GRIEF SEVERITY AND HEALTH BEHAVIORS FOLLOWING BEREAVEMENT: EXPLORING THE MODERATING ROLE OF EMOTION REGULATION PROCESSES

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GRIEF SEVERITY AND HEALTH BEHAVIORS FOLLOWING BEREAVEMENT: EXPLORING THE MODERATING ROLE OF EMOTION REGULATION PROCESSES

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ABSTRACT

The extant literature investigating associations between grief symptom severity and engagement in health behaviors is limited. Furthermore, research examining health outcomes in bereaved populations has yielded mixed findings. Contemporary theoretical conceptualizations of pathological grief suggest emotion regulatory processes (i.e., experiential avoidance and rumination) play key roles in the development and maintenance of Prolonged Grief Disorder (PGD). Within the broader health behavior literature, these emotion regulatory processes have also been demonstrated as significant factors affecting engagement in the "Big 4" modifiable health behaviors (i.e., tobacco use, excessive alcohol use, lack of physical activity, and poor nutrition). The present study aims to 1) examine the relationships between grief severity and the "Big 4" modifiable health behavior indicators, 2) examine the relationships between emotion regulation variables (i.e., experiential avoidance and rumination) and each of the "Big 4" modifiable health behavior indicators in a bereaved sample, and 3) examine the moderating effects of emotion regulation variables in the relationships between grief severity and each of the "Big 4" modifiable health behavior indicators.

Participants were 425 adults who were recruited online, located in the United States, and endorsed the bereavement of a family member or close friend within the last five years. They were administered a battery of measures examining bereavement and grief experiences and health behaviors via online survey. On average, participants were 36.82 (*SD* = 10.01) years old, and identified as White (*n* = 339, 79.8%) and male (*n* = 215, 50.6%). Results indicate all but one (i.e., tobacco use) of the "Big 4" modifiable health behavior indicators were significantly associated with grief symptom severity. Tobacco use and eating behavior were not significantly associated with either emotion regulation processes, individually. The remaining "Big 4" modifiable health behavior indicators were significantly associated with both emotion regulation processes. In models examining the moderating roles of the emotion regulation variables in the relationship between grief symptom severity and health behaviors for each post-death modifiable health behavior, significant moderation effects were only evidenced in three of the models (i.e., sedentary behavior, physical activity, and eating behavior). These findings suggest further attention is warranted in developing primary and secondary interventions aimed at improving long-term mental and physical health outcomes via strengthening emotion regulation skills in bereaved or soon-to-be bereaved individuals.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Education, Social Work, and Psychological Sciences have examined a dissertation titled "Grief Severity and Health Behaviors Following Bereavement: Exploring the Moderating Role of Emotion Regulation Processes," presented by Madeleine M. Hardt, candidate for the Doctor of Philosophy Degree, and certify that in their opinion it is worthy of acceptance.

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DEDICATION

This work is dedicated to my brother, Noah Hardt, who told me to be who I am, keep asking questions, and remain open to learning. He taught me the value of silliness and how to stay grounded in times of uncertainty. His spark was and will always be a motivating force in my life.

CHAPTER 1

OVERVIEW

In the United States (U.S.), recent estimates suggest that nearly five million children have or will have experienced the death of an immediate family member by the age of 18. By the age of 25, this estimate more than doubles to 12.9 million (Burns et al., 2020). As aging continues, so do rates of bereavement exposure. Although bereavement is often an inevitable occurrence in one's life, grief experiences vary both between individuals and even within the same individual depending on the death. Often, bereaved individuals' grief reactions do not persist or develop into pathological levels of grief, and they are able to maintain functioning in their daily lives (Bonanno et al., 2002; Shear et al., 2013). However, some people may experience persistent, intense grief reactions that do not resolve or become manageable over time, and may begin to meet criteria for Prolonged Grief Disorder (PGD).

Contemporary theoretical conceptualizations of PGD have increasingly focused on the roles of emotion regulatory processes (i.e., experiential avoidance and rumination) in the development and persistence of PGD (see Eisma & Stroebe, 2021). A growing body of literature demonstrates the impact of bereavement on mental health as well as physical health. However, the research on physical health outcomes (e.g., mortality, rates of disability and illness, health-related quality of life) following bereavement demonstrates inconsistent findings. Similarly, the literature investigating bereaved individuals' engagement in various modifiable health behaviors also yields mixed findings. Furthermore, the literature on both physical health outcomes and health behavior engagement seldomly examines differences across grief presentation (e.g., grief severity, PGD vs. no PGD).

Similar to the PGD literature, the research in broader health behavior engagement suggests emotion regulatory processes may play a key role (e.g., Adam & Epel, 2007; DeSteno et al., 2013; de Ridder et al., 2017; Ferrer et al., 2015; Kuntsche et al., 2017). Indeed, research suggests that individuals may engage in health risk behaviors, such as smoking, drinking, and dysfunctional eating, in efforts to cope with negative internal experiences (i.e., experiential avoidance; e.g., Hildebrandt & Hayes, 2013, Stewart et al., 2002). Additionally, it is argued that rumination affects physical health via interferences with health promoting behavior (e.g., Thomsen et al., 2004) and through increased engagement in health risk behaviors (e.g., Clancy et al., 2016). Since emotion regulatory processes serve a key function in both the health behavior and PGD literature, directing attention toward the role of these mechanisms in the relationship between grief severity and health risk behaviors amongst bereaved individuals may provide additional insight regarding the state of the current bereavement literature.

This study aimed to further understand the relationships between grief severity, emotion regulation processes, and engagement in health behaviors in bereaved individuals. More specifically, this study focused on the "Big 4" modifiable health behaviors identified by the Centers for Disease Control and Prevention (CDC) as major risk factors for the development of chronic disease (i.e., tobacco/nicotine use, excessive alcohol use, lack of physical activity, and poor nutrition). It was hypothesized that grief severity and emotion regulation variables (i.e., higher experiential avoidance and rumination) would be positively associated with post-death tobacco/nicotine use, alcohol use, and sedentary behavior level; and negatively associated with post-death physical activity levels, eating behaviors, and diet quality in bereaved individuals. It was also hypothesized that emotion regulation variables

would significantly moderate the relationships between grief symptom severity and the modifiable health behavior indicators. That is, when experiential avoidance and rumination are high, the aforementioned associations between grief symptom severity and the modifiable health behaviors would strengthen.

CHAPTER 2

REVIEW OF THE LITERATURE

Bereavement, Grief Symptoms, and Prevalence

Bereavement refers to the objective situation an individual faces following the death of an important person (e.g., family member, close friend). Bereaved individuals often experience grief, which primarily includes the emotional/affective process of reacting to the death of a loved one (Stroebe et al., 2008). It is common for grief to present in a variety of ways and with different symptoms. Indeed, grief presentations can vary in intensity and length, and differ across cultural groups and from person to person. Grief symptoms can include but are not limited to emotional pangs triggered by reminders of the loss, loneliness, difficulty concentrating, loss of interest or pleasure related to missing the deceased, preoccupation with the deceased, avoidance of reminders of the death, guilt and self-blame, intrusive death-related imagery, and yearning and longing for the deceased (Zisook & Shear, 2009). Although variance exists in presentation and manifestation of grief, many individuals' acute grief symptoms largely diminish in intensity or resolve by 18 months post-death (Bonanno et al., 2002). Many individuals are able to engage in the process of grieving in a way that leads to the acceptance of their loss, the integration of the death into their autobiographical narrative, and the ability to imagine the possibility of satisfaction and joy in their future (Shear et al., 2013).

In 2019, data from the CDC estimated that 2,854,838 Americans died (Kochanek et al., 2020). Provisional data for 2020 approximate 3,358,814 deaths occurred in the U.S. in the past year; COVID-19 is believed to have caused or contributed to approximately 11.3% of these deaths (Ahmed et al., 2021).

Prevalence rates for bereavement are not tracked in the U.S. However, past literature examining the number of individuals impacted by a single death may be able to assist in bereavement prevalence estimates. Research examining the number of individuals impacted by one incidence of suicide found that on average 15 to 30 people are severely affected (e.g., immediate and extended family members and friends) by every person lost to suicide (Cerel et al., 2018). One study focusing on the reach of COVID-19 kin loss in the U.S. estimated that on average approximately nine individuals will grieve the loss of a close relative (i.e., grandparent, parent, sibling, spouse, or child) for each COVID-19 death (Verdery et al., 2020). If applying these rates to each death estimated in 2020, approximately 30,229,326 to 100,764,420 people were affected by the death of a close loved one in the past year. Furthermore, these rough estimates are likely conservative as they do not include individuals residing in the U.S. who have experienced the death of a loved one from a different country. In regard to grief severity in COVID-19-related deaths, one study has found COVID-19 bereavement showing higher grief levels than natural bereavement but not unnatural bereavement, and that death expectedness explained the variation in grief between COVID-19 and natural bereavement (Eisma et al., 2021). Although the frequency and intensity of grief symptoms will diminish over time for many bereaved individuals, some may be susceptible to developing pathological levels of grief.

Pathological Grief and Risk Factors

Several major medical associations, both nationally and internationally, now recognize pathological grief as a unique health condition, although debate still exists regarding whether grief experiences should be pathologized. Arguments against the pathologizing of grief include: potential for misdiagnosis, overdiagnosis, and the

medicalization of grief (Kleinman, 2012; Thieleman & Cacciatore, 2013). These arguments were posited, despite the extant literature during the time demonstrating differences between normative grief and pathological grief regarding symptoms, etiology, outcomes, course, and response to treatment (Prigerson et al., 2009; Shear et al., 2011). Although symptoms of pathological grief can be similar to normative grief symptoms, pathological grief symptoms are more persistent in duration and intensity (Shear et al., 2011). Furthermore, individuals with pathological levels of grief demonstrate clinically significant distress or impairment in social, occupational, and/or other important areas of functioning that are not otherwise explained as culturally appropriate grief experiences (Prigerson et al., 2009; Shear et al., 2011).

