. There were no differences between family history groups in terms of esteem derived from breast health behaviors.

Hypothesis 3 served as an amalgamation of Hypotheses 1 and 2, placing focus on the mediating role of susceptibility perceptions and breast health esteem factors on intentions to engage in breast health behaviors. First, the serial mediation analysis did provide further evidence for the role of family history in susceptibility perceptions, given both the ANCOVA and the direct effect of family history on that the susceptibility perception outcome variable. Additionally, there was an intuitive and significant association between breast health esteem and intentions, where higher breast health esteem predicted higher intentions to engage in breast health behaviors. However, the lack of significant serial mediation stands as a failure to support the hypothesis.

I constructed the exploratory analyses branching from Hypothesis 3 as a means of evaluating breast cancer-death association as a potential contributor to the relationship between family history and breast health outcomes of interest. First, comparing the family history groups in terms of the extent to which each group associated breast cancer with death, the data show a replicated pattern from pilot testing. Women whose family member died of breast cancer associated the disease with death to a greater extent than both those whose family member survived breast cancer and those without any family history. This finding does give credence to the notion of breast cancer as an increasingly problematic existential threat when considering the context of one's family history. Having had a family member die of breast cancer clearly influences how women associate the disease with death.

In the next exploratory analysis, I used the same procedure as the analysis implemented to explicitly test Hypothesis 3, but where death association was used as a first mediator instead of susceptibility perceptions. Again, conceptually replicating pilot data and the results of the ANCOVA, those with a family history of death by breast cancer did associate the disease with

death to a greater extent. Additionally, among that group, death associations predicted breast health esteem; breast health esteem also predicted breast health intentions. This specific finding lends important support to the TMHM: where a health threat is perceived as deadly, it could serve to increase the extent to which people hinge feelings of esteem on engagement in health behaviors. Further, to the extent that they do, those feelings of esteem could help facilitate intentions to engage in the behaviors themselves.

Critically integrating the ideas of both susceptibility perceptions and death association, additional exploratory analyses further clarified the aforementioned effects. When death association was input as the first mediator and susceptibility perceptions as the second, no new notable effects manifested. However, when susceptibility was input into the model first and death association second, a more meaningful pattern of results emerged. Women who lost a family member to breast cancer associated breast cancer with death to a greater extent than those without a family history, which in turn predicted esteem based in breast health, which further related to intentions to engage in breast health behaviors, susceptibility perceptions notwithstanding. The same effect did not manifest among those whose family survived a breast cancer diagnosis. But, the most interesting component of this serial mediation analysis was the role of susceptibility perceptions when included in the model before, rather than after, the death association variable. Where women felt susceptible to breast cancer, they then associated the disease with death to a greater extent, which led them to place more feelings of esteem on breast health, which further predicted breast health intentions. These effects were significant both among women whose family member survived breast cancer, as well as among women whose family member passed away, compared to those without any family history.

Taken together, these findings show that a family history of breast cancer influences women's perceptions of their lifetime chances of breast cancer, as well as how much women associate breast cancer with death. While women who lost a family member to breast cancer associated the disease with death to a greater extent (which facilitated esteem and intentions in that group alone), the interplay between susceptibility and death association, in that order, was critical for all women at heightened breast cancer risk through family history. In turn, where women with any breast cancer in their family history perceived themselves as susceptible, they also associated breast cancer with death to a greater extent, and in turn were more prone to associate feelings of esteem with taking care of their breast health. Those feelings of esteem then facilitated intentions to engage in such behaviors.

These findings lend important insight to the TMHM. When association with death was the sole or first predictor in the models, only women who lost family to breast cancer reported heightened esteem, which mediated breast health intentions. Importantly, though, among all women who felt more susceptible as a result of any sort of breast cancer family history, the extent to which they associated the disease with death critically predicted esteem and then intentions across the board. This suggests that associating breast cancer with death is important for facilitating esteem and intentions among women who have lost family to breast cancer, but perceiving oneself as susceptible first is critical for esteem and intentions among all women with a family history of breast cancer.

This first study is not without limitations. First, the sample size for the family history groups could be considered problematic in the context of the ANCOVAs performed. The sample size for the group without family history was larger than the groups with family histories. This is not a major concern, though, because variances within each group were similar enough to allow

relatively sound conclusions about main effects. This imbalance may have also affected effect sizes of the family history main effects, which are admittedly small in some of the analyses. Pragmatically, it is simply difficult to attain such a specific sample using prescreening procedures and manual survey platform invitations for follow-up participation alone. I attempted to reconcile this limitation through more carefully monitoring specific group-level sample sizes in Study 2. However, future research should still aim to more carefully balance sample sizes between family history groups, which would be more practical in a team-oriented healthcare setting.

Additionally, the extent to which breast cancer was associated with death as a result of family history, as well as the delay in terms of the additional questions presented only to those who indicated a family history of breast cancer, may have added additional noise to results. The TMHM distinguishes between proximal and distal defenses (Pyszczynski et al., 1999), which are time-dependent in many cases. That is, there was a delay where questions about familial relationships and time since the death of a family member were presented only to the specific family history groups. As such, death salience could have been even more incongruent for participants in this initial study. This limitation was rectified in Study 2. Participants with all family history levels were also presented with a mortality salience manipulation so as to isolate the effects of death awareness as a motivating factor underlying breast health esteem and intentions.

Study 2

Purpose and Hypotheses

Study 2 was geared specifically to investigate the role of death awareness on of breast health esteem contingencies and subsequent behavioral intentions with considerations for family

history. I hypothesized that, when death is salient, women would report heightened breast health esteem, which would mediate increases in breast health intentions. I also hypothesized that family history would moderate this relationship. As such, priming death should lead to higher breast health esteem, which should mediate increases in breast health intentions, especially among women with a family history and potentially to an even greater degree among women with a family history in which a relative died as a result. I attempted to reconcile limitations of Study 1, where associations with death were inherently confounded with family history, by independently manipulating death awareness.

I also performed exploratory preregistered analyses.[6] I wanted to employ similar mediation models as in Study 1, with both susceptibility perceptions and death associations serving as serial mediators, in both orders, where MS effects on breast health intentions could be moderated by family history through those serial mediators. Additionally, I preregistered analyses using only the family history variable as the predictor and excluding MS to investigate whether the effects of family history found in Study 1 would replicate in Study 2.

Power Analysis and Participants

As with Study 1, participants were American cisgender women over age 40, recruited through the Prolific online survey platform using the prescreening procedure. Only Prolific workers who were recruited through the prescreen and did not participate in Study 1 were invited to take part in Study 2. Preliminary power analyses for a small-to-medium effect size for two experimental groups and a three-group moderator with five covariates, along with literature on moderated mediation with a 5000-sample bootstrapping approach (e.g., Preacher, Rucker, &

[6] The preregistration for Study 2 was updated twice – once to include the serial mediation component/replication for Study 1 with the family history predictor, and once to correct the PROCESS model number for moderated serial mediation. My packet of PROCESS templates only went to Model 76, while the appropriate model for moderated serial mediation was 83.

Hayes, 2007), and with considerations for oversampling in the event of incomplete data, suggested a sample size of 450. A total of 463 responses were collected from Prolific survey platform workers in exchange for $0.83.

Procedure

I report all measures, manipulations, and exclusions in this study. All materials were administered online. Participants were first provided with an informed consent and told that they were taking part in a study involving the effect of certain personality traits on reactions to certain information regarding health behaviors and feelings associated with them. Four hundred and sixty-three responses were collected, but 13 selected did not pass an attention check item (e.g., "Please select the color described in the instructions above – 'Pink') and were redirected back to the Prolific platform. All other participants successfully completed all measures and attention checks, amounting to a final sample of 450 participants. Materials are detailed below in order of presentation.

Demographics. The same demographics questionnaire from Study 1 was used again in this study. Participants reported their ages (M_{age} = 52.66, SD_{age} = 9.18, $skewness_{age}$ = .47, [SE = .11], $kurtosis_{age}$ = -.61, [SE = .23]), gender identity (all cisgender women, n =450), racial/ethnic identity, sexual orientation, whether they have health insurance, their annual income, and their level of education. Items pertaining to breast cancer family history status (including relationship to the person diagnosed and time since death of a family member), past BSE behaviors (which again, in line with the preregistration plan, was a registered covariate), and whether individuals had been diagnosed with breast cancer themselves were also presented in this section. In line with the preregistration plan, age, racial/ethnic identity, health insurance status, education level (SES), and prior BSE behaviors were included as covariates due to established differences in

breast cancer screening and mortality rates attributable to those demographic variables. See Table 10.

Mortality Salience Manipulation. The present study utilized a traditional TMT mortality salience manipulation (see Burke et al., 2010) to isolate death awareness as a mechanism underlying differences in breast health esteem and intentions. Participants in the mortality salience condition were presented with open-ended prompts to "Briefly describe the emotions that the thought of your own death arouses in you" and to "Jot down, as specifically as you can, what you think happens to you as you physically die and once you are physically dead." The control condition asked parallel questions about experiencing watching television.[7] See Appendix I.

Breast Health Information. I utilized the same breast health infographic from Study 1 again in Study 2.

Delay/Distraction. To better encourage breast health behaviors reaching a distal (and thus more self-contingent; Pyszczynski et al., 1999) status, participants were presented with the 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS (even as a short form) is commonly used as a delay and distraction task in TMT research (Burke et al., 2010).[8] See Appendix J.

[7] While some TMT studies use dental pain as a parallel control condition, I attempted to reduce potential noise which might arise from discussing too many different health issues (dental pain and breast cancer). Watching television is another TMT control-prime topic used frequently, especially in earlier research (see Burke et al., 2010). I anticipated that this control condition contrasting a health issue with a less health-related control topic would be more coherent than using dental pain as a control.

[8] Per research from Lambert and colleagues (2014), I performed a 2 (MS: death vs. television) x 3 (family history: none, yes/survived, yes/died) on the fear subscale (*scared, afraid, jittery, nervous*) of the PANAS-SF to determine if subsequent effects could be impacted by fear instigated in the MS condition, especially, Interestingly, there was a significant main effect of MS on fear, $F(1, 447) = 6.28$, $p = .013$, $\eta_p^2 = .014$. However, given the lack of interaction between MS and family history, as well as the small effect size, the fear subscale and its implications will only be noted further in the discussion section.

Breast Health Esteem. The same scale ($\alpha = .91$) used to measure breast health esteem in Study 1 was used in Study 2 (*M* = 4.30, *SD* = 1.65, skewness = -.07, [SE = .12], kurtosis = -.77, [SE = .23]). See Table 11.

Breast Health Intentions. The same intentions scale ($\alpha = .86$) used in Study 1 was used again in Study 2 (*M* = 4.50, *SD* = 1.08, skewness = -.28, [SE = .12], kurtosis = -.12, [SE = .23]). See Table 12.

Perceived Breast Cancer Susceptibility. The same susceptibility scale used in Study 1 was used again in Study 2, and again standardized for ease of analysis (*M* = .00, *SD* = 1.00, skewness = .21, [SE = .12], kurtosis = -.70, [SE = .23]).

Breast Cancer-Death Association. The same item in which participants reported the extent to which they associated breast cancer with death in Study 1 was used again in Study 2 (*M* = 4.34, *SD* = 1.88, skewness = -.23, [SE = .12], kurtosis = -.99, [SE = .23]).

Follow-up Questions. The same final items from Study 1 were presented to participants in Study 2. The first asked participants whether they had ever undergone genetic testing for mutations related to breast cancer risk (with responses "no (*N* = 404)," "yes, but I was negative (*N* = 41)," and "yes, and I was positive for at least one genetic risk factor (*N* = 5)."). The second item asked participants to rate how feasible they thought it might be for them to get a mammogram (*M* = 5.95, *SD* = 1.63, skewness = -1.57 [*SE* = .16], kurtosis = 1.62 [*SE* = .23]), on a 7-point Likert-style scale (ranging from 'not at all feasible' to 'extremely feasible').[9]

[9] Again, the mammogram feasibility variable was not a preregistered covariate, and will not be mentioned until the discussion section.

Results

The primary preregistered hypothesis in Study 2 was that, when death was salient, women would report heighted breast health esteem, which would in turn mediate breast health intentions, with family history status serving as a moderator for this relationship.

To directly investigate Study 2's explicit and preregistered hypothesis that family history status would moderate the effects of MS on breast health intentions through breast health esteem, a PROCESS Model 7 for moderated mediation (Hayes, 2017, see Figure 5) was implemented where MS was input as the predictor (death versus television, coded as 1 or 0 respectively), breast health esteem as mediator, breast health intentions as the dependent variable, and family history as the moderator variable (coded as 0 for no family history, 1 for family history, and 2 for a death in the family).[10] Again, age, race, insurance status, SES, and prior BSE behaviors were included as preregistered covariates in the model. The only significant effect that emerged was an association between breast health esteem and intentions, $B = .287$, $SE = .03$, 95%CI [.23, .34]. The hypothesis for Study 2 was not supported. See Table 13.

Moderated Serial Mediation Analyses

In line with the preregistration plan, and in attempts to extend Study 1 and investigate the role of explicit mortality salience, a moderated serial mediation approach using PROCESS Model 83 was implemented to investigate the moderating effect of family history on the impact of MS on breast health intentions through serial mediation with susceptibility perceptions, death association, and breast health esteem. Again, age, race, insurance status, SES, and prior BSE behaviors served as control variables. Five thousand bootstrap samples were used to create a

[10] Here, again, the indicator coding scheme in the PROCESS Macro for the multicategorical family history variable was laid out such that comparisons evaluated differences between the group whose family member survived to those without family history and between those whose family member died to those without family history.

95% confidence interval (CI) to investigate indirect effects, where effects are considered significant if the CI does not include 0.

In the first iteration of the model (see Figure 6), MS was input as the predictor variable (coded as 0 for the television control and 1 for the mortality salience manipulation) death association was input as the first mediator, susceptibility perception as the second mediator, esteem as the third mediator, and family history as the moderator. MS did not have any significant effects across both direct and indirect pathways in the model. Some significant direct effects did emerge aside from MS. First, there was a direct effect of family history on death associations, B = 1.01, SE = .28, 95%CI [.45, 1.57], where women whose family member died associated breast cancer with death to a greater extent compared to those with no family history. Further, there was a direct effect of death association on susceptibility perceptions, B = .19, SE = .02, 95%CI [.14, .24]. There was also a direct effect of death association on breast health esteem, B = .18, SE = .04, 95%CI [.10, .26]. Lastly, there was a direct effect of breast health esteem on breast health intentions, B = .29, SE = .03, 95%CI [.23, .34]. See Table 14. Generally, associating breast cancer with death to a greater degree (especially among women whose family member died of breast cancer) served to predict increased perceptions of susceptibility and esteem associated with breast health behaviors. Additionally, the increase in breast health esteem was associated with greater breast health intentions.

In the second iteration of the model (see Figure 7), susceptibility perception was input as the first mediator, death association as the second, esteem as the third, and family history as the moderator, with MS still serving as the predictor variable and intentions as the dependent variable. Again, MS did not have any significant direct nor indirect effects. Some other significant direct effects did emerge. First, there was a direct effect of susceptibility perception

on death association, *B* = .65, *SE* = .08, 95%CI [.49, .82]. There was also a direct effect of death association on breast health esteem, *B* = .18, *SE* = .04, 95%CI [.10, .26]. There were direct effects of susceptibility perceptions (*B* = -.11, *SE* = .05, 95%CI [-.20, -.02]) and esteem on breast health intentions (*B* = .29, *SE* = .03, 95%CI [.23, .34]). See Table 15. Interestingly, susceptibility was negatively related to intentions, which could indicate a level of reactance. However, and importantly, increased breast health esteem predicted breast health behaviors.

In these analyses, MS did not have any effects, but the direct effects that did arise lend support to the findings in Study 1, where death associations and susceptibility connected with family history comparisons to facilitate breast health behavioral intentions when those behaviors relate to feelings of esteem.

Replication Analyses

In considering the lack of MS effects across the board, and in line with my preregistration plan, I performed additional analyses in an attempt to replicate findings from Study 1. To do so, I excluded MS from these models and used family history as the predictor variable. Mirroring the exploratory analyses from Study 1, two PROCESS Models 6 for serial mediation using death association, susceptibility perception (either coming first or second) and breast health esteem as mediators on breast health intentions were evaluated with family history used as the sole predictor.

In the first model (see Figure 8), family history was input as the predictor (coded with no family history = 0, family history/survived = 1, and family history/death = 2), death association as the first mediator, susceptibility perceptions as the second mediator, breast health esteem as the third mediator, and breast health intentions as the dependent variable. First, there was a direct effect of family history on death associations among women whose family member died, *B* = .85,

SE = .21, 95%CI [.44, 1.27]. There were also anticipated direct effects on susceptibility perceptions, such that women with any breast cancer family history, regardless of survival status, perceived themselves as more susceptible (*B* = .54, *SE* = .10, 95%CI [.34, .72] for women whose family survived; *B* = .64, *SE* = .10, 95%CI [.44, .84] for women whose family member died). There was also a direct effect of death association on susceptibility perception, *B* = .16, *SE* = .02, 95%CI [.12, .21]. There was also a direct effect of death association on breast health esteem, *B* = .19, *SE* = .04, 95%CI [.10, .27]. On the breast health intentions variable, there were direct effects of susceptibility perceptions (*B* = -.10, *SE* = .05, 95%CI [-.20, -.01] and breast health esteem (*B* = .29, *SE* = .03, 95%CI [.23, .34]). Interestingly, the indirect effect of family history through susceptibility perceptions on intentions was also significant among both family history groups (*B* = -.06, *SE* = .03, 95%CI [-.11, -.00] for women whose family survived and *B* = -.07, *SE* = .03, 95%CI [-.13, -.00] for women whose family member died). Further, there was an indirect effect of family history on breast health intentions through death associations and then susceptibility among women whose family member died, *B* = -.01, *SE* = .01, 95%CI [-.03, -.00].

Critically, and replicating the family history analyses of Study 1, the anticipated indirect effect of family history through death associations manifested again, only among those where a family member died of breast cancer, *B* = .05, *SE* = .02, 95%CI [.02, .08]. For those with a family history of breast cancer in which a family member died compared to those without a family history, the extent to which breast cancer was associated with death predicted breast health esteem, which in turn predicted breast health intentions. See Table 16.

The second model (see Figure 9) again included family history as the predictor variable, but this time with susceptibility perceptions as the first mediator, death association as the second, breast health esteem as the third mediator, and breast health intentions as the dependent variable.

There were direct effects of family history on susceptibility perceptions for both women whose family member survived (*B* = .56, *SE* = .11, 95%CI [.35, .76]) and women whose family member died (*B* = .78, *SE* = .11, 95%CI [.57, .99] compared to women without family history. There was also a direct effect of susceptibility perceptions on death association, *B* = .62, *SE* = .09, 95%CI [.45, .80]. Additionally, there was a direct effect of death association on breast health esteem, *B* = .19, *SE* = .04, 95%CI [.10, .27]. There were also direct effects of susceptibility perception (*B* = -.10, *SE* = .05, 95%CI [-.20, -.01]) and breast health esteem (*B* = .29, *SE* = .03, 95%CI [.23, .34]). These results again display relationships between death associations and susceptibility perceptions, and the notion that those two constructs are critical for esteem and intentions for breast health serially.

Taken together and looking more closely at the hypothesized indirect effects, there was first an indirect of family history such that increased susceptibility perceptions decreased intentions among both women whose family member survived (*B* = -.06, *SE* = .03, 95%CI [-.12, -.01]) and women whose family member died (*B* = .08, *SE* = .04, 95%CI [-.16, -.01]).

Critically, though, the same results from the same model in Study 1 replicated in this iteration. First, susceptibility perceptions, death association, and esteem mediated the effects of family history on intentions among women whose family member survived, *B* = .02, *SE* = .01, 95%CI [.01, .03], as well as among women with a family history in which a family member died, *B* = .02, *SE* = .01, 95%CI [.01, .04]. While women whose family member died from breast cancer still reflected the serial mediation pattern on breast health esteem and intentions through death associations, all women who had a family history of breast cancer and thus felt susceptible reported higher intentions through the order of susceptibility perceptions, death associations, and esteem. See Table 17.

Study 2 Discussion

In Study 2, I hypothesized that death reminders would serve to increase the extent to which breast health was associated with feelings of esteem to facilitate intentions to engage in breast health behaviors, especially among those with more traumatic familial experiences with breast cancer. There was no evidence for moderated mediation for the effects of MS on breast health esteem or intentions when considering the role of family history. There were also no effects of MS across the board in the moderated serial mediation analyses which included both the susceptibility perception and death association variables. The specific hypothesis for Study 2 was not supported.

Despite the lack of support for the preregistered hypothesis, preregistered analyses geared toward replicating the results of Study 1 using family history as the sole predictor variable (i.e., excluding MS) in the serial mediation models did replicate with the same effects. A deviation from Study 1 did arise in the form of a negative association of susceptibility perception on esteem and intentions. As noted, this negative relationship could have been attributed to a level of reactance, whereby feeling at higher risk led women to lessen their focus on breast health.

Further, despite the unexpected negative impact of susceptibility perception on intentions, the pattern of results was meaningfully different and most meaningful overall when the mediators were entered in the same order as in Study 1. Namely, women with a family history of breast cancer (regardless of survival status) saw themselves as more susceptible, which related to increased breast cancer-death association, which predicted breast health esteem, which facilitated increases in intentions to engage in breast health behaviors.

Broadly, these results lend evidence to the notion that familial experiences with breast cancer, especially those experiences which involve the death of a loved one, have implications

for the manner in which women view their own risk of breast cancer. Those risk perceptions then influence how important to one's sense of self engagement in adaptive breast health behaviors might be, which in turn relates to willingness to engage in such behaviors. Importantly, too, the critical interplay of susceptibility perceptions and death associations support a variety of health theories, including the Extended Parallel Process Model (Popova, 2012; Witte, 1992) and Health Belief Model (Rosenstock, 2000), which detail that one must first feel vulnerable to a health threat and perceive that threat as sufficiently serious to warrant positive behavioral intentions or changes. Critically, among women who are at increased risk of breast cancer through family history compared to those without family history, perceiving one's self as susceptible to breast cancer does not facilitate adaptive behavioral intentions alone – there must also be an association between the disease and death, and there must be a degree of esteem or value ascribed to health behaviors in order for intentions to engage in those behaviors manifest.

However, and importantly for theorizing under the umbrella of the TMHM, priming death had no effects on any of the variables of interest. This could be due to a confound with family history. The pilot study, Study 1, and now Study 2, all provided congruent data in that women with a family history of breast cancer in which a family member died all associated the disease with death to a higher degree, as exhibited through the main effects on the death association variable across analyses. As such, though the lack of interaction between family history and MS may be viewed as problematic, it could also suggest that family history alone is a death prime in itself. Combining family history reminders with reminders of death more generally could be conceptual overkill. At face value, one could interpret the lack of MS effects as evidence contesting TMT and the TMHM. Instead, the present studies could suggest *more* evidence for the TMHM specifically, insofar as a health threat appears to serve the same role as

salient mortality in terms of impact on esteem and intentions among those most at risk through their family histories.

General Discussion

Across two studies, I found that having a family history of breast cancer bears important implications for both perceptions of one's lifetime susceptibility, as well as the extent to which individuals associate breast cancer with death. Further, where susceptibility perceptions and death associations are heightened as a result of family history, those risk-related variables predict how much women integrate taking care of their breast health with feelings of esteem. Lastly, a culmination of those variables stands to facilitate the degree to which women are willing to engage in healthy behaviors to the benefit of their own breast health.

In Study 1, women with any kind of breast cancer family history perceived themselves as more susceptible over their lifetimes. Additionally, women who lost a family member to breast cancer associated the disease with death more than those with no family history, as well as those where a family member survived their breast cancer diagnosis. While family history did not directly impact women's esteem based in breast health nor their intentions to engage in breast health behaviors, women who felt susceptible and associated the disease with death as a result of their family history status displayed a chain through which their own risk perceptions ultimately predicted both esteem and intention factors.

In Study 2, coupling family history and death reminders did not produce any notable interactions, and the family history status did not moderate any effects of mortality salience. This is due to a lack of mortality salience effects across the board. However, and critically for the purposes of this investigation and future research, findings from Study 1 based exclusively in the predictive role of breast cancer family history replicated. Where women with any form of family

history felt susceptible and then associated breast cancer with death, esteem hinged on taking care of one's breasts then predicted intentions to actually do so. Again, while this study does not provide direct evidence for the mortality salience hypothesis derived from TMT specifically, it does show that breast cancer serves the purpose of making mortality salient, especially among those with family affected by the disease.

Taken together, the current studies show that women who have a family history of the most commonly-diagnosed gynecologic cancer do not take that family history lightly. Instead, and intuitively, women with a family history do see a higher possibility of their own lives being impacted by the disease in the future. Additionally, and also intuitively, women who lost family to breast cancer associated the disease with death to a much greater extent, thus lending support to the notion that deadly health issues constitute an innate sort of existential predicament. With those critical risk-related perceptions coupled together, women with a family history of breast cancer do display a greater degree of integration of breast health with feelings of esteem, which relates to intentions to care for their breasts in the future. Additionally, and in keeping with theories of health behavior (e.g., Popova, 2012; Rosenstock, 2000; Witte, 1992), the specific order of variables where women first feel susceptible due to their family history, and subsequently see the threat of breast cancer as more deadly in the context of their own, breast-cancer-affected lives composed the model that successfully predicted both breast health esteem and intentions. That is, these findings support the idea that the women who perceive themselves as more vulnerable (and arguably actually are more vulnerable) as a result of their family history and also associate the disease with death can all benefit from integrating breast health with feelings of esteem to facilitate intentions to engage in adaptive breast health behaviors.

Implications

Breast cancer affects thousands of women each year, and research suggests that between five and ten percent of those cancer cases are largely related to family history as a primary risk factor (Liu et al., 2021). Hereditary forms of breast cancer are also generally more aggressive in nature, typically characterized by significantly faster tumor growth and metastasis (e.g., triple-negative breast cancer; Tilanus-Linthorst et al., 2005). Family history is also associated with other immutable risk factors like ancestry (especially Central/Eastern European Ashkenazi Jewish ancestry), age of familial breast cancer diagnosis, and whether the cancer diagnosed in a family member was a more aggressive form of cancer (CDC, 2021).

However, a family history of breast cancer is not a lifetime guarantee of diagnosis. Despite the fact that family history is an unchangeable risk factor, family history can be used as a means through which an individual's risk level can be assessed in order to stratify risk reduction strategies. For example, genetic mutations (like BRCA) in some families can increase breast cancer risk from 13% to over 70% (National Cancer Institute [NCI], 2020). In those specific populations, it is even more critical to identify risk level and find appropriately aggressive means of facilitating risk-reducing behaviors, including mammography and MRI screening procedures, chemoprevention (e.g., Tamoxifen) and surgical intervention (e.g., mastectomy, salpingo-oopherectomy; NCI, 2020). In the current studies, there were only eight participants across studies who reported testing positive for a genetic risk factor, which precluded me from being able to conduct robust investigations. But, and applying the present research, even behaviors like healthy diet and regular exercise are critical for risk reduction in high-risk populations. As such, identifying and educating groups of people with high-risk genetic factors to encourage adaptive breast health behaviors is critical for reducing risk, improving prognoses, and increasing breast cancer survivorship. The current research provides evidence that, where high-risk women do

garner feelings of esteem from their breast health, they are more likely to report intentions to engage in breast health behaviors. It follows that finding means of encouraging high-risk women to intertwine breast health with feelings of esteem would facilitate adaptive risk reduction behaviors.

In accordance with the TMHM, the extent to which health behaviors connect with feelings of worth or meaning is a highly influential pathway for intentions to engage in such behaviors in response to a severe health threat. Despite a wide breadth of breast cancer research in both the social-psychological and health sectors, and despite studies on the role of self-esteem, little research has focused on the extent to which health behaviors could be considered a component of one's self-esteem. Additionally, no prior research has investigated the extent to which personal experience with a health issue (i.e., family history), could imbue health behaviors with personal significance. The current studies employed an existential framework to aim to better understand the extent to which women with a family history of breast cancer consider breast health behaviors important to a sense of self, and how those esteem factors might impact intentions to engage in adaptive breast health behaviors. Importantly, and mirroring health-based research, these studies identified crucial roles of susceptibility perceptions and how women with family histories actually associated breast cancer with death as facilitators in how women integrated breast behaviors with feelings of esteem. Following in the tenets of the TMHM, esteem associated with breast health did predict future intentions in women at heightened risk due to family history.