Due to historical variance in diagnostic criteria for pathological grief, or Prolonged Grief Disorder (PGD), prevalence rates within the current literature vary. One recent multisite (i.e., three universities located in the U.S., the Netherlands, and England) study of bereaved individuals ($N = 672$) estimated that between 6% to 16% of individuals meet criteria for PGD using the 5th edition of the *Diagnostic and Statistical Manual-5-Text Revised* (*DSM-5-TR*) diagnostic criteria (Prigerson et al., 2021). Another recent study examining bereaved college students found a similar PGD prevalence rate of 13.4%, with PGD being most prevalent for students of color (Glickman, 2021). A study examining the prevalence of PGD in a representative sample of the general population in Germany ($N = 2498$) found a prevalence rate of 1.2% using the aforementioned *DSM-5-TR* diagnostic criteria and a rate of 1.5% using the 11th revision of the *International Classification of Diseases* (*ICD-11*) PGD criteria (Rosner et al., 2021). Over the past decade, much of the research on pathological grief has sought to compare diagnostic criteria sets for PGD.

Indeed, in 2018, the World Health Organization published the *ICD-11*, which included the first published diagnostic criteria of PGD (World Health Organization, 2018). The *DSM-5* originally captured clinically significant levels of grief under the diagnosis of Persistent Complex Bereavement Disorder (PCBD; American Psychiatric Association [APA], 2013). However, in 2020, the APA approved a new diagnosis of PGD to be included in its recently released *DSM-5-TR* to replace PCBD (APA, 2020). Although the PGD criteria proposed in the *DSM-5-TR* varies slightly from the *ICD-11* PGD criteria (see Sekowski & Prigerson, 2021), the present study will focus on *DSM-5-TR*'s PGD criteria because the U.S. is the setting of the current study and the *DSM-5* is predominantly used in the U.S. The *DSM-5-TR* defines PGD as persistent and pervasive grief responses that meet the following criterion:

> A. The death of a person close to the bereaved at least 12 months previously.
>
> B. Since the death, there has been a grief response characterized by intense yearning/longing for the deceased person or a preoccupation with thoughts or memories of the deceased person. This response has been present to a clinically significant degree nearly every day for at least the last month.
>
> C. As a result of the death, at least 3 of the following symptoms have been experienced to a clinically significant degree, nearly every day, for at least the last month:
>
> 1. Identity disruption (e.g., feeling as though part of oneself has died)
> 2. Marked sense of disbelief about the death
> 3. Avoidance of reminders that the person is dead
> 4. Intense emotional pain (e.g., anger, bitterness, sorrow) related to the death

5. Difficulty moving on with life (e.g., problems engaging with friends, pursing interests, planning for the future)
6. Emotional numbness
7. Feeling that life is meaningless
8. Intense loneliness (i.e., feeling alone or detached from others)

D. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

E. The duration of the bereavement reaction clearly exceeds expected social, cultural, or religious norms for the individual's culture and context.

F. The symptoms are not better explained by another mental disorder.

Although the formal recognition of clinically significant grief as a *DSM-5* diagnosis has been supported by many grief researchers, even those who welcome this step have publicly voiced concern about the criteria and have provided suggestions for additional consideration. In an editorial letter, Boelen and colleagues (2020), for example, suggest shortening the timing criterion and diagnostic algorithm given that prior research demonstrates that elevated PGD symptoms exceeding six months post-loss reliably identifies individuals at risk for long-term dysfunction. Even so, APA's recognition of clinically significant grief as a formal diagnosis in the *DSM-5-TR* has been widely supported by clinicians and researchers (Boelen et al., 2020).

The development of PGD can be impacted by both intrinsic and extrinsic factors. Factors associated with increased likelihood of developing PGD include: insecure attachment style, being the deceased's caregiver, a lack of social support after the loss, a violent cause of death (e.g., homicide, accident, house fire), a history of prior trauma or loss, and a history of

mood or anxiety disorders (e.g., Lobb et al., 2010). Experiencing trauma or cumulative loss prior to the death of a loved one can further contribute to the potential development of PGD (Prigerson et al., 2009).

Of particular significance on this topic, Criterion E of the *DSM-5-TR* diagnostic criteria for PGD specifies that the duration of one's bereavement reaction needs to clearly exceed one's cultural and/or contextual norms. Although grief is often examined as an individual, psychological process, it is impossible to fully extract the individual's experience from the context in which it occurs; including social, cultural, religious, economic, political, and historical components (see Silverman et al., 2021). For example, the dominant Euro-American perspective of grief is individualistic in nature and aligns with Western culture, which prioritizes the individual over the group (Hofstede, 1997). This broader framework includes the idea of categorizing grief experiences as normative versus pathological. Conversely, in many non-Western cultures (e.g., African and Asian cultures), the community's loss is of equal importance to the loss of the family, and there is an emphasis on the role the community plays in healing. Importantly, it is crucial to remind oneself that norms regarding emotional expression regularly change over time (Simonds & Rothman, 1992). When considering norms of grief presentations, it is important to consider the perspective of the bereaved to be able to fully appreciate any interpretations of behavior. Furthermore, acknowledging the breadth of death and mourning rituals that exist both between and within various cultural contexts is critical.

Focusing on the setting of the current study (i.e., United States of America), there are clear differences in grief presentations and mourning rituals within the population. For example, European Americans often demonstrate more stoic or subdued grief responses,

whereas African Americans tend toward demonstrating an intersection of grief and "home-going" which is a more soulful celebration of the deceased's life. Furthermore, in line with non-Western experiences of grief, many Black Americans report collective grief experiences that go beyond narrow, individualistic conceptualizations of grief (Wilson & O'Connor, 2022). In regard to Latino/a groups in the U.S., there are a breadth of mourning rituals practices and grief manifestations demonstrated both across and withing these groups (see Falzarano et al., 2022). For example, Mexican Americans tend to externalize their grief and demonstrate heightened physiological reactions, and often commemorate the deceased at a wake or "velorios" in efforts to share in collective grieving (Oltjenbruns, 1998). Of note, there is a need for more research to delineate grief and bereavement norms and practices within racial and ethnic groups. Indeed, as explained by Falzarano and colleagues (2022) – in the context of Lantino/a groups – much research tends to discuss cultural determinants of grief in monolithic groupings.

In regard to religion, some Jewish communities are expected to outwardly mourn (e.g., women wailing) in efforts to be in touch with their emotions, and there are clearly defined traditions surrounding death (e.g., no cremation, no open casket), as well as many stages of rituals across the first year following the death (see Hillard, 2020). However, some Jewish-American communities now engage in hastened versions of the grieving process (i.e., "fast grief"). Within Christian communities mourning is expressed more privately. In Muslim communities, death is considered to occur with the will of Allah and is thus predetermined (Kristiansen & Sheikh, 2012). In pre-Islamic practice, individuals are encouraged to express their feelings openly and loudly (e.g., wailing), as it is believed to cleanse the soul.

In regard to gender, social constructions of masculinity prescribe stoicism as the expected expression of bereaved men (Creighton et al., 2013). With respect to individuals who are trans or identify with a historically oppressed sexual orientation, disenfranchised grief experiences and facing additional barriers/stressors is common (e.g., failure of others to acknowledge the relationship, legal obstacles, actively kept from mourning rituals by the deceased's family; Bristowe et al., 2016). Individuals with intellectual disabilities belong to another community that often faces various levels of disenfranchised grief regarding ability to or opportunities given to communicate about or express their grief (O'Riorden et al., 2022).

The current study and much of the literature cited within examines grief through a Western, predominately individualistic, and secular lens. Research examining various factors impacting the development of PGD, as viewed through this lens, have spurred various theoretical conceptualizations of grief aiming to better understand mechanisms underlying PGD.

Cognitive Behavioral Conceptualization of Pathological Grief

A cognitive-behavioral conceptualization of pathological grief was first introduced by Boelen, van den Hout, and van den Bout (2006), offering a framework to encourage the generation of hypotheses about mechanisms underlying pathological grief that can be targeted in the treatment of grief. Broadly, their conceptualization posits that background variables (i.e., individual vulnerability factors, loss event characteristics, loss sequelae characteristics) influence core grief processes, consequently influencing the development of PGD (Boelen, van den Hout et al., 2006). The core grief processes include 1) insufficient integration of the loss into the bereaved's autobiographical knowledge base, 2) negative global beliefs and misinterpretations of grief reactions, and 3) anxious and depressive

avoidance strategies. Although the first two core processes are conceptualized as separate from the third, the avoidance strategies play a clear role in maintaining the first two processes.

Insufficient integration of the loss into the autobiographical knowledge base refers to the sense of unrealness the bereaved may experience regarding the irreversibility of the loss. Compared to individuals without PGD, individuals with PGD have been found to more often and more easily get reminded of the deceased (Lichtenthal et al., 2004). Due to the lack of integration of the reality and irreversibility of the loss in their autobiographical knowledge base, individuals with PGD continue to experience the loss as very distinct (i.e., not connected with other information in memory), very consequential (i.e., holding greater significance), and very emotional (i.e., triggering strong feelings; Berntsen, 2001). Consequently, thoughts, feelings, and recollections linked with the death can be triggered easily and by a wide range of stimuli, and can become intrusive and disruptive. This core process is thought to be similar to cognitive theories of posttraumatic stress disorder (PTSD) where the memory of the traumatic event is insufficiently integrated into the individual's existing autobiographical database and, thus, the individual continues to relive pieces of the traumatic event while simultaneously continuing to anticipate the reoccurrence of danger instead of seeing the threat as existing in the past (e.g., Dalgeish, 2004). Comparably, in PGD, the separation between the bereaved and the deceased is poorly integrated, and this lack of connectivity to one's autobiographical database leads to individuals continuing to experience an intrusive preoccupation with memories of the deceased while simultaneously becoming shocked or dazed by the death and associated beliefs that the separation is not permanent. This then manifests as difficulty acknowledging the loss.

The second core process, negative global beliefs and misinterpretations of grief reactions, posits that the experience of grief and loss often violates the bereaved person's previously maintained global beliefs and that bereaved individuals often interpret their emotional pain as intolerable. Again rooted in cognitive theories of PTSD (see Ehlers & Clark, 2000), it is argued that issues may arise when the bereaved individual makes adjustments to their global beliefs in a negative direction that aligns with the death rather than creating new functional beliefs that take into account the death, or when the death confirms previously held negative beliefs (Boelen et al., 2003). Global negative beliefs about the self (e.g., "Since my loved one died, I am of no importance to anybody anymore"), life (e.g., "Life has got nothing to offer me anymore"), and the future (e.g., "My wishes for the future will never be fulfilled because my loved one died") are thought to lead the bereaved to focus on what was lost rather than attend to the present and future. Consequently, they experience yearning for what was lost and have difficulty engaging in activities that may help facilitate adjustment (e.g., planning goals for the future, engaging with friends, pursuing interests). When individuals do experience grief reactions, they may interpret their emotional pain to be intolerable. This then contributes to feelings of distress and discomfort (Boelen, van den Hout et al., 2006).