These results bear important implications for terror management research. First, and as noted directly above, the findings provide important support for the TMHM. Though some critics of terror management processes could argue that the lack of MS effects stands as evidence

against TMT in general, I suggest that the lack of MS effects instead supports the notion that the threat of breast cancer is enough of an existential threat in itself, especially for women with a deadly family history of the disease. As such, future research in the TMHM would benefit from continued investigations into the role of family history on perceptions of existential threat. Despite the proliferation of breast cancer diagnoses, significantly deadlier diseases do exist, and can be genetically linked. Future research should involve direct investigations of existential threat perception among those at especially high risk for especially deadly diseases. Further, it would be worthwhile to continue consider how health-related behaviors could be contextualized with feelings of esteem, especially for high-risk populations who should internalize as many risk reduction strategies as possible. In the same way Hunt and colleagues (2000) and Palmer and colleagues (2007) found that family history influences how individuals ascribe value and subjective normativity to health behaviors in the context of heart disease and colorectal cancer, research which employs an existential framework for particularly deadly health issues could include similar measures.

Similarly, more research can and should focus on the extent to which health behaviors constitute feelings of esteem. For example, and again using an existential framework, pandemic-related behaviors like mask-wearing and vaccination carry with them reflections of individual values – health behaviors related to COVID-19 became integrated with ideological beliefs (e.g., Courtney, Felig, & Goldenberg, 2021; Courtney, Goldenberg, & Boyd, 2020; Fairlamb & Courtney, 2022). Previous work in the TMHM has still integrated esteem factors with health behaviors, but almost entirely within the scope of exercise behaviors (Arndt et al., 2003) and appearance standards related to behaviors like tanning (Arndt et al., 2009; Cox et al., 2009; Morris et al., 2014; Routledge et al., 2004). However, exercise, breast health, and tanning

encompass a limited number of adaptive health behaviors. Given that existential threat perceptions based in susceptibility and connection with death could apply to a variety of health issues (see pilot testing footnote), investigating means of imbuing a wider range of adaptive behaviors with esteem relevance would provide fruitful avenues for future research.

In the vein of continuing to imbue health behaviors with meaning, and reconnecting breast health with culture, the current studies could serve to inform future breast health communications. Current approaches to communicating about breast cancer tend to ignore the deadlineness of the disease (Duerringer, 2013). Other approaches, similarly drawing attention away from deadliness, also tend to focus on integration of breast health behaviors with routine and with feelings of personal esteem and empowerment (e.g., Bright Pink, 2021). Additional theorizing suggests that, especially among high-risk women, viewing breast health behaviors as personally important while also psychologically distancing from the existentially-troubling physicality of breasts themselves could also serve as a pathway to healthier risk mitigation behaviors (Courtney & Goldenberg, 2021). The present studies culminate in showing that it is critical that women at heightened breast cancer risk actually do connect breast cancer with death, in addition to feelings of esteem, to best facilitate adaptive behaviors. The current studies may help to inform a new generation of public health campaigns in which both deadliness of cancer and esteem contingent on taking care of one's health are highlighted to produce favorable outcomes – not only for breast cancer, but potentially for other deadly diseases, as well.

Limitations and Strengths

These studies are not without limitations. First, it is unclear whether the timing of one's familial breast cancer diagnosis, along with the closeness of that familial relationship, may have impacted either susceptibility perceptions or death associations. This is due to the fact that

sample sizes for both relationships and timing were not only too small, but also not applicable to the majority of the sample who lacked a family history at all. As such, analyses considering these factors would have not provided much in the way of meaningful conclusions. Future research would benefit from an increased focus on proximity to familial breast cancer diagnoses, both in terms of temporality and closeness of a given relationship. This same limitation applies to experiences with breast cancer outside the context of one's family sphere. Given that the sample was composed of women aged 40 and over, there is a strong possibility that these women have friends or acquaintances (or even non-blood-related relatives) who may have also been affected by a breast cancer diagnosis. Though these women may not be directly related to those affected, experiences and relationships outside their families may similarly impact both susceptibility perceptions and death associations. The present study did not ask any questions about breast cancer experiences outside one's family, and future research should.

Another limitation lies in the breast health intentions variable. Though the reliability for the composite scale was acceptable in both studies ($\alpha = .87; .86$, in Studies 1 and 2 respectively), there were some items which may have been difficult for participants to report accurately in terms of time. For example, one participant on Prolific sent a direct message noting that their responses for the "in the next week" group of items were impacted by the fact that they had their annual well-women's checkup and accompanying mammogram the week prior to participating in the study. The studies are also limited in the self-report intentions-based measures employed. While intentions to perform adaptive breast health behaviors bode well for future behavioral engagement, it is impossible to tell if the women who reported heightened intentions to eat healthy, exercise, request clinical breast exams, get mammograms, and do self-exams actually did. As with all studies about health behaviors, monitoring and measuring actual

behaviors instead of behavioral intentions can provide clarity for this issue and robustness to findings. Future research may aim to longitudinally investigate breast health esteem and congruent behaviors by surveying women and following up during their annual checkups.

In light of the lack of MS effects, I opted to review the mortality salience manipulation. Casual, non-systematic evaluations of text responses revealed an interesting thematic pattern. Approximately a third of responses in the death reminder condition included some mention of religion or an afterlife. Select phrases include "my spirit will go to heaven," "I will be free of this body," and "the physical body dies, releasing our eternal soul to return back to our Creator." The notion of religiosity in health behaviors, and through an existential lens, constitutes a double-edged sword. On one hand, attending religious services is a predictor of engagement in cancer screenings (including mammograms and PAP smears), but the relationship between church attendance and screening engagement is contingent on social support (Leyva et al., 2015). In another study, adherence to mammograms and clinical breast exams was associated with lower levels of religiosity among orthodox religious groups (Freund, Cohen, & Azaiza, 2019). Further, religious health fatalism (i.e., the belief that death is inevitable and God is in control) is significantly higher among Black/African American people (especially women), and can contribute to poorer management of chronic illnesses (Franklin et al., 2007).

In the context of the present study, it could be the case that mortality salience could have instigated religious responses as a buffering function, which could partially explain the lack of MS effects on breast health esteem, especially. For example, mortality salience can heighten fundamentalist religious beliefs and lead to beliefs that prayer can substitute for medical attention, as well as endorsements for refusals of medical treatment (Vess et al., 2009). Given the lack of MS effects on esteem and intention variables, a reliance on God and the afterlife may

have produced a level of religious cancer fatalism in the study sample, which could have given rise to alternate terror-buffering mechanisms. Where death awareness is being buffered by religious beliefs from which esteem can be drawn, it follows that relying on health behaviors for esteem would be secondary or irrelevant. Future TMHM research should better consider religious factors and their influence on health behaviors.

In the same vein as limitation association with the religiosity third variable problem, another limitation is the unclear role of fear, as measured by the PANAS-SF delay/distraction task. Those in the mortality condition did report higher fear-related affect than those in the television-watching control. But, in the critical preregistered and exploratory mediation and moderated mediation analyses, including fear as a covariate did not contribute to any meaningful differences or changes in significance in the pathways in the models. Despite the lack of significant differences, fear could still be contributing a fair amount of noise to the dependent variables of interest, especially the susceptibility variable and its relationships to breast health esteem and intentions. It makes sense that women who feel susceptible to a deadly health threat like breast cancer might feel a bit more frightened at a state level during a study such as this. Future research in the TMHM could benefit from increasing focus on the role of fear.

Considering the preregistration further, the sample sizes listed and attained were informed by the explicit hypotheses, and not the exploratory analyses. As such, the exploratory analyses may be underpowered. Future research should collect more data from groups of women who are at heightened risk through family history. Such research would be more practical in a healthcare setting, with more plentiful funding, and preexisting access to a relevant sample.

Finally, the study sample serves as a strength as well as a limitation in the present studies. For one, and as a major strength, these studies used a sample for whom breast cancer risk

actually matters: women over 40. Much TMHM research has used student convenience samples, and so the age and risk-related generalizability of these studies is substantially greater than previous investigations. The current study sample also serves as a major strength to TMHM literature because no prior research in the field has examined populations of people who lost family members to breast cancer, nor compared those who have lost family members to those who have not lost family members. Samples with considerations for family history in general are not part of the TMHM research zeitgeist at this point. The fact that sample used included women for whom breast cancer is a real threat, especially women affected by hereditary cancer, and especially women who have lost family to breast cancer, serves as a critical bolster for the quality of the present research.

However, the sample was limited in that women were generally highly educated and almost entirely insured. Given these characteristics, the sample likely had adequate access to healthcare services, like clinical breast exams and mammography (as exemplified by the fact that the mammogram feasibility variable was skewed in both studies, so the majority of women reported that they would not have much of an issue getting a mammogram when needed.) As such, the generalizability of these findings to women who might have lesser access to healthcare services critical for early detection of breast cancer is limited. Future research may aim to investigate the ways women with limited resources or from marginalized backgrounds may be able to prioritize their breast health.

The sample was also overwhelmingly White. This is a major, glaring, and continuing problem in research on hereditary breast cancer, especially for Black women. Hereditary breast cancer prevalence among Black women is severely understudied, and there may be more BRCA prevalence among Black women than previously thought. In one study, the BRCA prevalence

among young Black women diagnosed with breast cancer was 12.4%, a shockingly high number given that the estimated prevalence in the general population hovers between .3 and 1% (Pal et al., 2015). Further, the five-year survival rate for Black women is roughly nine percent lower compared to White women and compared to all other racial groups (82% compared to 91.0% and 91.1%, respectively; CDC, 2021c) and Black women are significantly more likely to die as a result of breast cancer than women of other races/ethnicities (Richardson et al., 2016). The disparity in survivorship is at least partially attributable to delayed cancer diagnosis, which could be ameliorated with an increased focus on education, prevention, and risk reduction in high-risk populations of Black women. As such, study samples extending the present research should better focus on groups who may more directly benefit from findings in terms of breast health behavior uptake.

Conclusion

Despite advances in medical treatment, breast cancer is not a disease that will likely ever be eradicated, or even fully curable or preventable. While all people with breast tissue (including men!) are at risk of the disease, there are some people at significantly higher risk than others. It is critical to first identify those at the highest risk, especially through their family histories and potential genetic mutations associated with hereditary breast cancer. Then, it is the responsibility of researchers, healthcare providers, and patients alike to find best practices for encouraging risk-reduction and early-detection behaviors to improve prognoses and survivorship. These studies provide support for the notion that, for those at higher risk, finding ways of intertwining health with the self can provide a critical pathway to improve potential behavioral outcomes. In turn, by encouraging those behaviors and improving actual engagement with them, lives may ultimately be saved.

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Appendices

Appendix A: RMarkdown Documents

Participant Selection: Random Number Generation - FamilyHx:Live

Emily Courtney

11/24/2021

```
knitr::opts_chunk$set(echo = TRUE)

library(random)

randomNumbers(n=225, min = 1, max = 435, col=1)

## Warning in doTryCatch(return(expr), name, parentenv, handler): unable to load share
d object '/Library/Frameworks/R.framework/Resources/modules//R_X11.so':

##   dlopen(/Library/Frameworks/R.framework/Resources/modules//R_X11.so, 0x0006): Libr
ary not loaded: /opt/X11/lib/libSM.6.dylib

##   Referenced from: /Library/Frameworks/R.framework/Versions/4.0/Resources/modules/R
_X11.so

##   Reason: tried: '/opt/X11/lib/libSM.6.dylib' (no such file), '/Library/Frameworks/
R.framework/Resources/lib/libSM.6.dylib' (no such file), '/Library/Java/JavaVirtualMac
hines/jdk1.8.0_241.jdk/Contents/Home/jre/lib/server/libSM.6.dylib' (no such file)

##         V1

##   [1,] 215

##   [2,] 403

##   [3,] 172

##   [4,]  49

##   [5,] 366

##   [6,] 193

##   [7,] 414

##   [8,] 243

##   [9,] 236

##  [10,] 380

##  [11,] 235

##  [12,]  95

##  [13,] 155

##  [14,]  32

##  [15,] 252

##  [16,] 211

##  [17,] 316

##  [18,]  30
```

```
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##  [21,] 275
##  [22,] 110
##  [23,]  61
##  [24,] 336
##  [25,] 255
##  [26,] 277
##  [27,] 348
##  [28,] 328
##  [29,] 285
##  [30,] 144
##  [31,] 195
##  [32,] 412
##  [33,] 422
##  [34,] 334
##  [35,] 117
##  [36,] 392
##  [37,] 283
##  [38,] 245
##  [39,]  82
##  [40,] 342
##  [41,]  73
##  [42,] 319
##  [43,] 254
##  [44,] 144
##  [45,]  83
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##  [50,] 237
##  [51,] 243
##  [52,] 262
##  [53,] 188
##  [54,] 268
##  [55,] 145
```

```
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##  [62,] 319
##  [63,] 206
##  [64,]  26
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##  [72,] 343
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##  [75,] 365
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##  [83,] 145
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##  [86,] 192
##  [87,] 273
##  [88,] 311
##  [89,] 221
##  [90,]  84
##  [91,] 382
##  [92,] 301
```

```
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## [129,]  93
```

```
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## [146,] 419
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## [156,] 240
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## [158,] 417
## [159,] 362
## [160,] 233
## [161,] 413
## [162,] 116
## [163,] 165
## [164,] 112
## [165,] 410
## [166,] 303
```

```
## [167,] 365
## [168,] 259
## [169,] 396
## [170,] 262
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## [172,]  68
## [173,] 380
## [174,] 288
## [175,] 186
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## [177,] 273
## [178,] 331
## [179,] 265
## [180,]  56
## [181,] 419
## [182,] 411
## [183,] 156
## [184,]  99
## [185,] 161
## [186,] 237
## [187,] 367
## [188,] 168
## [189,] 356
## [190,] 220
## [191,]  99
## [192,] 101
## [193,] 200
## [194,] 182
## [195,]  27
## [196,] 120
## [197,] 140
## [198,] 159
## [199,] 154
## [200,]   8
## [201,] 166
## [202,]   3
## [203,] 115
```

```
## [204,] 235
## [205,] 183
## [206,]  89
## [207,]  81
## [208,] 346
## [209,] 387
## [210,] 248
## [211,] 358
## [212,] 315
## [213,] 411
## [214,]  99
## [215,]  20
## [216,] 188
## [217,] 119
## [218,] 375
## [219,] 435
## [220,] 338
## [221,] 257
## [222,] 117
## [223,] 426
## [224,]  62
## [225,] 404
```

R Markdown

Participant Selection: Random Number Generation - FamilyHx:Died

Emily Courtney

11/24/2021

```
knitr::opts_chunk$set(echo = TRUE)

library(random)

randomNumbers(n=225, min = 1, max = 435, col=1)

## Warning in doTryCatch(return(expr), name, parentenv, handler): unable to load share
d object '/Library/Frameworks/R.framework/Resources/modules//R_X11.so':

##   dlopen(/Library/Frameworks/R.framework/Resources/modules//R_X11.so, 0x0006): Libr
ary not loaded: /opt/X11/lib/libSM.6.dylib
```

```
##   Referenced from: /Library/Frameworks/R.framework/Versions/4.0/Resources/modules/R
_X11.so
##   Reason: tried: '/opt/X11/lib/libSM.6.dylib' (no such file), '/Library/Frameworks/
R.framework/Resources/lib/libSM.6.dylib' (no such file), '/Library/Java/JavaVirtualMac
hines/jdk1.8.0_241.jdk/Contents/Home/jre/lib/server/libSM.6.dylib' (no such file)
##         V1
##   [1,] 262
##   [2,] 393
##   [3,] 226
##   [4,]  65
##   [5,] 100
##   [6,] 377
##   [7,]  65
##   [8,] 423
##   [9,] 174
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##  [11,] 280
##  [12,]  90
##  [13,] 118
##  [14,]  39
##  [15,] 430
##  [16,]  94
##  [17,]   6
##  [18,]   7
##  [19,] 177
##  [20,] 249
##  [21,] 215
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##  [23,] 429
##  [24,]   4
##  [25,] 252
##  [26,] 377
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##  [28,] 163
##  [29,] 403
##  [30,] 270
##  [31,] 100
##  [32,] 350
```

```
##  [33,]  20
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##  [41,]  14
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##  [63,]   9
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##  [65,] 285
##  [66,] 405
##  [67,] 102
##  [68,] 159
##  [69,] 326
```

```
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```

```
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```

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```

```
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```

```
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## [220,]  94
## [221,] 201
## [222,] 108
## [223,]  88
## [224,] 315
## [225,] 225
```

R Markdown

Participant Selection: Random Number Generation - FamilyHx:Died

Emily Courtney

11/24/2021

```
knitr::opts_chunk$set(echo = TRUE)

library(random)

randomNumbers(n=225, min = 1, max = 324, col=1)

## Warning in doTryCatch(return(expr), name, parentenv, handler): unable to load share
d object '/Library/Frameworks/R.framework/Resources/modules//R_X11.so':

##   dlopen(/Library/Frameworks/R.framework/Resources/modules//R_X11.so, 0x0006): Libr
ary not loaded: /opt/X11/lib/libSM.6.dylib

##   Referenced from: /Library/Frameworks/R.framework/Versions/4.0/Resources/modules/R
_X11.so

##   Reason: tried: '/opt/X11/lib/libSM.6.dylib' (no such file), '/Library/Frameworks/
R.framework/Resources/lib/libSM.6.dylib' (no such file), '/Library/Java/JavaVirtualMac
hines/jdk1.8.0_241.jdk/Contents/Home/jre/lib/server/libSM.6.dylib' (no such file)

##         V1

##   [1,] 306

##   [2,] 185

##   [3,]  94

##   [4,] 261

##   [5,] 220

##   [6,] 227

##   [7,] 136

##   [8,] 173

##   [9,]  39
```

```
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```

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##  [83,] 214
```

```
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```

```
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## [219,] 167
## [220,] 253
## [221,] 313
## [222,] 211
## [223,] 273
## [224,] 294
## [225,]   7
```

R Markdown

Appendix B: Demographics Questionnaire

1. What is your age?

2. What is your race/ethnicity?
   Asian American/Pacific Islander Native American/Alaska Native
   White Black/African American Hispanic/Latinx
   Arab/Middle Eastern Biracial Other (please specify)

3. What is your gender identity?
   Man Woman Transman Transwoman
   Gender-Queer Non-binary Self-Identify (please specify)

4. What is your sexual orientation?
   Straight Gay Lesbian Bisexual Asexual
   Pansexual Queer Self-Identify (please specify)

5. Do you have health insurance?
   Yes No

6. What is your annual total household income?
   Input

7. What is the highest level of education you have completed?
   Some High School High School Diploma Associate's Degree
   Bachelor's Degree Master's Degree Professional Degree Doctorate

8. How often do you perform breast self examinations?
   Never 1-3 times per year 4-6 times per year 7-9 times per year
   10-12 times per year 12+times per year

9. Do you have a family history of breast cancer?
   No Yes, and those diagnosed survived
   Yes, and at least one person diagnosed passed away

10. Have you ever had breast cancer yourself?[11]

[11] Questions 9 and 10 will be the only questions presented to participants during the prescreen phase.

Appendix C: Perceived Breast Cancer Susceptibility Measure

What do you think your chance is of developing breast cancer in your lifetime?

0%, no chance of breast cancer 100%, definitely will get breast cancer

Appendix D: Breast Cancer Infographic

Appendix E: Breast Health Esteem Measure

1. Taking care of my breast health is an important part of who I am

   1 2 3 4 5 6 7

   Strongly Disagree Strongly Agree

2. Taking care of my breast health affects how good I feel about myself

   1 2 3 4 5 6 7

   Strongly Disagree Strongly Agree

3. Taking care of my breast health allows me to express my competence

   1 2 3 4 5 6 7

   Strongly Disagree Strongly Agree

Appendix F: Breast Health Intentions Measure

[Arranged in matrices]

In the future, how likely is it that you will:

Eat a healthy diet
Exercise for 30 minutes 3 times a week
Go get a mammogram
Ask for a clinical breast exam during your well-women's checkup
Do a breast self-exam

1 2 3 4 5 6 7

Not at all likely Extremely likely

In the next three months, how likely is it that you will:

Eat a healthy diet
Exercise for 30 minutes 3 times a week
Go get a mammogram
Ask for a clinical breast exam during your well-women's checkup
Do a breast self-exam

1 2 3 4 5 6 7

Not at all likely Extremely likely

In the next week, how likely is it that you will:

Eat a healthy diet
Exercise for 30 minutes 3 times a week
Go get a mammogram
Ask for a clinical breast exam during your well-women's checkup
Do a breast self-exam

1 2 3 4 5 6 7

Not at all likely Extremely likely

Appendix G: Breast Cancer-Death Association Measure

How much does breast cancer make you think about death?

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

Appendix H: Follow-Up Questions

1. Have you ever undergone genetic testing for breast cancer risk (e.g., BRCA, CHEK2, etc.?)
    a. No
    b. Yes, but I was negative
    c. Yes, and I was positive for at least one genetic risk factor
2. How feasible/easy do you think it would be for you to get a mammogram?

    1 2 3 4 5 6 7

    Not feasible at all Extremely feasible

Appendix I: Mortality Salience Manipulation

On the following pages are two open-ended questions, please respond to them with your first, natural response.

We are looking for peoples' gut-level reactions to these questions.

Mortality Salience Condition

"Briefly describe the emotions that the thought of your own death arouses in you"

"Jot down, as specifically as you can, what you think happens to you as you physically die and once you are physically dead."

Control Condition

"Briefly describe the emotions that the thought of watching television arouses in you"

"Jot down, as specifically as you can, what you think happens to you watch television."

Appendix J: PANAS-SF

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now using the scale below.

	Not at all	A little bit	Moderately	Quite a bit	Extremely
Interested	○	○	○	○	○
Distressed	○	○	○	○	○
Excited	○	○	○	○	○
Upset	○	○	○	○	○
Strong	○	○	○	○	○
Guilty	○	○	○	○	○
Scared	○	○	○	○	○
Hostile	○	○	○	○	○
Enthusiastic	○	○	○	○	○
Proud	○	○	○	○	○
Irritable	○	○	○	○	○
Alert	○	○	○	○	○
Ashamed	○	○	○	○	○
Inspired	○	○	○	○	○
Nervous	○	○	○	○	○
Determined	○	○	○	○	○
Attentive	○	○	○	○	○
Jittery	○	○	○	○	○
Active	○	○	○	○	○
Afraid	○	○	○	○	○
For this item, please select "Extremely"	○	○	○	○	○

Appendix K: Tables and Figures

Table A1. *Pilot Study Demographics (N=626)*

Item	*n*	%
Gender		
Man	154	22.80
Woman	458	68.70
Transman	2	.10
Transwoman	1	.10
Non-Binary	7	1.00
Self-Identify	4	6.00
Race/Ethnicity		
Asian American/Pacific Islander	61	9.0
Native American/Alaska Native	3	.40
White	276	40.80
Black/African American	68	10.10
Hispanic/Latinx	140	20.70
Arab/Middle Eastern	17	2.50
Biracial	31	4.60
Self-Identify	30	4.80

Table A2. *Pilot Study Descriptive Statistics*

Table 2

Pilot Study Descriptive Statistics for Association Between Breast Cancer and Death

	All Participants			Only Women		
	M	*SD*	*N*	*M*	*SD*	*N*
No Family History	3.77	1.18	411	3.90	1.12	283
Family History: Survived	3.90	1.01	133	4.02	.96	107
Family History: Died	4.37**	.85	82	4.45*	.75	66

Note: * Indicates $p < .05$; ** indicates $p < .001$

Table A3. *Study 1 Participant Demographics*

Item	*n*	%
Racial/Ethnic Identity		
Asian American/Pacific Islander	4	1.8
Native American/Alaska Native	1	.4
Black/African American	13	5.8
White	195	86.7
Hispanic/Latinx	5	2.2
Multiple/Biracial	6	2.7
Self-Identify	1	.4
Sexual Orientation		
Straight	206	91.6
Lesbian	2	.9
Bisexual	10	4.4
Asexual	3	1.3
Pansexual	1	.4
Self-Identify	3	1.3
Health Insurance		
Yes	198	88.0
No	24	10.7
Not Sure	3	1.3
Education Level		
Some high school	1	.4
High school diploma/GED	53	23.6
Associate's degree	29	12.9
Bachelor's degree	82	36.4
Master's degree	36	16.0
Technical degree	6	2.7
Professional degree	11	4.9
Doctorate	7	3.1

Table A3 (Continued). *Study 1 Participant Demographics*

Item	*n*	%
Family History Status		
No family history	90	40.0
Yes, and those diagnosed with breast cancer survived	67	29.8
Yes, and at least one person diagnosed with breast cancer passed away as a result of the disease	68	30.2
Relationship to Person with Breast Cancer (only presented to those who indicated family history to previous item, *N* = 135, could select all that apply)		
First-degree family member	54	
Second-degree family member	94	
Further removed (e.g., great grandparent)	13	
Time since death of family member (only presented to those who indicated that a family member diagnosed with breast cancer died as a result of the disease, *N* = 68)		
Less than 1 year	1	1.5
1-5 years	9	13.2
5-10 years	11	16.2
10+ years	47	69.1
Genetic Testing for Breast Cancer Risk		
No	203	90.2
Yes, but tested negative	19	8.4
Yes, and tested positive for at least one genetic risk factor	3	1.3

Table A4. *Study 1 Breast Health Esteem Correlations and Descriptive Statistics (N = 225)*

Variables		1	2	3
1.	Taking care of my breast health is an important part of who I am.	-		
2.	Taking care of my breast health affects how good I feel about myself.	.75**	-	
3.	Taking care of my breast health allows me to express my competence.	.70**	.80**	-
Mean		4.88	4.36	4.23
SD		1.57	1.73	1.77

Note: * Indicates $p < .05$, ** indicates $p < .001$

Table A5. *Study 1 Breast Health Intentions: Correlations and Descriptive Statistics*

Variables	1	2	3	4	5	6	7	9	10	11	12	13	14	15
In the future														
1. Eat a healthy diet	–													
2. Exercise for 30 minutes 3 times a week	.69**	–												
3. Go get a mammogram	.12	.19**	–											
4. Ask for a clinical breast exam during you well-women's checkup	.20**	.26**	.66**	–										
5. Do a breast self-exam	.18**	.07	.11	.21**	–									
In the next 3 months														
6. Eat a healthy diet	.92**	.67**	.12	.24**	.16*		–							
7. Exercise for 30 minutes 3 times a week	.65**	.94**	.22**	.28**	.07	.70**								
8. Go get a mammogram	.25**	.19**	.46**	.43**	.14*	.24*	.22**	–						
9. Ask for a clinical breast exam during your well-women's checkup	.27**	.22**	.40**	.63**	.26*	.26**	.23**	.70**						
10. Do a breast self-exam	.20**	.11	.16*	.30**	.88**	.22**	.12	.22**	.36**	-				
In the next week														
11. Eat a healthy diet	.83**	.67**	.11	.18**	.15*	.89**	.67**	.17*	.21**	.20**	-			
12. Exercise for 30 minutes 3 times a week	.59**	.88**	.15*	.25**	.08	.63**	.89**	.16*	.19**	.14*	.69**	-		
13. Go get a mammogram	.16*	.15*	.19**	.24**	.26**	.14*	.16*	.44**	.46**	.27**	.12*	.19**	-	
14. Ask for a clinical breast exam during your well-women's checkup	.19**	.16**	.20**	.26**	.28**	.17*	.20**	.46**	.49**	.30**	.16*	.22**	.92**	-
15. Do a breast self-exam	.21**	.13	.13	.21**	.70**	.21**	.13	.27**	.32**	.74**	.22**	.23**	.43**	.46**
Mean	5.61	5.33	5.96	5.53	5.44	5.71	5.38	4.15	4.22	5.20	5.55	4.89	1.91	1.99
SD	1.24	1.63	1.72	1.86	1.78	1.33	1.68	2.45	2.36	1.92	1.56	2.08	1.80	1.88

Note: * Indicates $p < .05$, ** indicates $p < .001$

Table A6. *Study 1 Hypothesis 3 PROCESS Model 6*

Estimates of effects for serial mediation model
Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 223

Study 1 Hypothesis 3 PROCESS Model 6	effect	SE	LLCI	ULCI
Direct Effects on Susceptibility				
Family History (a_1)				
No family history vs. Survived	**.690**	**.153**	**.389**	**.991**
No family history vs. Died	**.743**	**.152**	**.444**	**1.043**
Direct Effects on Breast Health Esteem				
Family History (a_2)				
No family history vs. Survived	.051	.249	-.441	.542
No family history vs. Died	.105	.250	-.388	.598
Susceptibility (d_{21})	.205	.106	-.005	.414
Direct Effects on Intentions				
Family History (c')				
No family history vs. Survived	.202	.169	-.132	.536
No family history vs. Died	.107	.170	-.228	.442
Susceptibility (b_1)	.020	.073	-.124	.164
Breast Health Esteem (b_2)	**.233**	**.047**	**.142**	**.325**
Indirect Effects				
Family history → Susceptibility → Intentions (a_1b_1)				
No family history vs. Survived	.033	.020	-.002	.078
No family history vs. Died	.036	.021	-.003	.083
Family history → Esteem → Intentions (a_2b_2)				
No family history vs. Survived	.012	.065	-.102	.150
No family history vs. Died	.025	.062	-.095	.150
Family history → Susceptibility → Esteem → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	.033	.020	-.002	.078
No family history vs. Died	.036	.021	-.003	.083

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A7. *Study 1 Exploratory PROCESS Model 6 (Death Association)*

Estimates of effects for serial mediation model
Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 223

Study 1 Exploratory PROCESS Model 6	effect	SE	LLCI	ULCI
Direct Effects on Death Association				
Family History (a_1)				
No family history vs. Survived	.063	.288	-.505	.630
No family history vs. Died	**.946**	**.287**	**.381**	**1.511**
Direct Effects on Breast Health Esteem				
Family History (a_2)				
No family history vs. Survived	.177	.231	-.278	.632
No family history vs. Died	.039	.236	-.425	.503
Death Association (d_{21})	**.231**	**.055**	**.123**	**.339**
Direct Effects on Intentions				
Family History (c')				
No family history vs. Survived	.216	.161	-.102	.533
No family history vs. Died	.068	.164	-.256	.391
Death Association (b_1)	.063	.040	-.016	.141
Breast Health Esteem (b_2)	**.214**	**.048**	**.120**	**.308**
Indirect Effects				
Family history → Death Association → Intentions (a_1b_1)				
No family history vs. Survived	.004	.022	-.035	.058
No family history vs. Died	.059	.045	-.016	.159
Family history → Esteem → Intentions (a_2b_2)				
No family history vs. Survived	.038	.067	-.059	.169
No family history vs. Died	.008	.050	-.088	.114
Family history → Death Association → Esteem → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	.003	.015	-.029	.034
No family history vs. Died	**.047**	**.021**	**.013**	**.094**

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A8. *Study 1 Exploratory PROCESS Model 6 (Death First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 223
Estimates of effects for serial mediation model.