The third core process includes anxious and depressive avoidance strategies. Anxious avoidance includes strategies where the bereaved individual avoids confrontation of reminders about the reality of the death in attempts to thwart threats of negative consequences (e.g., emotional pain). Reminders of the death can include feelings, thoughts, and/or memories. Additionally, situations, people, and/or objects that evoke feelings, thoughts, and/or memories about the death may also be avoided. Depressive avoidance

includes strategies where individuals avoid engagement in activities that could foster adjustment (e.g., pursuing new interests). However, engaging in avoidance strategies is not inherently maladaptive. If used in moderation, such strategies can serve protective functions, such as allowing moments of respite from grief (Stroebe & Schut, 1999). However, persistent engagement in avoidance can interfere with adjustment and ultimately increase grief symptoms. Indeed, both anxious and depressive avoidance behaviors have explained variance in PGD symptom severity (Boelen & van den Bout, 2010). For example, both forms of avoidance have been associated with poor long-term adjustment after a loss, with anxious avoidance being primarily detrimental during the first year post loss (Boelen & Eisma, 2015).

Since the cognitive-behavioral framework's original conceptualization, there have been no significant revisions to the framework taking into account more recent research regarding its core processes. However, much of the recent research based on this framework has underscored the importance of emotion regulatory processes as a key target in disrupting the maintenance and perpetuation of the aforementioned core processes.

Emotion Regulatory Processes within Pathological Grief

Since the original cognitive-behavioral conceptualization of pathological grief, a focus on the emotion regulatory processes within this framework has grown within the research examining the development and persistence of PGD (Eisma & Stroebe, 2021). Eisma and Stroebe (2021) posit that many of the core symptoms of PGD are emotional in nature (e.g., yearning, emotional pain, emotional numbing, intense loneliness) and that attending to these emotional experiences is critical for recovery and/or adjustment. Furthermore, unlike other factors found to increase the likelihood of PGD (e.g., traumatic nature of the death), emotion regulatory processes are viewed as targetable and amenable to change. Indeed, many therapy programs for PGD include emotion regulatory processes as

treatment targets, such as exposure therapies targeting avoidance of loss-related cues and related emotions (e.g. Boelen et al., 2007; Eddinger et al., 2019).

Eisma and Stroebe's (2021) systematic review investigating how emotion regulatory strategies play a role in PGD examined frequently studied emotion regulation strategies including: experiential avoidance, behavioral avoidance, depressive avoidance, expressive suppression, rumination, worry, positive repetitive thoughts, acceptance, mindfulness, problem-solving, reappraisal, and distraction. Of the emotion regulatory strategies examined, experiential avoidance and grief-related rumination were recognized as particularly critical underlying mechanisms in the perpetuation and treatment of PGD, followed to a lesser extent by behavioral avoidance (Eisma & Stroebe, 2021). The authors further concluded that preliminary evidence supports potential roles for other examined emotion regulation strategies (i.e., worry, positive thought, cognitive reappraisal, problem solving, and mindfulness), though this evidence was limited.

Experiential avoidance involves the unwillingness to stay in contact with distressing internal experiences (e.g., thoughts, feelings, memories, physical sensations) as well as any attempt by an individual to control or evade such distressing internal experiences (Hayes-Skelton & Eustis, 2020). Bereaved individuals engage in efforts to suppress internal experiences associated with their loss or the death in attempts to manage their distress (Boelen, van den Bout et al., 2006; Boelen, van den Hout et al., 2006). Although avoidance can be used adaptively by bereaved individuals as a way to allow oneself to engage in restorative activities that are not related to the death or their grief (e.g., enjoyable activities, meditation, other forms of self-care), avoidance can become maladaptive when one lacks control over their ability to employ avoidance techniques (Shear, 2010). The avoidance of

internal experiences (e.g., emotional, thoughts, memories related to the deceased) can lead to increased numbness and detachment, which contribute to PGD symptoms (Boelen, van den Bout et al., 2006; Boelen, van den Hout et al., 2006). Indeed, the extant literature demonstrates positive associations between general experiential avoidance and PGD symptoms (e.g., Davis et al., 2016; Eisma et al., 2013; Harper et al., 2014; Mornia, 2011; Nam, 2016; Terhorst & Mitchell, 2012). Furthermore, positive associations have also been demonstrated in regard to death-related experiential avoidance more specifically and PGD symptoms (e.g., Boelen et al., 2015; Boelen & Eisma, 2015; Eisma et al., 2013). Indeed, a laboratory-based dot-probe study found higher levels of PGD were associated with a stronger tendency toward avoiding death related stimuli (Yu et al., 2017).

Rumination is a type of perseverative cognition that involves the act of repetitively focusing on negative content (generally past and/or present), including thinking about an experience, the causes of an experience, and/or the consequences of negative emotion in a passive manner (Smith & Alloy, 2009). General rumination is positively associated with PGD symptoms (Eisma, Stroebe, et al., 2014; Morina, 2011; Tang et al., 2019). Grief-related rumination, or the repetitive thinking about the causes and consequences of the loss, has also been shown to be positively associated with PGD symptoms (Boelen, 2012; Doering et al., 2018; Eisma et al., 2013; Eisma, et al., 2015; Tang et al., 2019; van der Houwen et al., 2010). Indeed, grief rumination is higher in bereaved individuals with higher levels of PGD symptom levels compared to individuals with lower levels of PGD symptoms (Doering et al., 2018). Additionally, bereaved individuals who are high in grief rumination show higher PGD symptom levels than individuals who are low in grief rumination (Eisma, Schut, et al., 2014).

In the context of bereavement, grief rumination may encompass repetitive, self-focused thinking about injustice, meaning, reactions, relationships, and counterfactual thinking. Similar to experiential avoidance, grief rumination can serve both an adaptive and maladaptive function. Indeed, research indicates that repetitive, self-focused thinking intended to understand one's depressive and loss-related emotional reactions can be adaptive for bereaved individuals and ultimately reduce symptoms of grief (Eisma, Schut, et al., 2015). However, grief rumination focusing on injustice to the self and making passive comparisons between one's current situation (i.e., having experienced a loss) and unrealized alternatives has been demonstrated as maladaptive, predicting higher levels of grief symptoms (Eisma, Schut, et al., 2015). Despite the mixed impact of subtypes of grief rumination on the potential development of PGD, researchers caution against preventing rumination in bereaved individuals (Eisma & Stroebe, 2017). Indeed, the role of grief rumination in the coping process for bereaved individuals remains unclear. To an extent, rumination can serve as a confrontational process for individuals where they repeatedly focus on and revisit their thoughts about the causes and consequences of the loss as well as their feelings about the loss. However, rumination can also serve as a method of distraction from the most painful aspects of the loss (e.g., the permanence of the separation from the deceased).

In line with the work on emotion regulation and PGD symptoms, recent studies examining the neurobiology of PGD have been introduced suggesting a newer conceptualization of PGD as a reward system disorder (Bryant et al., 2020; Kakarala et al., 2020). Conceptualizations of PGD as a reward system disorder generally suggest that the development of pathological levels of grief can be explained by neurobiological differences

that impact an individual's motivation and approach behaviors toward a goal, which in cases of bereavement would be reengagement with internal and/or external reminders of their deceased loved one. The reward system disorder conceptualization of PGD posits that compared to individuals with normative grief, individuals with PGD engage in negative reinforcement processes where they use engagement in yearning and proximity seeking behaviors for the deceased as efforts to evade negative thoughts and emotions related to the death (Kakarala et al., 2020). This conceptualization arguably illuminates explanations around some of the more paradoxical phenomena demonstrated in PGD; particularly the often demonstrated engagement of both avoidance of reminders of the loss or circumstances of the death while simultaneously endorsing experiences of yearning for the deceased and engaging in proximity-seeking behaviors (e.g., wearing the deceased's clothing, relating unassociated conversation topics back to information and/or stories of the deceased). Multiple neuroimaging studies of individuals with PGD support this conceptualization; demonstrating the activation of several reward-related regions of the brain compared to bereaved individuals without PGD (Kakarala et al., 2020). This conceptualization further illuminates the centrality of aforementioned emotion regulation processes in PGD. Indeed, a psychological study examining the role of experiential avoidance in the relationship between reward system factors (i.e., motivational sensitivity) and PGD symptom severity found the relationship to be uniquely significant in individuals who endorse high experiential avoidance (Williams et al., 2019).

Despite extant debate regarding theories behind the development of PGD, it is clear that emotion regulation processes hold a central role in the development and maintenance of PGD in at least two contemporary conceptualizations (i.e., cognitive-behavioral

conceptualization, reward system conceptualization). Emotion regulatory processes are also implicated in the development and maintenance of a wide range of mental health problems more broadly, including problematic engagement in health risk behaviors. Several studies now suggest that overall health and health behaviors are impacted by grief symptoms, and aforementioned emotion regulation factors associated with pathological grief (i.e., experiential avoidance, rumination) may partially explain why researchers are now uncovering evidence of possible associations between PGD symptoms and health risk behaviors.

"Big 4" Modifiable Health Behaviors

The CDC report that six in 10 adults in the U.S. have a chronic disease and that four in 10 have two or more chronic diseases (CDC, 2021a). Broadly, the CDC defines chronic diseases as conditions lasting one year or more that require ongoing medical attention and/or limit activities of daily living (CDC, 2021a). In the U.S., chronic diseases such as heart disease, cancer, and diabetes are the leading causes of death and disability, and can be caused or significantly impacted by certain modifiable health behaviors.

The "Big 4" modifiable health behaviors identified by the CDC as major risk factors for the development of chronic diseases include tobacco use, excessive alcohol use, lack of physical activity, and poor nutrition. These health behaviors have been associated with physical health disorders including cardiovascular diseases, diabetes, and cancer (Ford et al., 2012; Lim et al., 2012; Mokdad et al., 2004). Indeed, the World Health Organization (WHO) has previously estimated that if these major modifiable risk factors for chronic disease were eliminated, approximately 80% of all heart disease, stroke, and type 2 diabetes would be prevented, and over 40% of cancer cases would be prevented (WHO, 2005a). Additionally, an analysis focused solely on the U.S. health system estimated that modest reductions in

modifiable risk behaviors could prevent or delay 40 million cases of chronic illness per year (Milstein et al., 2011).