Table 8: PROCESS Model 6	effect	SE	LLCI	ULCI
Direct Effects on Death Association				
Family History (a_1)				
No family history vs. Survived	.063	.288	-.505	.630
No family history vs. Died	**.946**	**.287**	**.381**	**1.512**
Direct Effects on Susceptibility Perceptions				
Family History (a_2)				
No family history vs. Survived	**.682**	**.149**	**.389**	**.976**
No family history vs. Died	**.626**	**.152**	**.326**	**.925**
Death Association (d_{21})	**.125**	**.035**	**.055**	**.194**
Direct Effects on Breast Health Esteem				
Family History (a_3)				
No family history vs. Survived	.103	.242	-.373	.580
No family history vs. Died	-.029	.245	-.511	.453
Death Association (d_{31})	**.217**	**.056**	**.106**	**.328**
Susceptibility Perceptions (d_{32})	.108	.106	-.101	.317
Direct Effects on Breast Health Intentions				
Family History (c')				
No family history vs. Survived	.218	.169	-.115	.552
No family history vs. Died	.070	.171	-.267	.407
Death Association (b_1)	.063	.041	-.017	.143
Susceptibility Perceptions (b_2)	-.004	.074	-.151	.143
Breast Health Esteem (b_3)	**.214**	**.048**	**.120**	**.309**
Indirect Effects				
Family history → Death Association → Intentions (a_1b_1)				
No family history vs. Survived	.004	.022	-.034	.059
No family history vs. Died	.060	.046	-.016	.163
Family history → Susceptibility → Intentions (a_2b_2)				
No family history vs. Survived	-.003	.056	-.110	.120
No family history vs. Died	-.003	.051	-.103	.107
Family history → Esteem → Intentions (a_3b_3)				
No family history vs. Survived	.022	.060	-.084	.154
No family history vs. Died	-.006	.056	-.117	.109
Family history → Death → Susceptibility → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	.000	.003	-.007	.006
No family history vs. Died	-.001	.010	-.022	.021
Family history → Death → Esteem → Intentions ($a_1d_{31}b_3$)				
No family history vs. Survived	.003	.014	-.027	.032
No family history vs. Died	**.044**	**.021**	**.012**	**.092**
Family history → Susceptibility → Esteem → Intentions ($a_2d_{32}b_3$)				
No family history vs. Survived	.016	.018	-.020	.055
No family history vs. Died	.015	.017	-.018	.051
Family history → Death Association → Susceptibility → Esteem → Intentions ($a_1d_{21}d_{32}b_3$)				
No family history vs. Survived	.000	.001	-.002	.003
No family history vs. Died	.003	.003	-.003	.010

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A9. *Study 1 Exploratory PROCESS Model 6 (Susceptibility First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 223
Estimates of effects for serial mediation model.

Table 9: PROCESS Model 6	effect	SE	LLCI	ULCI
Direct Effects on Susceptibility				
Family History (a_1)				
No family history vs. Survived	**.690**	**.153**	**.389**	**.991**
No family history vs. Died	**.743**	**.152**	**.444**	**1.043**
Direct Effects on Death Association				
Family History (a_2)				
No family history vs. Survived	-.243	.294	-.822	.336
No family history vs. Died	**.617**	**.294**	**.036**	**1.197**
Susceptibility (d_{21})	**.443**	**.125**	**.196**	**.690**
Direct Effects on Breast Health Esteem				
Family History (c')				
No family history vs. Survived	.103	.242	-.373	.580
No family history vs. Died	-.029	.245	-.511	.453
Susceptibility (d_{31})	.108	.106	-.101	.317
Death Association (d_{32})	**.217**	**.056**	**.106**	**.328**
Direct Effects on Breast Health Intentions				
Family History				
No family history vs. Survived	.218	.169	-.115	.552
No family history vs. Died	.070	.171	-.267	.407
Susceptibility (b_1)	-.004	.074	-.151	.143
Death Association (b_2)	.063	.041	-.017	.143
Breast Health Esteem (b_3)	**.214**	**.048**	**.120**	**.309**
Indirect Effects				
Family history → Susceptibility → Intentions (a_1b_1)				
No family history vs. Survived	-.003	.055	-.101	.115
No family history vs. Died	-.003	.058	-.113	.121
Family history → Death → Intentions (a_2b_2)				
No family history vs. Survived	-.015	.024	-.067	.030
No family history vs. Died	.040	.035	-.010	.120
Family history → Esteem → Intentions (a_3b_3)				
No family history vs. Survived	.022	.060	-.080	.157
No family history vs. Died	-.006	.053	-.113	.100
Family history → Susceptibility → Death → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	.019	.015	-.006	.053
No family history vs. Died	.021	.016	-.006	.057
Family history → Susceptibility → Esteem → Intentions ($a_1d_{31}b_3$)				
No family history vs. Survived	.016	.019	-.020	.056
No family history vs. Died	.017	.020	-.021	.059
Family history → Death → Esteem → Intentions ($a_2d_{32}b_3$)				
No family history vs. Survived	-.011	.017	-.051	.015
No family history vs. Died	**.029**	**.017**	**.001**	**.068**
Family history → Susceptibility → Death → Esteem → Intentions ($a_1d_{21}d_{32}b_3$)				
No family history vs. Survived	**.014**	**.008**	**.003**	**.035**
No family history vs. Died	**.015**	**.009**	**.003**	**.037**

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.
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Table A10. Study 2 Participant Demographics

Item	*n*	%
Racial/Ethnic Identity		
Asian American/Pacific Islander	8	1.8
Native American/Alaska Native	3	.7
Black/African American	23	5.1
White	393	87.3
Hispanic/Latinx	11	2.4
Multiple/Biracial	11	2.4
Self-Identify	1	.2
Sexual Orientation		
Straight	396	88.0
Gay	1	.2
Lesbian	11	2.4
Bisexual	28	6.2
Asexual	5	1.1
Pansexual	4	.9
Queer	2	.4
Self-Identify	3	.6
Health Insurance		
Yes	408	90.9
No	41	9.1
Choose to not report	1	.2
Education Level		
Some high school	2	.4
High school diploma/GED	115	25.6
Associate's degree	66	14.7
Bachelor's degree	160	35.6
Master's degree	73	16.2
Technical degree	9	2.0
Professional degree	18	4.0
Doctorate	7	1.6

Table A10 (Continued): *Study 2 Participant Demographics*

Item	*n*	%
Family History Status		
No family history	183	40.7
Yes, and those diagnosed with breast cancer survived	140	31.1
Yes, and at least one person diagnosed with breast cancer passed away as a result of the disease	127	28.2
Relationship to Person with Breast Cancer (only presented to those who indicated family history to previous item, *N* = 267, could select all that apply)		
First-degree family member	110	
Second-degree family member	174	
Further removed (e.g., great grandparent)	26	
Time since death of family member (only presented to those who indicated that a family member diagnosed with breast cancer died as a result of the disease, *N* = 127)		
Less than 1 year	5	3.9
1-5 years	21	16.5
5-10 years	26	20.5
10+ years	75	59.1
Genetic Testing for Breast Cancer Risk		
No	404	89.8
Yes, but tested negative	41	9.1
Yes, and tested positive for at least one genetic risk factor	5	1.1

Table A11. *Study 2 Breast Health Esteem Correlations and Descriptive Statistics (N = 450)*

Variables		1	2	3
1.	Taking care of my breast health is an important part of who I am.	-		
2.	Taking care of my breast health affects how good I feel about myself.	.78**	-	
3.	Taking care of my breast health allows me to express my competence.	.72**	.82**	-
Mean		4.67	4.25	3.96
SD		1.77	1.76	1.87

Note: * Indicates $p < .05$, ** indicates $p < .001$

Table A12. *Study 2 Breast Health Intentions: Correlations and Descriptive Statistics (N = 450)*

Variables	1	2	3	4	5	6	7	9	10	11	12	13	14	15
In the future														
1. Eat a healthy diet	–													
2. Exercise for 30 minutes 3 times a week	.60**	–												
3. Go get a mammogram	.15**	.09**	–											
4. Ask for a clinical breast exam during you well-women's checkup	.18**	.13**	.66**	–										
5. Do a breast self-exam	.25**	.14**	.31**	.41**	–									
In the next 3 months														
6. Eat a healthy diet	.89**	.60**	.12**	.14**	.20**									
7. Exercise for 30 minutes 3 times a week	.58**	.94**	.09	.11**	.14**	.63**								
8. Go get a mammogram	.18**	.09	.39**	.36**	.33*	.15**	.10*	–						
9. Ask for a clinical breast exam during your well-women's checkup	.23**	.14**	.36**	.55**	.36**	.21**	.14**	.76**						
10. Do a breast self-exam	.25**	.18**	.26**	.41**	.90**	.21**	.18**	.37**	.42**	-				
In the next week														
11. Eat a healthy diet	.77**	.56**	.09	.15**	.17**	.84**	.57**	.13**	.21**	.20**	-			
12. Exercise for 30 minutes 3 times a week	.51**	.84**	.04	.11*	.13**	.56**	.86**	.08	.13**	.19**	.64**	-		
13. Go get a mammogram	.10*	.02	.10*	.14**	.19**	.09	.02	.38**	.36**	.20**	.09	.05	-	
14. Ask for a clinical breast exam during your well-women's checkup	.11*	.07	.10*	.21**	.16**	.11*	.07	.32**	.41**	.16**	.15**	.10*	.76**	-
15. Do a breast self-exam	.14**	.11*	.22**	.30**	.63**	.11*	.13**	.35**	.42**	.69**	.12**	.15**	.36**	.33**
Mean	5.45	5.23	5.78	5.19	5.33	5.53	5.24	3.91	3.70	5.10	5.20	4.70	1.65	1.72
SD	1.29	1.68	1.79	1.98	1.80	1.36	1.75	2.44	2.27	2.04	1.76	2.11	1.42	1.48

Note: * Indicates $p < .05$, ** indicates $p < .001$

Table A13. *Study 2 Hypothesis PROCESS Model 7*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 447
Estimates of effects for serial mediation model.

Model 7:	effect	SE	LLCI	ULCI
Direct Effects on Breast Health Esteem				
MS Condition	-.140	.234	-.600	.320
Family History				
No family history vs. Survived	.082	.263	-.436	.599
No family history vs. Died	.252	.246	-.232	.736
MS x Survived Interaction	.017	.357	-.684	.719
MS x Died Interaction	-.308	.366	-1.026	.411
Direct Effects on Breast Health Intentions				
MS Condition	.071	.852	-.093	.235
Esteem	**.287**	**.027**	**.234**	**.340**
Conditional Indirect Effects				
MS → Esteem → Intentions				
No family history	-.040	.071	-.185	.095
No family history: Survived	-.035	.073	-.179	.110
Family history: Died	-.128	.082	-.289	.030
Index of Moderated Mediation				
MS → Esteem → Intentions				
No family history vs. Survived	.005	.102	-.193	.208
No family history vs. Died	-.088	.109	-.294	.142

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A14. *Study 2 PROCESS Model 83 (Death First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 447
Estimates of effects for serial mediation model.

Model 83:	effect	SE	LLCI	ULCI
Direct Effects on Death Association				
MS Condition	-152	.270	-.379	.682
Family History				
No family history vs. Survived	.433	.304	-.165	1.030
No family history vs. Died	**1.010**	**.284**	**.452**	**1.568**
MS x Survived Interaction	-.546	.412	-1.355	.263
MS x Died Interaction	-.340	.422	-1.169	.488
Direct Effects on Susceptibility				
MS Condition	.037	.088	-.135	.210
Death Association	**.187**	**.024**	**.140**	**.235**
Direct Effects on Breast Health Esteem				
MS Condition	-.190	.145	-.475	.094
Death Association	**.181**	**.042**	**.098**	**.264**
Susceptibility	.059	.079	-.095	.214
Direct Effects on Breast Health Intentions				
MS Condition	.077	.083	-.087	.240
Death Association	.278	.025	-.021	.076
Susceptibility	**-.110**	**.045**	**-.199**	**-.021**
Esteem	**.287**	**.027**	**.234**	**.341**
Conditional Indirect Effects				
MS → Death Association → Intentions				
No family history	.004	.010	-.017	.027
Family history: Survived	-.011	.016	-.052	.013
Family history: Died	-.005	.013	-.037	.017
Index of Moderated Mediation				
MS → Death Association → Intentions				
No family history vs. Survived	-.015	.020	-.063	.021
No family history vs. Died	-.009	.017	-.050	.023
Conditional Indirect Effects				
MS → Susceptibility → Intentions	-.004	.010	-.026	.016
MS → Esteem → Intentions	-.055	.042	-.140	.027
Conditional Serial Indirect Effect				
MS → Death Association → Susceptibility → Intentions				
No family history	-.003	.006	-.017	.009
Family history: Survived	.008	.008	-.004	.028
Family history: Died	.004	.007	-.009	.021
Index of Moderated Mediation				
MS → Death Association → Susceptibility → Intentions				
No family history vs. Survived	.011	.011	-.006	.037
No family history vs. Died	.007	.010	-.010	.030
Conditional Serial Indirect Effects				
MS → Death Association → Esteem → Intentions				
No family history	.008	.015	-.020	.041
Family history: Survived	-.021	.018	-.062	.011
Family history: Died	-.010	.018	-.050	.021
Index of Moderated Mediation				
MS → Death Association → Esteem → Intentions				
No family history vs. Survived	-.028	.025	-.083	.015
No family history vs. Died	-.018	.024	-.073	.022
Serial Indirect Effect				
MS → Susceptibility → Esteem → Intentions	.000	.003	-.004	.007
Conditional Serial Indirect Effect				
MS → Death Association → Susceptibility → Esteem → Intentions				
No family history	.001	.002	-.003	.004
Family history: Survived	-.001	.003	-.008	.003

Table A14 (Continued). *Study 2 PROCESS Model 83 (Death First)*

	effect	SE	LLCI	ULCI
Family history: Died	-.001	.002	-.005	.003
Index of Moderated Mediation				
MS → Death Association → Susceptibility → Esteem → Intentions				
No family history vs. Survived	-.002	.003	-.010	.004
No family history vs. Died	-.001	.003	-.007	.004

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A15. *Study 2 PROCESS Model 83 (Susceptibility First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 447
Estimates of effects for serial mediation model.