Although each of these modifiable behaviors contributes to health to some extent, variance occurs in rates and breadth of direct impact to health. Furthermore, for some of these behaviors nuance exists within the understanding of their impact on one's health. Of the modifiable behaviors, tobacco use (i.e., heavy smoking) demonstrates the strongest association with the risk of experiencing at least one chronic disease (Ng et al., 2020). Indeed, the CDC identifies tobacco as the leading cause of preventable disease, disability, and death in the U.S. Specifically, conditions such as cancer, heart disease, stroke, lung disease, and diabetes are all associated with tobacco use (CDC, 2021b). Excessive alcohol use is linked to 95,000 deaths in the U.S. annually, with binge drinking being responsible for approximately half of these deaths (CDC, 2020a). Excessive alcohol use is unique in that it has been linked to both various chronic health conditions (e.g., high blood pressure, heart disease, stroke, liver disease, cancer) and various more immediate health issues (e.g., injuries, violence, poisonings, poor pregnancy outcomes).

Lack of physical activity has been demonstrated as a contributor to heart disease, type 2 diabetes, and several cancers; whereas engagement in physical activity has been demonstrated as a contributor to benefits such as improved sleep, increased ability to perform daily activities, improved cognitive abilities, reduced risk of dementia, and improved bone and musculoskeletal health (CDC, 2019). Engagement in physical activity also has been shown to reduce risks for cardiovascular disease, type 2 diabetes, metabolic syndrome, and some cancers (CDC, 2008). The last "Big 4" modifiable health behavior is poor nutrition. The CDC suggests that healthy eating can aid with chronic disease management and prevent

complications. In general, eating a healthy diet has been shown to prolong life and lower risk of heart disease, type 2 diabetes, and certain cancers (CDC, 2021c). According to the CDC, a healthy diet includes eating a variety of fruits, vegetables, grains, dairy or fortified soy alternatives, and protein foods while limiting consumption of food with added sugars, saturated fat, and sodium (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Although the first two CDC identified modifiable health behaviors (i.e., tobacco use and excessive alcohol use) are generally agreed upon regarding their impact to health, more controversy and nuance surrounds narratives related to physical activity and healthy diet.

The existing controversy regarding physical activity and healthy diet is not directly linked to these behaviors but rather to the often accompanying focus on obesity and weight as a frequently identified "health concern" and weight loss as a "goal." Rather than developing healthy lifestyle habits, these foci often lead to enforcement of overly restrictive eating plans and rigorous activity to achieve immediate weight loss. However, such an approach is often unsustainable and can also lead to health complications. Indeed, research demonstrates that 95% of people who follow such diet and exercise programming regain the lost weight within three to five years (Ikeda et al., 2005). Furthermore, preoccupation with only eating foods perceived as healthy can lead to cutting out entire food categories and lead to consequences such as vitamin and nutrient deficiencies (e.g., Hunter & Crudo, 2018).

The Health at Every Size (HAES) approach encourages a shift in research paradigms, arguing that although associations have been demonstrated between obesity and chronic disease, these associations do not prove causality (Burgard, 2009). Furthermore, taking a HAES approach for disease risk reduction has been particularly supported for use in women

of color due to concerns of weight stigma, bias, and size discrimination that often occur with diet-for-weight-loss approaches (Rauchwerk et al., 2020). In regard to diet, rather than external food plans or diets, HAES emphasizes intuitive eating (i.e., eating based on internal hunger, satiety, and appetite cues), individual nutritional needs, and enjoyment (Burgard, 2009). Engagement in intuitive eating has been tied to improved psychological health and physical health indicators (e.g., blood pressure, cholesterol levels; Van Dyke & Drinkwater, 2013). In regard to physical activity, rather than following a specific exercise regimen for the primary purpose of weight loss or management, HAES encourages all physical activities for the purpose of pleasure and health benefits (Burgard, 2009). When conducting research regarding these two modifiable health behaviors, rather than focusing on BMI and weight, it is important to use a HAES approach and focus the narrative on the behaviors themselves (e.g., measuring eating behavior and nutrition, measuring various forms and intensities of physical activity).

Of note, in addition to HAES approaches, it is important to acknowledge the role of culture in an individual's engagement and/or perspective regarding the "Big 4" health behaviors. Indeed, it is argued that in order to provide holistic care, medical professionals must understand how an individual's behaviors are rooted in their unique cultural experience and in the context of social pressures (Napier et al., 2014). Furthermore, it is important to acknowledge the presence of eurocentrism in determining health standards (e.g., nutrition standards; Khanna, 2020) and how the framing of these behaviors as "healthy" vs. "unhealthy" or "good" vs. "bad" can hold adverse implications across cultures. Although this study examines the "Big 4" health behaviors in accordance with and through the lens of CDC

guidelines, it is important to acknowledge the reality of diverse perspectives on health behaviors.

Emotion Regulatory Processes and Health Behaviors

While researchers acknowledge there are multiple contributing factors linked to engagement in health behaviors, emotion regulation may play a pivotal role. Emotion regulatory processes aim to 1) downregulate one's subjective experience, physiological reactions, or expression of negative affect; or 2) weaken the influence of such experiences on subsequent behavior (Gross, 2015; Jamieson et al., 2013; Lazarus & Folkman, 1984; Mendes et al., 2003**).** Emotion regulatory processes are conceptualized as influencing health directly (e.g., physiological response) and indirectly (e.g., guiding behavior and decision-making; DeSteno et al., 2013)**.** Health behaviors and decision-making often occur in emotionally charged or stressful circumstances. When stress is increased, uncontrolled, and/or chronic, or emotion regulation is poor, health-promoting behaviors (e.g., exercise, healthy eating) are often compromised (e.g., Ferrer et al., 2017; Schnohr et al., 2005; Tomiyama et al., 2011). Conversely, in such circumstances, individuals may engage in health risk behaviors (e.g., smoking, overeating, and drinking alcohol) in efforts to regulate emotion or reduce stress (e.g., Adam & Epel, 2007; DeSteno et al., 2013; de Ridder et al., 2017; Ferrer et al., 2015; Kuntsche et al., 2017). The combination of compromised health promoting behaviors and increased health risk behaviors suggests poor emotion regulation may result in significant health risk. Furthermore, some research suggests that even behaviors viewed traditionally as health promoting can become dangerous avenues for attempted emotion regulation. Indeed, engagement in compulsive exercise has been tied to dysfunctional emotion regulation strategies (Goodwin et al., 2012). The emotion regulatory processes of focus in the current

study (i.e., experiential avoidance, rumination) in particular have been linked with a variety of health problems and risk behaviors.

Experiential avoidance is associated with general physical health issues as well as engagement in modifiable health behaviors (e.g., alcohol use, smoking, dysfunctional eating, physical activity). For example, research examining cardiovascular risk posits that engagement in experiential avoidance may explain the relationship between negative affectivity and cardiovascular risk via engagement in problematic health behaviors including smoking, drinking, and binge eating (Hildebrandt & Hayes, 2013). Relatedly, another study in a sample of patients participating in outpatient cardiac rehabilitation found lower endorsed experiential avoidance to be associated with better exercise outcomes (Goodwin & Emery, 2016). Experiential avoidance has also been demonstrated as a significant predictor of coping-motivated drinking behaviors (Stewart et al., 2002). Indeed, experiential avoidance has been associated with harmful drinking patterns in individuals who demonstrate a general tendency to experience negative affect (Luoma et al., 2020). In a sample of combat veterans, experiential avoidance was found to moderate the relationship between posttraumatic stress symptoms and alcohol use disorder (Feingold & Zerach, 2021). In smokers, experiential avoidance moderates the relationship between internal distress and smoking behavior during quit attempts, suggesting individuals smoke to regulate aversive internal experience (Minami et al., 2015). Similarly, a study examining substance use (i.e., cannabis use) found that when experiential avoidance was average or high, it moderated the relationship between PTSD symptom severity and cannabis dependence, again suggesting that use may be a mechanism to reduce negative internal experiences in PTSD (Bordieri et al., 2014). In regard to eating behaviors, decreased experiential avoidance has been associated with improvement in

dysfunctional eating (Cavicchioli et al., 2019). Furthermore, experiential avoidance has been found to partially explain the relationship between negative emotions and emotional eating (Litwin et al., 2017). Overall, the extant literature regarding psychological distress and health behaviors suggests individuals may engage in the aforementioned health behaviors in efforts to cope with or reduce negative internal experiences (i.e., experiential avoidance).

Past research suggests that rumination affects physical health by interfering with engagement in health behaviors (Thomsen et al., 2004). A systematic review and meta-analysis examining extant literature regarding the relationship between perseverative cognition and health risk behaviors also found that increases in perseverative cognitions were associated with increases in health risk behaviors (i.e., substance use, alcohol consumption, unhealthy eating, and smoking), primarily driven through rumination (Clancy et al., 2016). An additional study similarly found rumination to be associated with lower vegetable intake and higher alcohol intake (Riley et al., 2018). Furthermore, higher levels of rumination have been shown to predict less engagement in daily physical activity (e.g., walking; Clancy et al., 2020). In a sample of U.S. veterans, rumination moderated the relationship between PTSD and risk behaviors, including dangerous substance use, where PTSD symptoms were associated with risky behaviors for veterans endorsing moderate to high levels of rumination (Borders et al., 2012). Overall, the extant literature suggests individuals may engage in the aforementioned health risk behaviors in efforts to cope with psychological distress.

Emotion regulatory processes holding a key role in both the health behavior literature and the PGD literature invites inquiry into further examining health behaviors of bereaved individuals. Findings in this literature also underscore the need for investigating the relationship between PGD symptom severity and engagement in health behaviors, and

exploring the role of emotion regulation in this relationship. Interestingly, the depth, breadth, and consistency of the physical health literature within bereaved populations is limited.

Grief and Health Outcomes

Findings related to health outcomes reported by bereaved individuals varies significantly. Furthermore, grief studies examining health outcomes have been conducted predominately in the context of spousal bereavement. Consequently, the generalizability of such findings to other forms of bereavement remains unclear.

In regard to mortality, a review of the literature demonstrated an early excess risk of mortality following bereavement, with some studies also indicating risks persisting for longer than six months post-loss (Stroebe et al., 2007). For example, compared to married individuals, mortality for widowed individuals has been demonstrated as very high for accidental and violent causes and alcohol-related diseases, moderate for chronic ischemic heart disease and lung cancer, and small for other causes of death (Martikainen & Valkonen, 1996).

When examining physical health outcomes, the majority of research suggests bereaved individuals report greater occurrences of physical health issues compared to their non-bereaved counterparts. One review found such issues to include physical symptoms, higher rates of disability and illness, more hospitalizations, and greater use of medical services and medications compared to non-bereaved counterparts (Strobes et al., 2007). Additional but less widely examined health outcomes found within this review include increased insomnia, increased somatization of grief symptoms across cultures, impaired memory performance, nutritional problems, and higher health care costs (Strobe et al., 2007).

Since Strobe and collogues' (2007) review, grief research related to health has continued to primarily focus on broader health outcome metrics rather than examining

underlying mechanisms and behaviors, and/or limited their scope to specific bereavement characteristics (e.g., spousal, parental, suicide). For example, one study found that bereaved parents report significantly worse health-related quality of life than non-bereaved parents (Song et al., 2010). Additionally, a nation-wide cohort study in Denmark examining spousal suicide bereavement found an excess in overall mortality, as well as elevated risk for developing physical disorders (e.g., cirrhosis, cancer, sleep disorders, lower respiratory tract diseases) within the first five years post-loss (Erlansen et al., 2017). Cardiovascular-related research has found loss of a parent or sibling associated with increased risk of atrial fibrillation (Chen et al., 2023) and partner bereavement associated with increased rate of cardiovascular disease and acute kidney injury hospitalization, as well as death in individuals with reduced kidney disease (Bidulka et al., 2021). Another cohort study conducted in Sweden examining child bereavement found bereaved parents to be at higher risk for cervical, liver, and stomach cancers (Fang et al., 2011). Interestingly, another cohort study in the United Kingdom and Denmark found decreased risk of melanoma diagnosis associated with partner bereavement, but increased associated melanoma mortality (Wong et al., 2020). Finally, a systematic review paper found a high prevalence of sleep disturbances following bereavement (Lancel et al., 2020).

Some research has incorporated time since loss as a focus. Indeed, a longitudinal sibling bereavement study found that most illnesses and treatments or health services occur in the first six months post-sibling death (Brooten et al., 2018). Similarly, the death of a spouse in older individuals was found to be associated with a variety of cardiovascular events during the acute grief period (Carey et al., 2014). Additional studies suggest such increased risk for cardiovascular events may be associated with inflammatory and prothrombotic

changes evidenced during acute bereavement (Buckley et al., 2012). Indeed, one study found that the loss of a spouse or partner the year before an individual's first acute myocardial infarction (AMI; i.e., acute heart attack) was associated with increased risk of combined non-fatal recurrent AMI and death due to ischemic heart disease (Wei et al., 2021). Relatedly, inflammatory markers can distinguish bereaved spouses with higher grief severity compared to spouses with lower grief severity (Fagundes et al., 2019). This study is one of the few health outcome studies to focus on grief severity.

Despite the general consensus of the aforementioned findings, it is crucial to examine the nuance present. For example, in a study including a focus on grief severity, Prigerson et al. (1997) found that bereaved women who reported high grief intensity had reduced use of health services for physical health disorders despite the fact that they had a significantly increased likelihood of high blood pressure and functional impairment compared to bereaved widows who reported low grief intensity. Yet another, more recent, study found severe grief reactions negatively related to self-reported health but positively associated with the use of health services (Thimm et al., 2020). Indeed, severe grief reactions were related to increased use of a broad range of health services, including both an increased likelihood of service use and the number of times individuals sought services (Thimm et al., 2020). Both studies found negative physical health outcomes reported by bereaved individuals. However, they differ regarding the health related behavior of engagement in service utility.

These mixed findings further underscore a potential underlying issue related to bereaved individuals' engagement with health behaviors, especially as it related to grief intensity. Indeed, variance in the existing health outcomes research in bereaved populations could, in part, be due to a lack of attention given to variance in grief severity and/or instances

of PGD within samples. It could be posited that maladaptive emotion regulatory processes play a role in a bereaved individual's engagement in the aforementioned health behaviors. Variance in the degree of daily engagement in health behaviors, such as the "Big 4," may then partially explain variance in individual's physical health outcomes. Indeed, the general lack of accounting for differences reported between individuals with PGD versus normative grief may explain variance demonstrated in reported health outcomes. Compared to individuals presenting with normative grief, individuals with PGD may be more likely engaging in maladaptive coping via health risk behaviors as a means of regulating heightened emotional experiences (e.g., yearning, emotional pain, emotional numbing, intense loneliness), which in turn increases their likelihood of developing physical health problems.

Grief and Health Behaviors

Although few studies have looked at associations between PGD severity and each of the "Big 4" modifiable health behaviors, several studies have examined these behaviors within the context of bereavement more generally. However, the extant bereavement research examining post-loss health behaviors has yielded mixed findings.

Longitudinal studies have demonstrated that bereaved adults report significantly higher substance use than nonbereaved individuals (e.g., Giordano et al., 2014; Hamdan et al., 2013). Indeed, a qualitative study of bereaved college students found individuals indicate that the substance use was affected by the death, citing their feelings of grief and mental health distress as key contributors to increased substance use after the death (Tureluren et al., 2022).

Empirical evidence regarding tobacco/nicotine use following bereavement is also mixed. Some research demonstrates no significant differences in tobacco use or quit rates

over a two year period following spousal bereavement (Franks et al., 2002). Wilcox et al. (2003) found that widowed women decreased tobacco use to a greater extent than women who remain married. However, other research examining tobacco use during the acute bereavement period demonstrates increased consumption of cigarettes (e.g., Levy & Scalre, 1976; Pienta & Franks, 2005). Similarly, in an Australian study, recent widows demonstrated higher odds of smoking than individuals who remained married (Ding et al., 2021.) In a sample of individuals bereaved in the 9/11 terrorist attack in New York City, increases in cigarette smoking were common among those with pathological levels of grief 2.5 to 3.5 years post-loss (Neria et al., 2007). Similarly, Parisi and colleagues (2019) found that high levels of clinically significant grief predicted increases in smoking. The last two identified studies were the only tobacco use studies that examined pathological vs. non-pathological levels of grief.

In regard to alcohol consumption, previous research has found bereavement to impact use in varying ways. A recent health-related statewide telephone survey in Georgia examining behavioral risk factors found past 30 day binge drinking rates for bereaved individuals (31.0%) to be higher than non-bereaved individuals (23.6%), and that combined bereavement and binge drinking increased poor mental health risk (Miles, 2022). Interestingly, a cross-sectional study of 9,123 bereaved individuals in Japan found both increases and decreases in alcohol consumption after bereavement to be risk factors for possible PGD (Aoyama et al., 2020). However, a systematic review of health behavior changes after late-life bereavement found moderate evidence for a relationship between bereavement and increased alcohol consumption (Stahl & Schulz, 2014). Similarly, a study focusing only on bereaved men found the risk of alcohol related problems increased in the

two years following bereavement (Pilling et al., 2012). Conversely, a study examining bereaved spouses of patients with cancer found a higher likelihood for bereaved spouses to decrease alcoholic drink consumption compared to partners of patients who remained cancer free (Ezendam et al., 2019). Similarly, a recent Australian study examining the effects of divorce and widowhood on subsequent health behaviors in a sample of middle- and older-aged adults found recent widowhood appeared to reduce high alcohol consumption risk among women (Ding et al., 2021). Yet another study of 1,854 suddenly bereaved young adults in the United Kingdom found the majority of their sample reporting no increases in alcohol use (Pitman et al., 2020). However, the same study also found individuals bereaved by suicide to endorse an overall increase in substance use compared to people bereaved by other forms of loss (Pitman et al., 2020). Finally, in a sample of suddenly bereaved college students, Eddinger and colleagues (2019) found a significant positive association between PGD symptom severity and alcohol use. This study was the only alcohol use study that included grief symptom severity in their findings.

In regard to physical activity, the extant research in related changes post-bereavement is also unclear. Indeed, mixed evidence for a relationship between bereavement and physical activity was demonstrated in a systematic review of health behavior changes following late-life bereavement (Stahl & Schulz, 2014). Interestingly, a recent systematic review found that physical activity as an intervention may provide benefit for physical health and psychological health outcomes following bereavement (Williams et al., 2021). However, bereavement has been associated with decreases in physical activity engagement in multiple studies. Indeed, one study of elderly widows found newly bereaved women demonstrating a decrease in physical activity (Grimby et al., 2008). Another study examining spousal bereavement found

that individuals who were not primary caregivers to their spouse, or who were non-strained caregivers, reported not having enough time to exercise post-loss compared to strained caregivers (Schulz et al., 2001). In an Australian study, insufficient physical activity was only associated with widowhood in individuals with a medium level of educational attainment (Ding et al., 2021). Another study found irregular physical activity reported in bereaved elder individuals (Smagula et al., 2019). Interestingly, one study found widowed men adopting more active lifestyles during the acute period post-loss, but not at 48-month follow-up (Pienta & Franks, 2005). Perhaps conversely, another study found longer term widowed women reporting increased levels of physical activity compared to women who remained married; however, this was only a small effect size (Wilcox et al., 2003). A behavioral intervention feasibility study providing health coaching to spousally bereaved older adults related to their physical activity, sleep, and meals found significant declines in depression symptoms from baseline to postintervention, and more specifically found higher depression symptoms were associated with more inconsistent daily physical activity patterns (Stahl et al., 2020). No studies were found examining the relationship between grief symptom severity and physical activity engagement.