Model 83:	effect	SE	LLCI	ULCI
Direct Effects on Susceptibility Perception				
MS Condition	.148	.129	-.125	.420
Family History				
No family history vs. Survived	**.722**	**.156**	**.416**	**1.029**
No family history vs. Died	**.845**	**.146**	**.558**	**1.131**
MS x Survived Interaction	-.304	.211	-.719	.111
MS x Died Interaction	-.130	.217	-.556	.295
Direct Effects on Death Association				
MS Condition	-.172	.164	-.493	.149
Susceptibility Perception	**.652**	**.083**	**.488**	**.815**
Direct Effects on Breast Health Esteem				
MS Condition	-.190	.145	-.475	.094
Susceptibility Perception	.059	.079	-.095	.214
Death Association	**.181**	**.042**	**.098**	**.264**
Direct Effects on Breast Health Intentions				
MS Condition	.077	.083	-.087	.240
Susceptibility Perception	**-.110**	**.045**	**-.199**	**-.021**
Death Association	.028	.025	-.210	.076
Esteem	**.287**	**.027**	**.234**	**.341**
Conditional Indirect Effects				
MS → Susceptibility → Intentions				
No family history	-.016	.017	-.054	.013
Family history: Survived	.017	.020	-.018	.065
Family history: Died	-.002	.020	-.045	.037
Index of Moderated Mediation				
MS → Susceptibility → Intentions				
No family history vs. Survived	.034	.028	-.010	.098
No family history vs. Died	.014	.026	-.038	.068
Conditional Indirect Effects				
MS → Death Association → Intentions	-.005	.008	-.025	.006
MS → Esteem → Intentions	-.055	.043	-.141	.029
Conditional Serial Indirect Effect				
MS → Susceptibility → Death Association → Intentions				
No family history	.003	.004	-.004	.013
Family history: Survived	-.003	.005	-.015	.004
Family history: Died	.000	.004	-.008	.010
Index of Moderated Mediation				
MS → Susceptibility → Death Association → Intentions				
No family history vs. Survived	-.006	.007	-.024	.006
No family history vs. Died	-.002	.006	-.015	.010
Conditional Serial Indirect Effects				
MS → Susceptibility → Esteem → Intentions				
No family history	.003	.005	-.006	.015
Family history: Survived	-.003	.006	-.016	.007
Family history: Died	.000	.005	-.010	.011
Index of Moderated Mediation				
MS → Susceptibility → Esteem → Intentions				
No family history vs. Survived	-.005	.009	-.028	.010
No family history vs. Died	-.002	.007	-.019	.101
Serial Indirect Effect				
MS → Death Association → Esteem → Intentions	-.009	.009	-.029	.008
Conditional Serial Indirect Effect				
MS → Susceptibility → Death Association → Esteem → Intentions				
No family history	.005	.005	-.004	.016

Table A15 (Continued). *Study 2 PROCESS Model 83 (Susceptibility First)*

	effect	SE	LLCI	ULCI
Family history: Survived	-.005	.006	-.020	.005
Family history: Died	.001	.006	-.012	.012
Index of Moderated Mediation				
MS → Death Association → Susceptibility → Esteem → Intentions				
No family history vs. Survived	-.010	.008	-.029	.003
No family history vs. Died	-.004	.008	-.022	.011

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A16. *Study 2 Replication, PROCESS Model 6 (Death First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 447
Estimates of effects for serial mediation model.

Model 6:	effect	SE	LLCI	ULCI
Direct Effects on Death Association				
Family History (a_1)				
No family history vs. Survived	.128	.204	-.272	.529
No family history vs. Died	**.854**	**.210**	**.442**	**1.266**
Direct Effects on Susceptibility Perceptions				
Family History (a_2)				
No family history vs. Survived	**.537**	**.099**	**.341**	**.732**
No family history vs. Died	**.640**	**.104**	**.435**	**.844**
Death Association (d_{21})	**.164**	**.023**	**.118**	**.209**
Direct Effects on Breast Health Esteem				
Family History (a_3)				
No family history vs. Survived	.022	.178	-.328	.373
No family history vs. Died	-.079	.189	-.450	.292
Death Association (d_{31})	.187	.043	.103	.270
Susceptibility Perceptions (d_{32})	.063	.083	-.100	.226
Direct Effects on Breast Health Intentions				
Family History (c')				
No family history vs. Survived	.061	.102	-.140	.261
No family history vs. Died	-.115	.108	-.327	.097
Death Association (b_1)	.032	.025	-.017	.081
Susceptibility Perceptions (b_2)	**-.103**	**.048**	**-.196**	**-.010**
Breast Health Esteem (b_3)	**.285**	**.027**	**.231**	**.338**
Indirect Effects				
Family history → Death Association → Intentions (a_1b_1)				
No family history vs. Survived	.004	.009	-.011	.025
No family history vs. Died	.028	.024	-.017	.078
Family history → Susceptibility → Intentions (a_2b_2)				
No family history vs. Survived	-.055	.028	-.115	-.003
No family history vs. Died	**-.066**	**.033**	**-.133**	**-.004**
Family history → Esteem → Intentions (a_3b_3)				
No family history vs. Survived	.006	.050	-.091	.104
No family history vs. Died	-.023	.056	-.131	.092
Family history → Death → Susceptibility → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	-.002	.004	-.011	.005
No family history vs. Died	**-.014**	**.008**	**-.031**	**-.001**
Family history → Death → Esteem → Intentions ($a_1d_{31}b_3$)				
No family history vs. Survived	.007	.012	-.015	.032
No family history vs. Died	**.045**	**.017**	**.017**	**.086**
Family history → Susceptibility → Esteem → Intentions ($a_2d_{32}b_3$)				
No family history vs. Survived	.010	.013	-.015	.036
No family history vs. Died	.012	.015	-.018	.044
Family history → Death Association → Susceptibility → Esteem → Intentions ($a_1d_{21}d_{32}b_3$)				
No family history vs. Survived	.000	.001	-.002	.003
No family history vs. Died	.003	.003	-.004	.010

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

Table A17. *Study 2 Replication, PROCESS Model 6 (Susceptibility First)*

Controlling for age, race, insurance status, SES, and past BSE behaviors, N = 447
Estimates of effects for serial mediation model.

Model 6:	effect	SE	LLCI	ULCI
Direct Effects on Susceptibility				
Family History (a_1)				
No family history vs. Survived	**.558**	**.105**	**.352**	**.763**
No family history vs. Died	**.779**	**.108**	**.568**	**.991**
Direct Effects on Death Association				
Family History (a_2)				
No family history vs. Survived	-.218	.200	-.610	.174
No family history vs. Died	.370	.211	-.044	.784
Susceptibility (d_{21})	**.621**	**.088**	**.448**	**.795**
Direct Effects on Breast Health Esteem				
Family History (c')				
No family history vs. Survived	.022	.178	-.328	.373
No family history vs. Died	-.079	.189	-.450	.292
Susceptibility (d_{31})	.063	.083	-.100	.226
Death Association (d_{32})	**.187**	**.043**	**.103**	**.270**
Direct Effects on Breast Health Intentions				
Family History				
No family history vs. Survived	.061	.102	-.140	.261
No family history vs. Died	-.115	.108	-.327	.097
Susceptibility (b_1)	**-.103**	**.048**	**-.196**	**-.010**
Death Association (b_2)	.032	.025	-.017	.081
Breast Health Esteem (b_3)	**.285**	**.027**	**.231**	**.338**
Indirect Effects				
Family history → Susceptibility → Intentions (a_1b_1)				
No family history vs. Survived	-.057	.029	-.118	-.005
No family history vs. Died	**-.080**	**.040**	**-.162**	**-.007**
Family history → Death → Intentions (a_2b_2)				
No family history vs. Survived	-.007	.010	-.032	.009
No family history vs. Died	.012	.013	-.008	.043
Family history → Esteem → Intentions (a_3b_3)				
No family history vs. Survived	.006	.049	-.090	.102
No family history vs. Died	-.023	.057	-.134	.091
Family history → Susceptibility → Death → Intentions ($a_1d_{21}b_2$)				
No family history vs. Survived	.011	.009	-.007	.030
No family history vs. Died	.016	.013	-.010	.042
Family history → Susceptibility → Esteem → Intentions ($a_1d_{31}b_3$)				
No family history vs. Survived	.010	.014	-.015	.038
No family history vs. Died	.014	.019	-.022	.053
Family history → Death → Esteem → Intentions ($a_2d_{32}b_3$)				
No family history vs. Survived	-.012	.012	-.036	.011
No family history vs. Died	.020	.013	-.003	.050
Family history → Susceptibility → Death → Esteem → Intentions ($a_1d_{21}d_{32}b_3$)				
No family history vs. Survived	**.018**	**.007**	**.008**	**.034**
No family history vs. Died	**.026**	**.009**	**.011**	**.047**

Note: 95% confidence intervals (CI) that do not include zero are considered statistically significant and denoted in **bold**. For comparisons of family history, no family history is coded as 1, family history: survived is coded as 2, and family history: died is coded as 3. The no family history group is treated as the reference category in this analysis, so the other groups are compared to that reference category.