Similar to the rest of the aforementioned health behaviors, the literature involving indicators of eating behaviors and/or diet quality is mixed. A systematic review of health behavior change following late-life bereavement found strong evidence of existing relationships between bereavement and nutritional risk and involuntary weight loss (Stahl & Schulz, 2014). For example, one study found that bereaved partners of patients with cancer were more likely to decrease their BMI, and also more likely to decrease fruit intake and increase sugared beverage intake compared to partners of patients with cancer who remained

alive (Ezendam et al., 2019). Indeed, an Australian study found recent widows demonstrated higher odds of insufficient fruit and vegetable consumption than individuals who remained married (Ding et al., 2021). Similarly, another study found that widowed women demonstrate unintentional weight loss over the first three years post-loss, and less fruit and vegetable consumption relative to married women (Wilcox et al., 2003). Demonstrated changes in dietary routines after bereavement include more frequent meal skipping, less home food production, and less variety in food choice (Quandt et al., 2000). Smagula and colleagues (2019) also found reported meal skipping as prevalent in bereaved elders. Another study examining the relationship between acute bereavement and cardiac risk factors found reduced appetite in acutely bereaved individuals compared to non-bereaved individuals (Buckley et al., 2009). An early family medicine-based study also found reductions in appetite and weight during the acute bereavement period (Levy & Sclare, 1976). Perhaps conversely, one study found that bereaved adults reported significantly higher levels of emotional eating than non-bereaved individuals (Høeg et al., 2017). No studies were found examining the relationship between grief symptom severity and eating behaviors and/or diet quality.

Gaps in the Literature and Study Aims

Various explanations for differences in health behaviors, and often consequently health outcomes, following bereavement have been posited in the existing literature. In their review, Stroebe et al. (2007) consolidate potential risk and/or protective factors in bereavement into four categories including: situation and circumstances of death; intrapersonal risk or protective factors; interpersonal or non-personal resources and protective factors; and coping style, strategies, and processes. However, a common issue

within much of the literature lies in the lack of examination of differences in health behaviors across different grief presentations (e.g., grief severity level, PGD vs. no PGD). Instead, the health behaviors of bereaved individuals are typically examined over time or in comparison with non-bereaved groups. Although these approaches do provide helpful and potentially valuable information, issues remain due to inconsistency in findings. Directing attention toward different presentations in grief, such as PGD symptom severity, may provide insight regarding which processes or factors of grief account for differences in reported engagement in health behaviors and, perhaps consequently, physical health outcomes amongst bereaved individuals. Furthermore, since emotion regulatory processes have been demonstrated as key factors in both the PGD and health risk behavior literature, the role of these mechanisms in the relationship between PGD severity and health risk behaviors in bereaved individuals may provide additional clarity in understanding the state of the current literature.

The present study examined the "Big 4" modifiable health behaviors following bereavement with a focus on their relationship to grief severity, with particular focus given to further understanding the role of aforementioned emotion regulatory processes in these relationships. Specific aims of this study included:

Aim 1: Examining the relationships between grief severity and each of the "Big 4" modifiable health behavior indicators;

Aim 2: Examining the relationships between emotion regulation variables (i.e., experiential avoidance and rumination) and each of the "Big 4" modifiable health behavior indicators in a bereaved sample;

Aim 3: Examining the moderating effects of emotion regulation variables (i.e., experiential avoidance and rumination) in the relationships between grief severity and each of the "Big 4" modifiable health behavior indicators.

Hypotheses and Exploratory Questions

Hypothesis 1: In regard to Aim 1, and consistent with Parisi et al. (2019), Eddinger et al. (2019), and Ding et al. (2021), we hypothesized that grief severity would be positively correlated with post-death tobacco/nicotine use, alcohol use, and sedentary behavior levels in bereaved individuals, respectively. Further, consistent with Grimby et al. (2008), Quandt et al. (2019), and Ding et al. (2021), we hypothesized that grief severity would be negatively correlated with post-death physical activity levels, eating behaviors, and diet quality in bereaved individuals, respectively.

Exploratory Question 1: Related to Aim 1, we examined the extent to which participants' pre-death self-ratings of the identified "Big 4" modifiable health behavior indicators influence the relationship between grief severity and post-death engagement in "Big 4" modifiable health behavior indicators using regression analyses.

Hypothesis 2: In regard to Aim 2, consistent with Minami et al. (2015), Stewart et al. (2002), and Clancy et al. (2020), we hypothesized that higher scores on emotion regulation variables (i.e., higher experiential avoidance and rumination) would be positively correlated with post-death tobacco/nicotine use, alcohol use, and sedentary behavior levels, respectively. Further, consistent with Clancy et al. (2020), Clancy et al. (2016), and Riley et al. (2018), we hypothesized that higher scores on emotion

regulations variables would be negatively correlated with post-death physical activity levels, eating behaviors, and diet quality.

Exploratory Question 2: Related to Aim 2, we examined the extent to which self-ratings of identified "Big 4" modifiable health behavior indicators (i.e., tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality) prior to death impact the relationship between emotion regulation variables (i.e., experiential avoidance and rumination) and post-death "Big 4" modifiable health behavior indicators using regression analyses.

Hypothesis 3: In regard to Aim 3, consistent with modeling approaches demonstrated within previous traumatic stress and health behaviors research (e.g., Borders et al., 2012), we hypothesized that emotion regulation variables (i.e., experiential avoidance and rumination) would significantly moderate the relationships between grief symptom severity and "Big 4" modifiable health behavior indicators (i.e., tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality). That is, we predicted that grief symptom severity would be associated with tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality at high, but not average or low levels of, experiential avoidance and rumination. The decision to explore moderation effects was based on grief not necessarily being a predictor of emotion regulation variables, and the belief that the variance in health-related grief literature could potentially be explained by the individual differences of grievers on emotion regulation styles and tendencies.

CHAPTER 3

METHODOLOGY

Participants

Full demographic descriptive information for the 425 included participants is presented in Table 1. Average participant age was 36.82 years (*SD* = 10.01). Regarding sex and/or gender, just over half of the sample identified as male (*n* = 215, 50.6%). For race and/or ethnicity, most participants identified as White (*n* = 339, 79.8%). The majority of participants self-described their household as middle income (*n* = 218, 51.3%) and their highest level of education as having a bachelor's degree (*n* = 256, 60.2%). Regarding relationship status, most participants indicated that they were married (*n* = 257, 60.5%). Cumulative sex/gender and race/ethnicity percentages exceed 100% because participants were able to indicate all self-relevant response options.

Table 1
Demographics

Variable	*M*	*SD*
Age (19 – 67)	36.82	10.07
Sex/Gender	*n*	%
Female	203	47.8
Male	215	50.6
Non-binary	2	.5
Transgender	1	.2
Cisgender	7	1.6
Genderqueer	1	.3
Agender	1	.2
Race and/or Ethnicity		
White	339	79.8
Asian/Asian American	40	9.4
Black/African American	27	6.4
Hispanic/Latino/Spanish origin	22	5.2

(continued)

Table 1 (continued)
Demographics

Variable	*n*	%
Native American/Alaskan Native	17	4.0
Middle Eastern or North African	2	.5
Native Hawaiian/Other Pacific Islander	1	0.2
Household		
Middle income	218	51.3
Upper-middle income	92	21.6
Lower-middle income	51	12.0
Low income	40	9.4
High income	15	3.5
Highest level of education		
Did not finish high school	1	0.2
High school graduate	14	3.3
Some college	39	9.2
Associate's degree	29	6.8
Bachelor's degree	256	60.2
Master's degree	70	16.5
Doctoral or professional degree	8	1.9
Relationship status		
Partnered	308	72.5
Not partnered	106	24.6
Chronic condition limiting major life activities	44	10.4
Disability diagnosis	43	10.1
Sensory impairment (vision or hearing)	9	2.1
Mobility impairment	20	4.7
Learning disability	16	3.8
Mental health disorder	16	3.8
Other disability not listed	6	1.4

Note. Cell sizes vary due to missing data and/or participants indicated preference for not sharing demographic information.

Full death characteristic descriptive information is presented in Table 2. Approximately half of the sample identified the deceased as their "close friend" (*n* = 218, 51.3%). Participants who identified the deceased as an "other relative" (*n* = 94, 22.1) described their deceased relative as their grandparent (*n* = 54), uncle (*n* = 16), aunt (*n* = 8),

cousin (*n* = 6), father-in-law (*n* = 3), nephew (*n* = 3), niece (*n* = 1), great aunt (*n* = 1), great uncle (*n* = 1), and sister-in-law (*n* = 1). Sudden illness was the most endorsed cause of death (*n* = 166, 39.1%). The top three types of sudden illnesses reported included cardiovascular (*n* = 148), cancer (*n* = 26), and neurological (*n* = 19) diseases or events. Fourteen participants indicated the type of sudden illness their loved one died of was COVID-19. Remaining sudden illness types included lung diseases (*n* = 3), autoimmune disorders (*n* = 2), diabetes (*n* = 1), complex health issues (*n* = 1), head injury (*n* = 1), internal bleeding (*n* = 1), Valley Fever (*n* = 1), liver diseases (*n* = 1), and kidney diseases (*n* = 1). Remaining individuals reported sudden illness type as unknown. Of the participants who identified chronic illness as the cause of death, 23 participants indicated cancer, five indicated lung disease, and five reported heart disease. Remaining chronic illness types included dementia (*n* =3), complex health issues (*n* = 3), liver disease (*n* = 2), COVID-19 (*n* = 1), failure to thrive (*n* = 1), diabetes (*n* = 1), and kidney disease (*n* = 2). One participant did not report the type of chronic illness from which their loved one died. Of the individuals who selected "other" type of death, nine reported COVID-19 related deaths, two reported dementia, six reported natural causes and/or old age, one reported blood being cut off to their loved one's brain, and one reported pneumonia. Of note, COVID-19 appeared as the reported cause of death across all three of the aforementioned death-type categories. The total number of COVID-19 reported deaths is 24. Most participants indicated that they were exposed to the death/death scene to some extent (*n* = 290, 68.2%) and learned about the loss immediately or soon after the death occurred (*n* = 282, 66.4%). The majority of participants reported attending the funeral (*n* = 356, 83.8%) and/or participating in rituals related to the loss (*n* = 301, 70.8%). Less than half of participants endorsed experiencing additional significant deaths recently (*n* = 172, 40.5%).

Table 2

Death-related variables

Variable	*n/M*	*%/SD*
The person who died was my:		
Close friend	155	36.5
Parent	96	22.6
Other relative	94	22.1
Sibling	68	16.0
Partner/Spouse	6	1.4
Child	1	.2
How/from what did your loved one die?		
Sudden illness	166	39.1
Plane crash, car wreck, fire, or other accident	81	19.1
Suicide	48	11.3
Chronic illness	47	11.1
Overdose of alcohol or drugs	33	7.8
Other	21	4.9
Natural disaster	19	4.5
Homicide	9	2.1
Exposed to the death/death scene	290	68.2
Saw the scene of death	198	46.6
At the scene prior to removal of deceased	209	49.2
Saw the individual die	190	44.7
Discovered the deceased	143	33.6
Saw individual get taken to the hospital	223	52.5
When did you learn about the death?		
Immediately	282	66.4
Kept from you for a little while	123	28.9
Kept from you for a long while	16	3.8
Attended the funeral	356	83.8
Participated in loss-related rituals	301	70.8
Experienced other significant deaths recently	172	40.5
Mean years since loss (0 – 5)	1.55	1.46
Mean months since loss (0 – 64)	18.86	16.97
Mean degree of exposure to death/death scene (0 – 5)	2.28	1.93

Note. Cell sizes vary due to missing data and/or participants indicated preference for not sharing information. Exposure to the death/death scene variable indicates any participant who endorsed witnessing the death or events leading up to the death. Degree of exposure to death/death scene variable was calculated summing all affirmative responses to items related to witnessing the death or events leading up to the death.

Recruitment and Procedures

Adult participants were recruited online via Amazon's Mechanical Turk (MTurk) program. The MTurk platform allows researchers to post "human intelligence tasks" (HITs) that workers can sign up for and complete remotely (n.d.). The study was advertised to adults currently living in the U.S. who have experienced the death of a loved one in the past five years. Inclusion criteria included 1) age 18 to 65 years, 2) current U.S. residency, 3) English fluency, and 4) bereaved within the past five years. The five year post-loss time frame corresponds with a nationwide cohort study conducted by Erlansen and colleagues (2017) who found an excess in overall mortality and elevated risk for developing various physical disorders (e.g., cirrhosis, cancer, lower respiratory tract diseases) within the first five years following the death of a loved one.

Compensation, Consent, and Ethics Approval

Due to the online nature of this study, there were related unique ethical concerns. As a participant recruitment and management platform, MTurk's generally low wages, as well as the inherent power imbalance between the researcher and participant, challenges the ethical principle of respect for autonomy (Gleibs, 2017). For example, after a participant completes a HIT, researchers have the ability to reject the HIT and refuse to compensate the participant for their work. Multiple processes were embedded in the design of this study in efforts to thwart such potential issues. First, all individuals who completed the screener were assigned a screener qualification (i.e., include vs. exclude). Since workers were only compensated for completing the screener once, assigning a qualification to all screener completers addressed the risk of an individual completing the screener multiple times and their additional efforts not being compensated. Next, all participants who met inclusion criteria first received

information describing the study procedures, potential for emotional distress due to the content of the survey, and voluntary nature of their participations (i.e., right to stop at any time). Contact information for study personnel was provided, in case participants had questions related to the study. Additionally, national crisis line phone numbers and links were provided in case participants experienced urgent distress.

Compensation for participant completion of the survey was calculated using the current federal minimum wage (U.S. Department of Labor, n.d.). Time estimates for HIT completion was based on a six questions per minute rate (Cloud Research, 2020). The survey battery included 129 multiple choice questions. Total estimated survey completion time was 21.5 minutes. Applying the aforementioned proposed rates, compensation was 21.5/60 x $7.25 = $2.60. The study was approved by the Institutional Review Board of the University of Missouri – Kansas City.

Procedure

Screening Process. A three item screener was created as a HIT on MTurk to identify individuals who have experienced bereavement within the past five years. Within this screener HIT, other inclusion criteria (e.g., age, English fluency, U.S. residency) was controlled for using MTurk's "worker qualification" setting embedded within the platform. The screener introduction read:

> Welcome to our qualification test/screener! You will be asked a few questions to determine if you are eligible to participate in our larger study. If your responses indicate that you are not eligible for our study, you will still be compensated for completing this screener, but you will not be granted the worker qualification to gain access to our larger study. If your responses indicate that you are eligible, you will be

> compensated for completing this screener and later assigned worker qualifications that give you access to our larger study. **ONCE YOU COMPLETE THE TEST/SCREENER, YOU WILL BE PROVIDED A UNIQUE CODE TO ENTER & SUBMIT USING THE ORIGINAL MTURK PAGE. IF YOU DO NOT SUBMIT THIS CODE, WE WILL NOT BE ABLE TO PAY YOU**

The warning text included in all capitalized letters served multiple roles: 1) to ensure payment was only provided to participants who completed the screener and, thus, were given a code to enter and 2) to signal to workers that the code they received was uniquely tied to them, aiming to communicate to individuals that we were tracking responses and, thus, serving as another effort to thwart multiple attempts per worker.

The first two screener items were included as distractors, aiming to mask inclusion criteria. The first item asked if the individual had any siblings, with response options "Yes" and "No." If individuals indicated yes, they were prompted with a follow-up item stating, "Which of the following best explains your experience(s): (Mark all that apply)," with response options including, 1) "My sibling(s) and I have the same two biological parents," 2) "My sibling(s) and I only share one biological parent," and 3) "My sibling(s) and I do not share any biological parents." The second distractor item asked the individual if they currently had any pets, with response options "Yes" and "No." If individuals selected yes, they were prompted with a follow-up item asking if they were the primary caregiver for their pet(s), with "Yes" and "No" response options. The contents of these items were created with the goals of developing items in relation to family systems and dynamics, which aligns with the bereavement-related screener item and plausibly suggests intent to identify a very specific population (i.e., individuals with/without siblings who are primary pet caregivers).

The last screener item asked workers to indicate which of the following best described their experience(s), with response options of "I have never experienced the death of a loved one (i.e., close family member or friend)" and "I have experienced the death of a loved one (i.e., close family member or friend)." For those who endorsed experiencing the death of a loved one, an additional item appeared asking the individual to indicate when their most recent loss occurred with response options of: "Less than 6 months ago," "Greater than 6 months ago but less than 1 year ago," "Between 1 to 5 years ago," and "Greater than 5 years ago." Rather than asking directly if the most recent death occurred within the last five years, multiple options were offered in efforts to again mask the inclusion criteria.

Each screener participant received $0.05 in compensation for their participation. Once screened, eligible participants were assigned qualifications on MTurk that allowed them access to the full study survey. Participants who did not meet inclusion criteria were excluded and assigned a separately created qualification to ensure they did not participate in the screener again.

Survey Completion. Screened participants who met inclusion criteria were assigned qualifications on MTurk granting them access to the full study survey. Eligible participants who opted into completing the survey were provided a link that took them to the survey (see Appendix A for measure battery) using REDCap, a secure, HIPAA compliant, web-based data collection application (Harris et al., 2009). Participants were instructed to complete the survey in one sitting and not to start the survey until they are able to allot the necessary time. Once finished, participants were thanked and provided onscreen debriefing information including a reiteration of contact information and resources for assistance if any distress occurred while participating in the study. Participant survey completion time was recorded to

ensure they completed the survey in one sitting and attended to the survey appropriately. Data from participants who completed the survey too quickly or too slowly were not included in final analyses. To identify outliers in terms of completion time, we followed guidelines proposed by Tabatchnick and Fidel (2013) who suggest computing standardized (*Z)* scores of the variable of interest, and then identifying cases that are above or below 3.29 standard deviations (*SD*) from the mean. Any cases ± 3.29 *SD* from the mean are considered outlying values and should not be included. Additionally, answers from participants who respond to open-ended items with nonsensical or unrelated content were excluded from analyses.

Recruitment Data. The total number of screener responses in the REDCap project was 1,033. Of these cases, 11 were deleted due to no item responses; leaving a count of 1,022 individuals screened. There were 725 (70.9%) individuals who indicated that they had experienced the death of a loved one (i.e., close family member or friend). Of those who endorsed experiencing the death of a loved one, there were two (0.3%) individuals who did not indicate when their most recent loss occurred. There were 141 (19.5%) responders who indicated their loss was less than six months ago, 201 (27.7%) who indicated more than six months ago but less than one year ago, 239 (33.0%) who indicated between one to five years ago, and 142 (19.6%) who indicated more than five years ago. Overall, the REDCap screener responses suggested there were 581 (80.1%) individuals who screened positive for study eligibility. Only 954 MTurk workers requested and were then given payment for their screener completion. Total cost of screening was $57.24. Of those compensated, 59.1% (*n* = 564) screened positive and 40.9% (*n* = 390) screened negative. Of the MTurk workers who screened positive, 456 (80.9%) requested and were given payment for their completion of the full study survey. Total cost for compensation to survey completers was $1,422.72. Prior to

data cleaning, the total number of survey responses within the REDCap project was 519 cases. See Figure 1 for the recruitment and data cleaning flowchart.