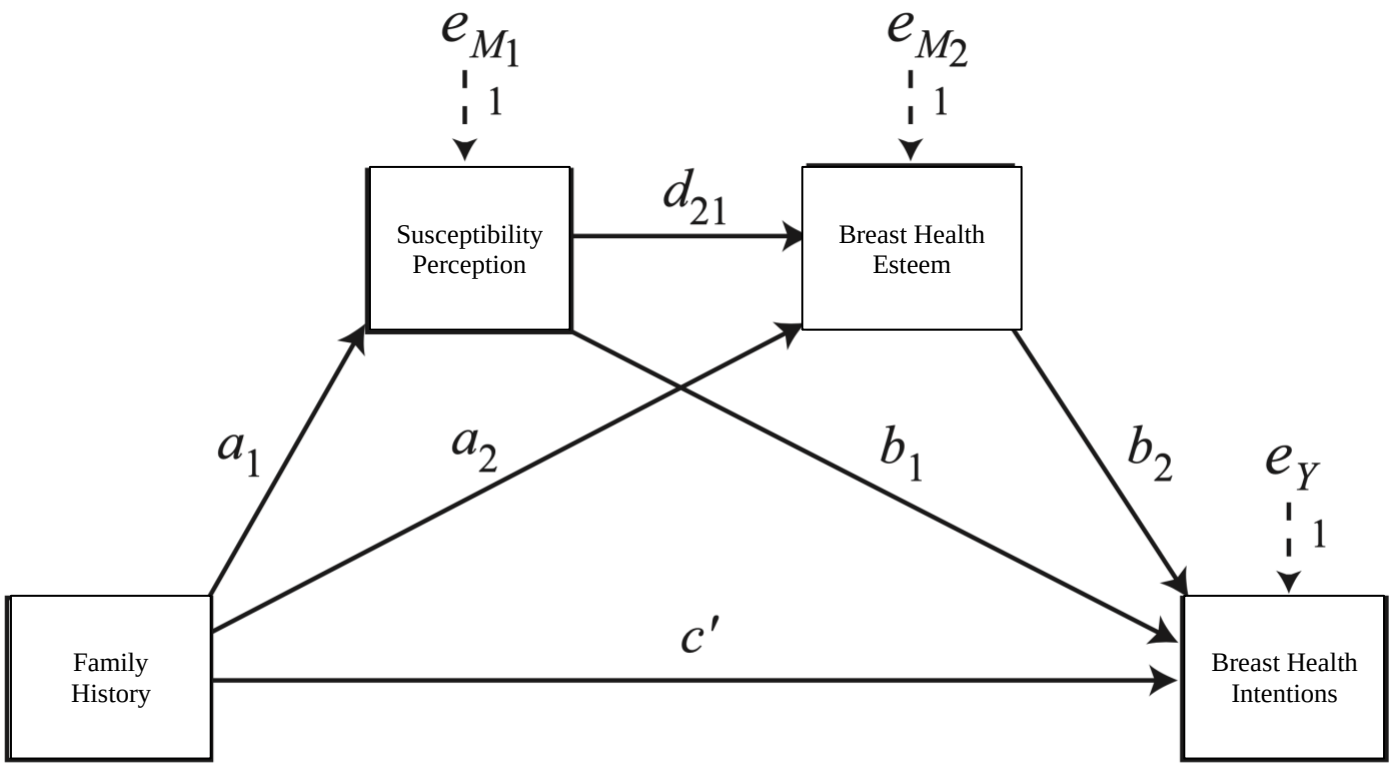

Figure A1. *Hypothesis 3, PROCESS Model 6*

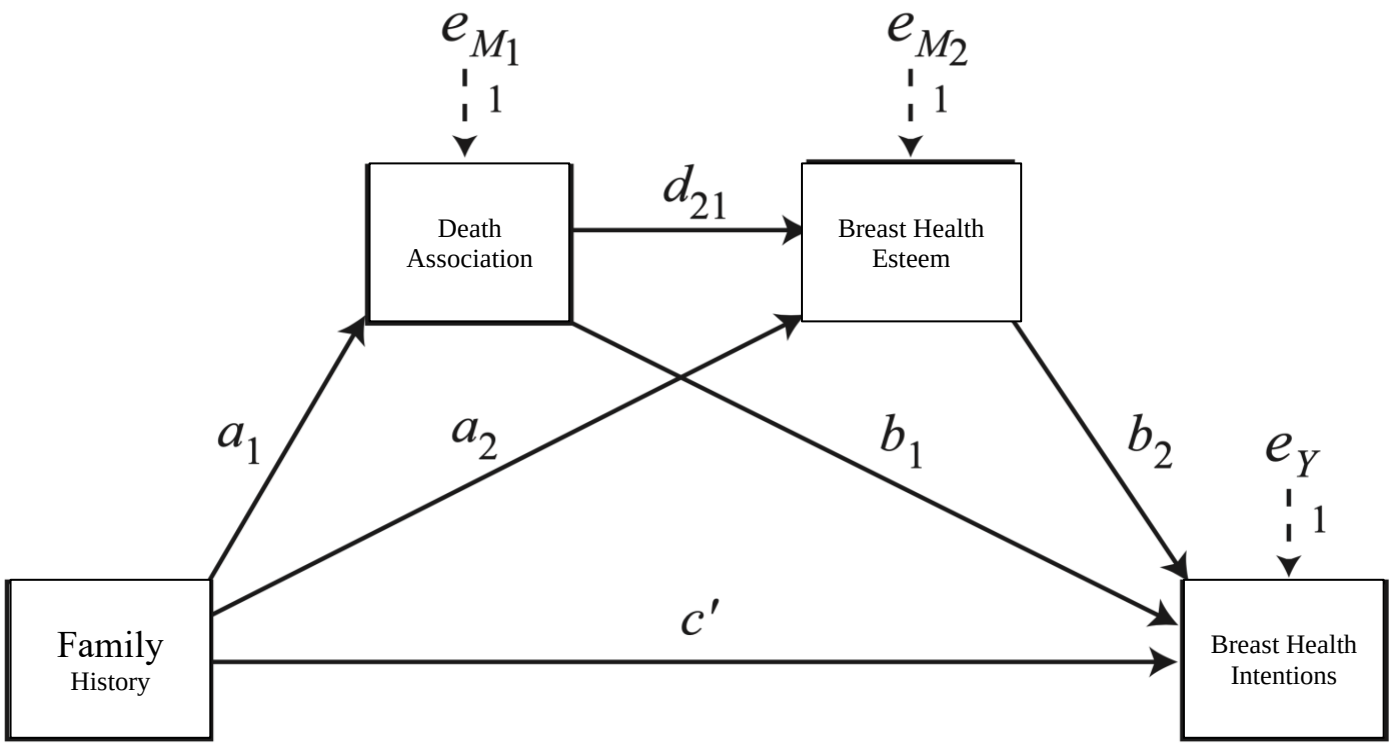

Figure A2. *Study 1 Exploratory PROCESS Model 6 (Death Association)*

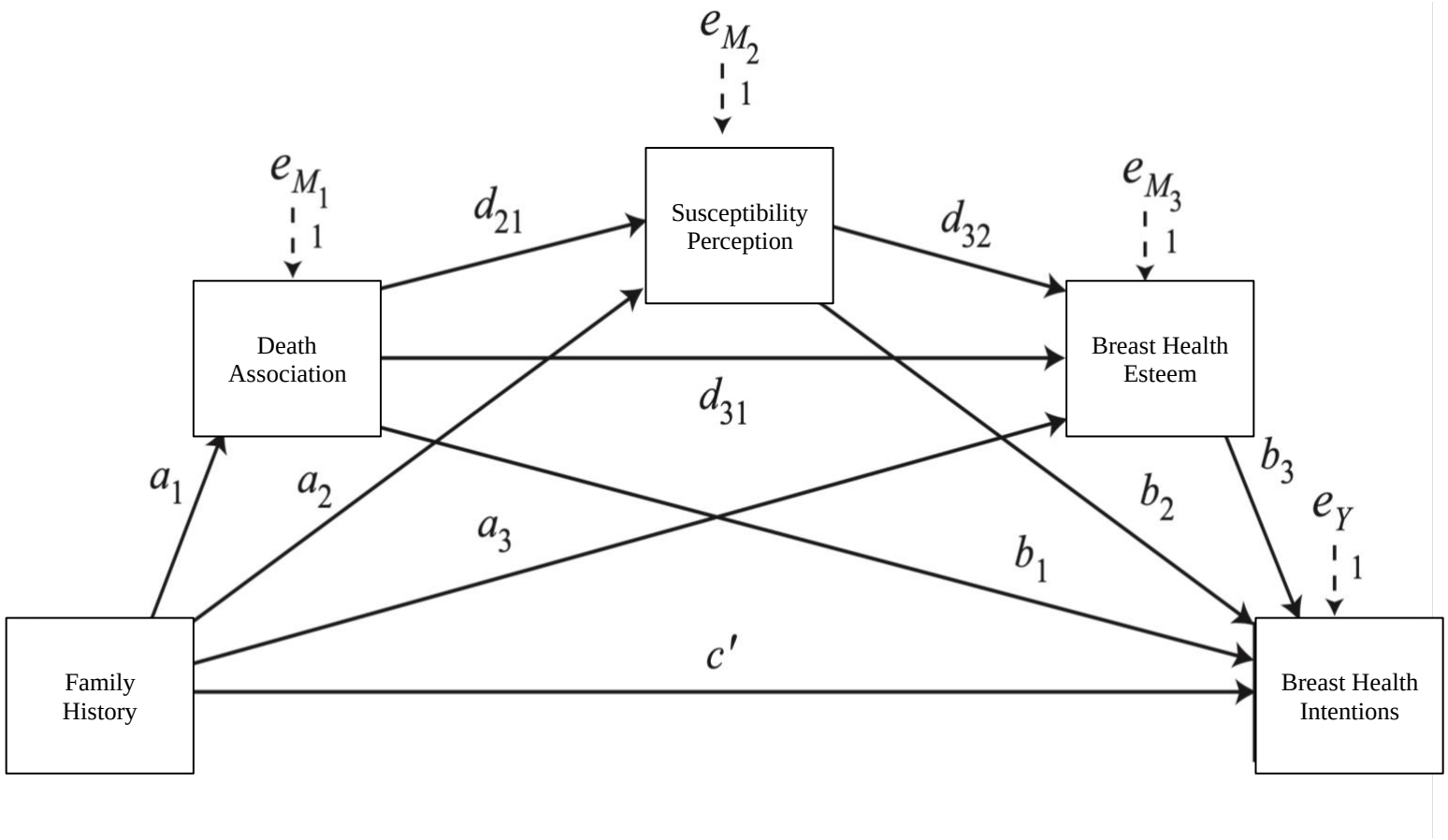

Figure A3. *Exploratory PROCESS Model 6 (Death First)*

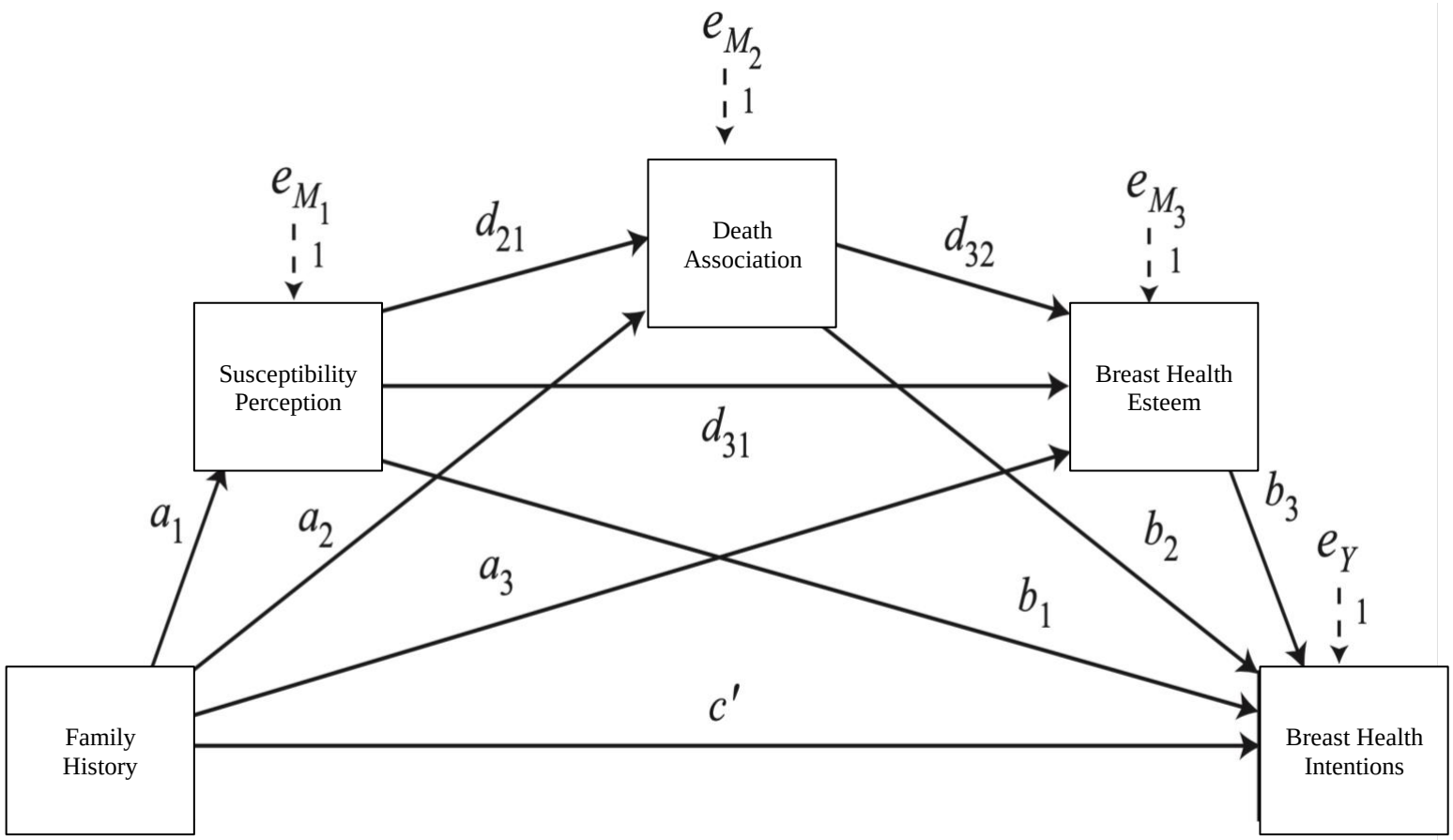

Figure A4. *Exploratory PROCESS Model 6 (Susceptibility First)*

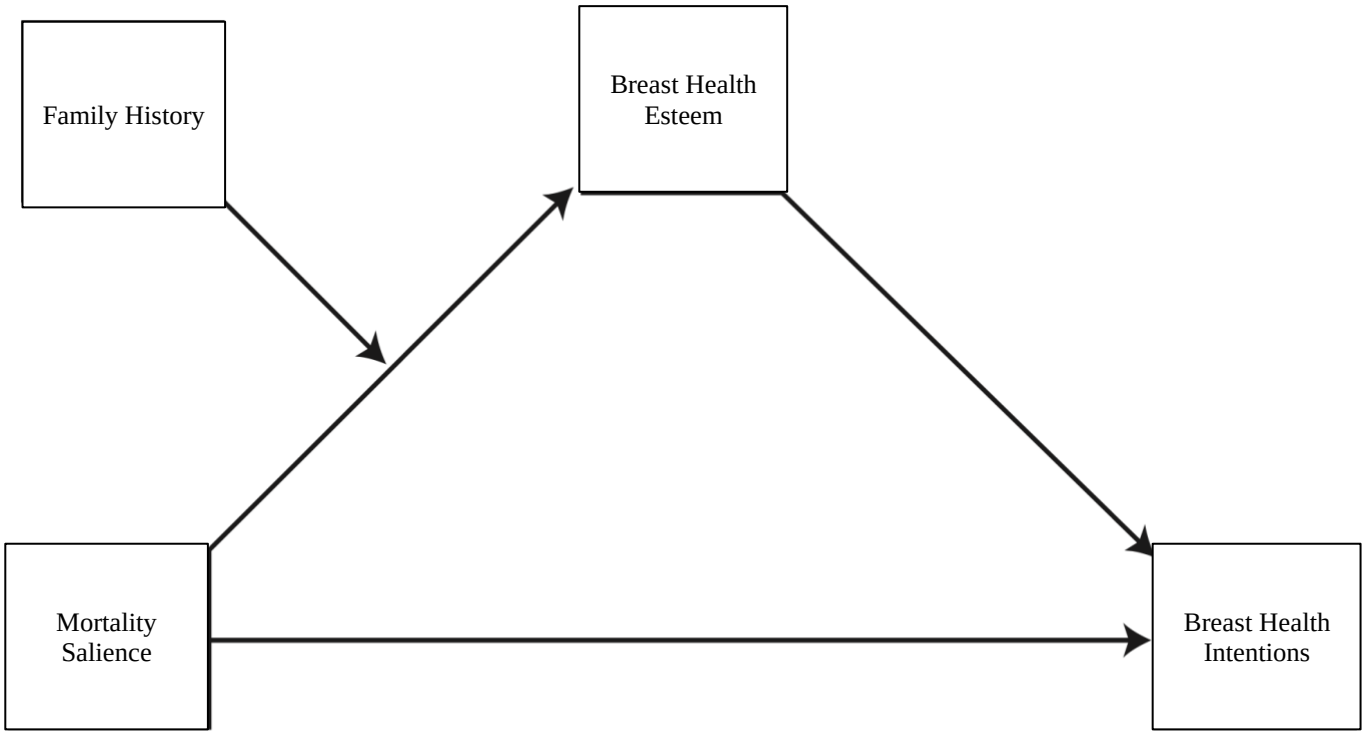

Figure A5. *Study 2 Hypothesis PROCESS Model 7*

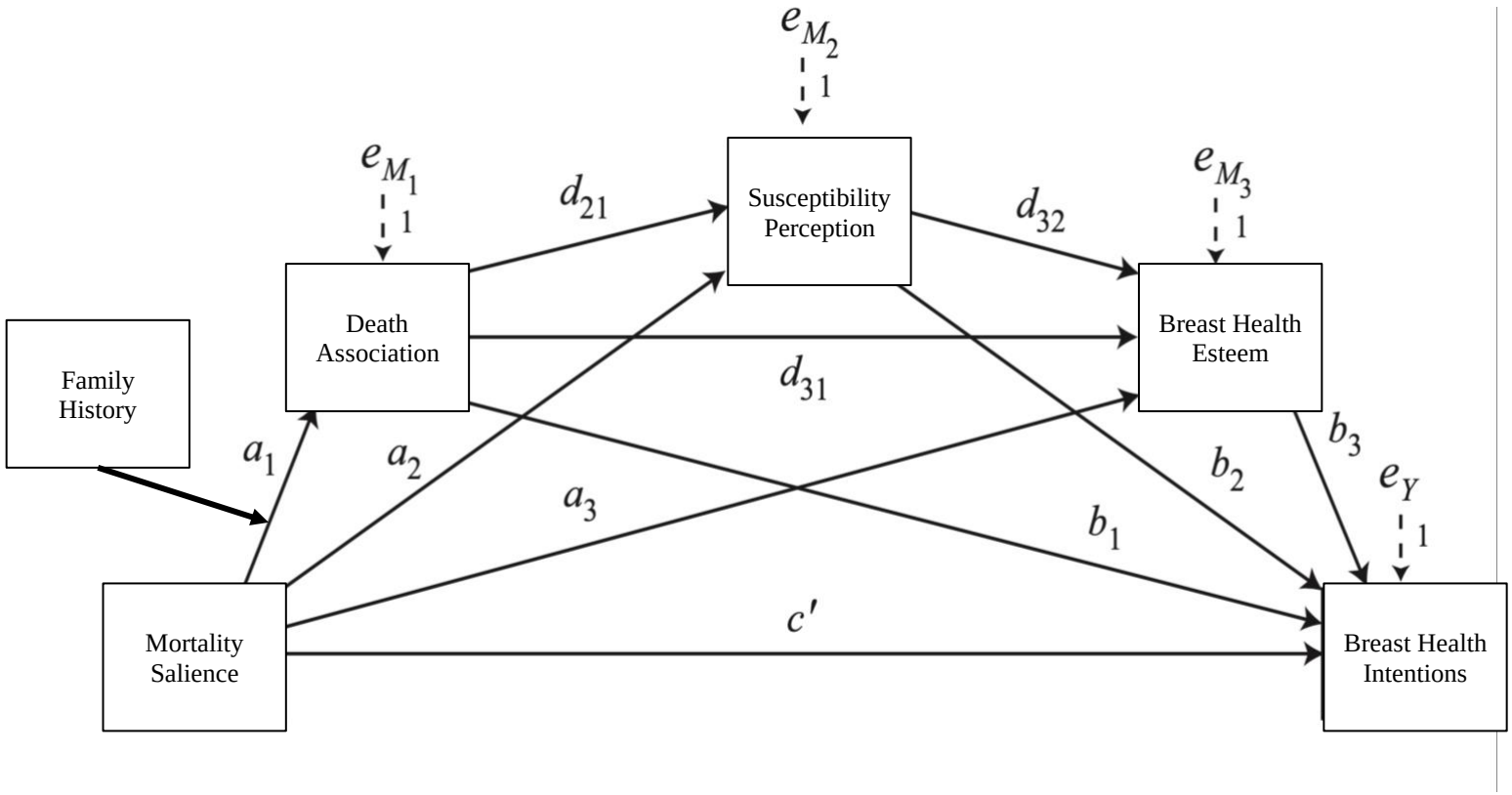

Figure A6. *Study 2 PROCESS Model 83 (Death First)*

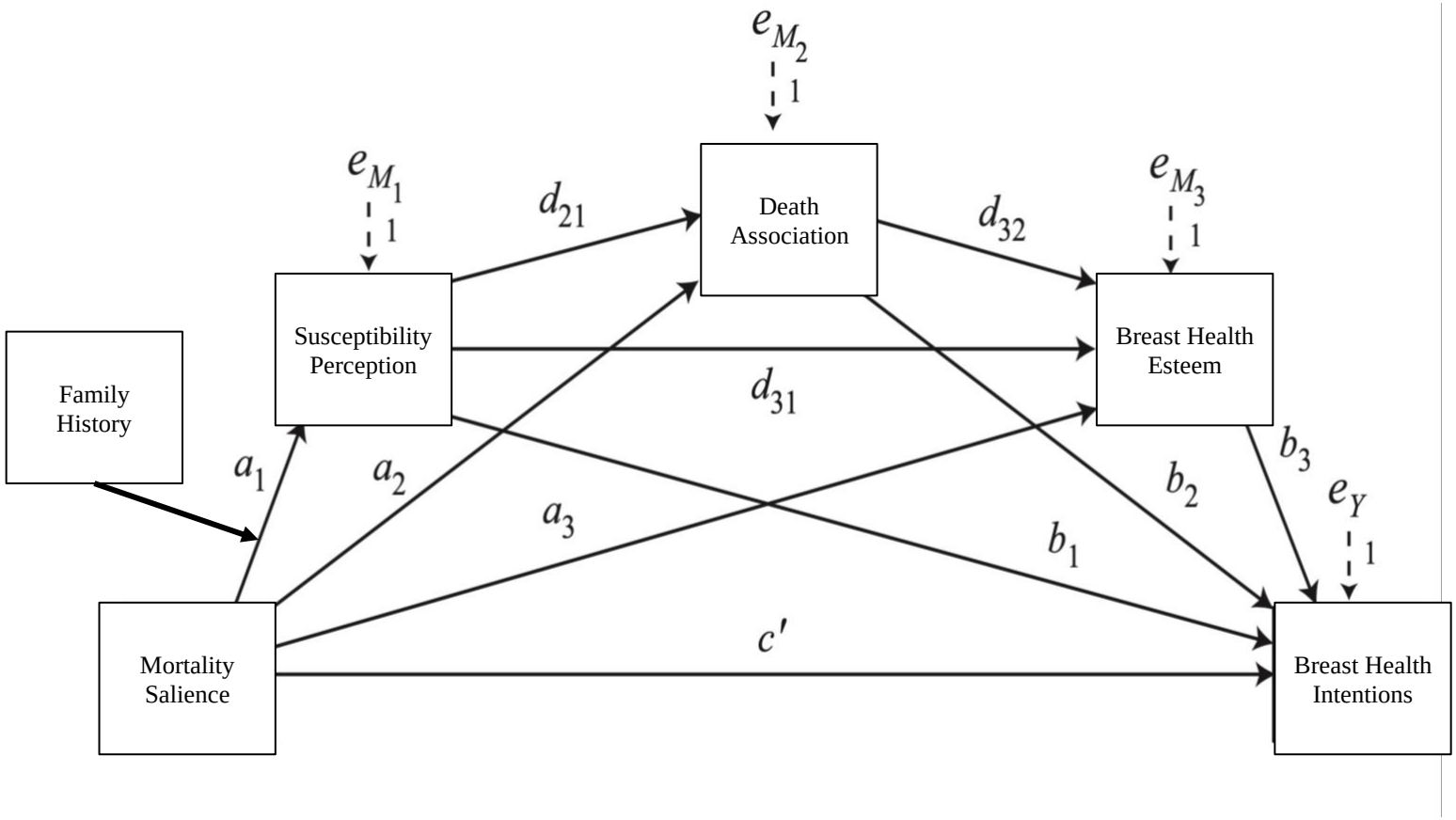

Figure A7. *Study 2 PROCESS Model 83 (Susceptibility First)*

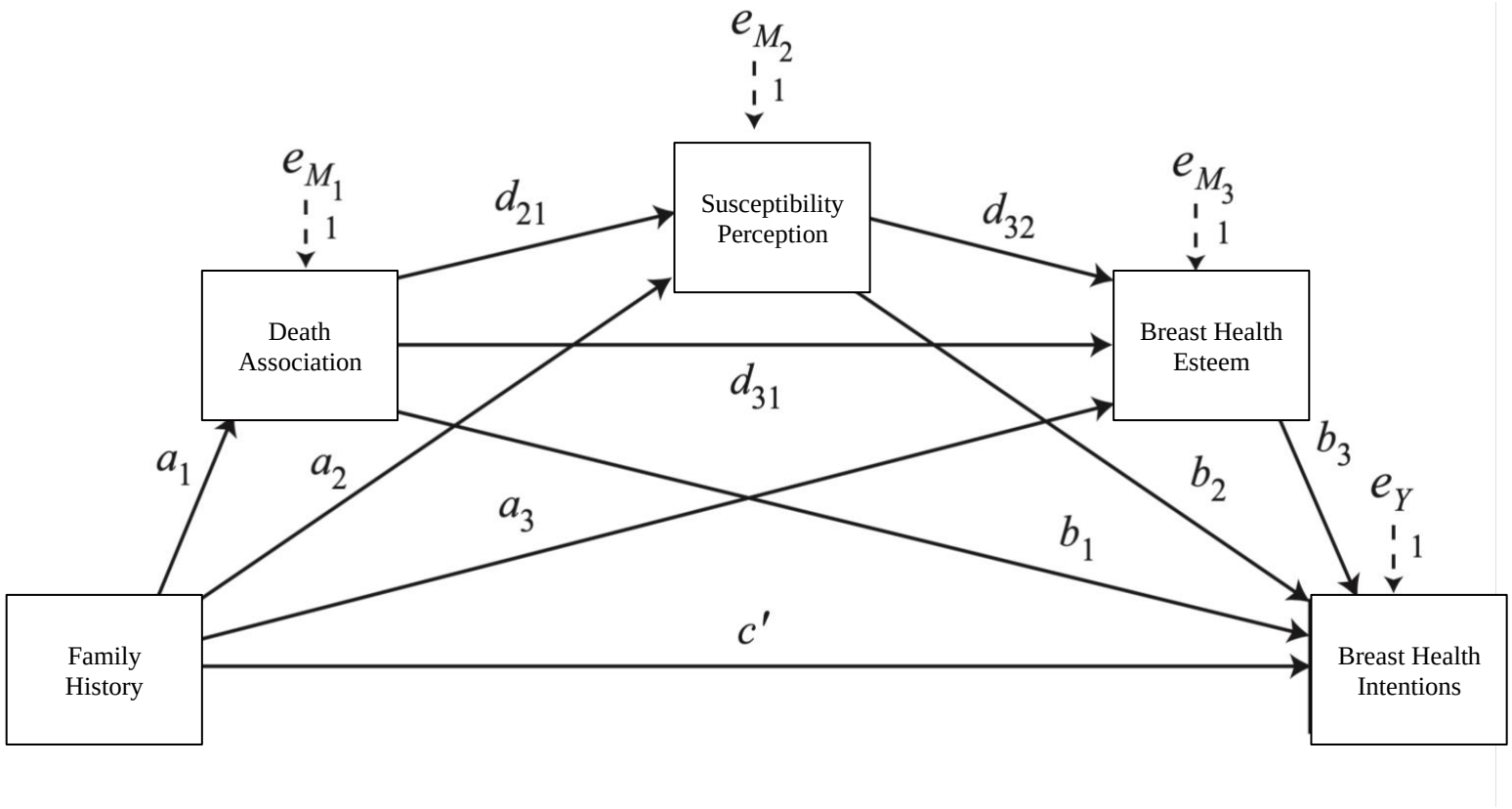

Figure A8. *Study 2 Replication, PROCESS Model 6 (Death First)*

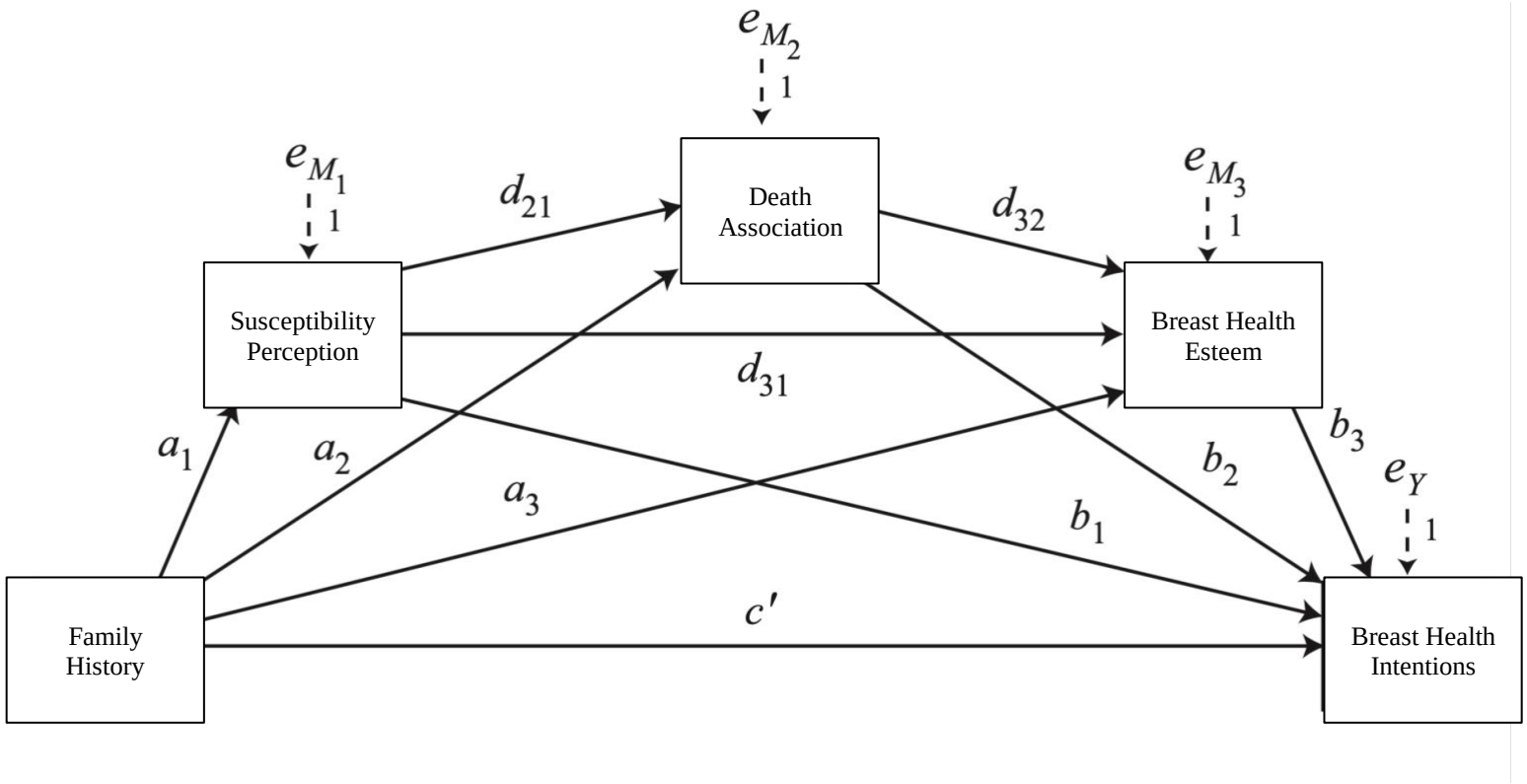

Figure A9. *Study 2 Replication, PROCESS Model 6 (Susceptibility First)*