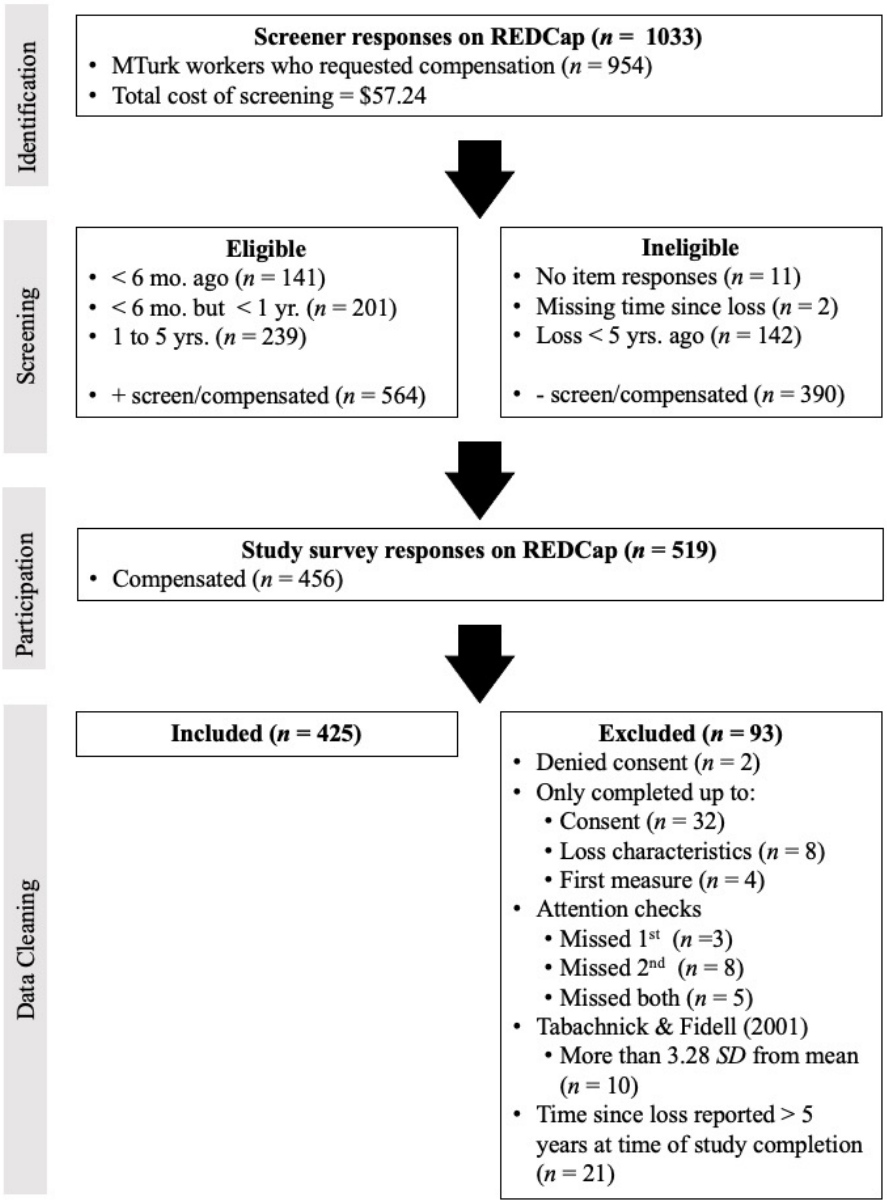

Figure 1. Study recruitment screening and data cleaning flowchart.

The incongruent number of MTurk workers paid versus the number of screener and survey responses in the REDCap project suggests there were individuals who did not complete the survey and therefore did not request payment. Alternatively, MTurk workers

may have shared the survey link with individuals who are not on MTurk or MTurk workers might have experienced issues (e.g., technical, environmental) that led to them restarting the survey and creating multiple cases within the REDCap project. Once data were cleaned, the number of remaining cases fell below the total number of MTurk workers compensated, suggesting success in the methodology of data quality control. See below for more information.

Data Cleaning and Screening. There were 519 cases reviewed in the data cleaning process. A total of 93 cases were deleted, leaving 425 participant responses for statistical analyses. Two cases were deleted due to denying consent to the survey and consequently, not completing the survey. Thirty-two cases were deleted for only completing the consent and not responding to any additional measures. There were eight cases deleted due to only completing initial loss characteristic data and therefore not having completed the measures necessary to be included in analyses. Four cases were deleted for only completing the first measure (i.e., PG-13-TR). Regarding attention check items, three cases were deleted for missing the first attention check only, eight people were deleted for missing the second attention check only, and five people were deleted for missing both attention checks. Following guidelines suggested by Tabachnick and Fidell (2001), 10 cases were deleted because participants' completion times were more than 3.28 standard deviations from the mean. There were 21 cases deleted because the time they reported since their loved one's death exceeded the five-year inclusion criterion.

Survey Measures

Demographics. Demographic information including gender identity, age, race, ethnicity, highest level of education, self-described income, sexuality, long-lasting or chronic

condition status (e.g., physical, visual, auditory, cognitive or mental, emotional), and disability or impairment status (e.g., sensory impairment, mobility impairment, learning disability, mental health disorder) was collected. Items for collecting demographic information were selected using a compilation of guidelines for more comprehensive and inclusive approaches to demographic data collection (see Fernandez et al., 2016; Hughes et al., 2016; Harvard Office of Regulatory Affairs and Research Compliance, 2020).

Loss History and Death Related Information. Items measuring characteristics of and exposure to the loss were taken from a clinical screening form developed for use in a specialty care outpatient behavioral health clinic for bereaved persons on the U.S. West Coast (Rynearson & Correa, 2010). Prior to starting the survey, participants were presented instructions requesting that they respond to loss-related questions thinking about the family member/close friend whose death that they reported experiencing within the past five years. Participants who had experienced multiple deaths within the past five years were asked to complete the survey thinking about the loss that was the worst or most impactful for them. Participants were asked to indicate their relationship to the deceased, when the loss occurred, and how or from what the person died. Participants were also asked a series of dichotomous—Yes/No—items including questions about their presence/witnessing of the death, attendance of the funeral, participation in other rituals related to the loss, and whether they have experienced any other significant deaths recently. An additional item was asked regarding the time frame of when they were informed of the death, with response options including "*Immediately,*" "*Kept from you for a little while*," and "*Kept from you for a long while*."

Grief Severity. The Prolonged Grief Disorder – 13 – Revised (PG-13-R) is a 13-item self-report measure assessing PGD symptoms (Prigerson et al., 2021). The PG-13-R was designed to map on to the *DSM-5-TR* criteria for PGD. Item 1 asks respondents if they have lost someone significant to them, with a dichotomous—Yes/No—response option. Item 2 asks respondents to indicate how many months it has been since their significant other died. Items 1 and 2 were excluded from the battery to avoid redundancy and minimize participant fatigue. Items 3 through 12 include PGD symptoms that the individual may or may not have experienced since the death, or as a result of the death. For these items, respondents are instructed to rate how they currently feel on a 5-point scale (1 = *not at all*, 2 = *slightly*, 3 = *somewhat*, 4 = *quite a bit*, 5 = *overwhelmingly*). Item 13 asks respondents to indicate if the symptoms have caused a significant impairment in functioning (i.e., social, occupational, or other important areas), with a dichotomous—Yes/No—response option. Total symptom severity scores are computed by summing items 3 through 12. Scores can range from 10 to 50, with larger scores indicating higher symptom severity. Symptom threshold scores of 30 or more suggest syndromal levels of grief. The PG-13-R has demonstrated excellent internal validity across multiple studies (Prigerson et al., 2021). Additionally, threshold scores of 30 in combination with the impairment criterion (item 13) have demonstrated excellent external validity for PGD (Prigerson et al., 2021). The measure exhibited excellent internal consistency ($\alpha = .94$) in the present study.

General Substance Use Screen. To screen participants' current general substance use, we used a modified item from the National Institute on Drug Abuse (NIDA) Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) Quick Screen (WHO ASSIST Working Group, 2002). To screen for general substance use, the NIDA quick screen

first asks about past year frequency of drug use for alcohol, tobacco products, prescription drugs for nonmedical reasons, and illegal drugs. Because we planned to include individuals who are as little as six months post-loss, a note was be added to the directions stating, *"If the death of your loved one occurred less than 1 year ago, please only think about your use since their death. If the death of your loved one occurred more than one year ago, please think about your use within the last year."* Item response options include *"Never," "Once or Twice," "Monthly," "Weekly,"* and *"Daily or Almost Daily."* Since the creation of this screener, new legal substances (i.e., nicotine vapes/e-cigarrettes) have been introduced. Indeed, although there have been declines in cigarette use amongst young adults, e-cigarette/nicotine vape use rates have increased in the U.S. in recent years (Johnston et al., 2020). To avoid confusion and/or misreporting, the present study used the NIDA Quick Screen past year use item with the following modifications: 1) "Tobacco Products" was divided into two options "Smoked Tobacco (e.g., cigarettes, cigars)" and "Smokeless Tobacco (e.g., chew, snuff, dip, snus)," 2) "Nicotine vape (e.g., Juul, e-cigarette, vapes)" was added as its own option.

Participants also completed a series of questions regarding their substance use during the year prior to the death of their loved one. There are currently no validated screens for pre-bereavement substance use. Consequently, participants were asked to complete a modified version of the above proposed NIDA Quick Screen past year use item. This modified version asked participants to think about the year prior to the death of their loved one and prompted them to indicate how many times they used each substance. Response options include *"Never," "Once or Twice," "Monthly," "Weekly,"* and *"Daily or Almost Daily."*

Individual Substance Use. After completing the general substance screen, participants were asked a series of follow-up questions for both tobacco and alcohol use if they indicated use in the past year or, for those within the first year of bereavement, since the death of their loved one for either substance.

Quantity and frequency items from the Global Adult Tobacco Survey (CDC, 2020b) were asked to tobacco and nicotine users. First, participants were asked to indicate what type of tobacco or nicotine product(s) they use. Next, they were asked to indicate, *"In the past 30 days, how many days on average did you use [product type]?"* with response options ranging from 0 to 30 days. Next, tobacco users were asked to indicate the average number of cigarettes/cigars/etc. they smoke per day of use. Nicotine vape users were asked to indicate the number of vape sessions they have in a typical day (Vogel et al., 2020). Responses to these items were continuous. A monthly quantity of tobacco/nicotine use variable was calculated by first finding the monthly quantity of use for each endorsed tobacco/nicotine product (multiplying reported days of use by reported daily number of cigarettes/cigars/sessions/etc. used) and then—for individuals who endorsed using multiple forms of tobacco/nicotine—summing the monthly quantity of use for each product.

Alcohol users completed the past 30 day quantity and frequency items of the alcohol consumption section of the WHO STEPS Instrument (WHO, 2005b). The WHO STEPS Instrument was originally developed as part of an approach to chronic disease risk factor surveillance. The alcohol consumption section contains three items that aim to measure the frequency and quantity of alcohol consumption over the last 30 days. The first of these items asks participants if they have consumed any alcohol within the past 30 days, with response options of "*Yes"* or *"No."* The next item prompts participants to report the number of

occasions where they had at least one standard alcoholic drink during the past 30 days. Last of these items asks participants to report how many standard drinks they had during one drinking occasion on average during the past 30 days. A graphic depicting examples of standard drink size by beverage type was presented along with the questionnaire (see Appendix A). Participants responded to frequency and quantity items using single integer responses. Self-report recollection of alcohol intake using a quantity-frequency questionnaire has demonstrated close accuracy to other methods of obtaining self-reported intake, such as daily diary and biochemical test approaches (Poikolainen et al., 2002). A quantity of drinks per month variable was calculated by multiplying the number of drinking occasions reported by the number of drinks per occasion reported.

Physical Activity. The Global Physical Activity Questionnaire (GPAQ; Armstrong & Bull, 2006) was developed by the World Health Organization to assess level of physical activity in different settings. Although initially designed as an interview with accompanying show/cue cards, self-administered versions have since been validated demonstrating comparable quality criteria (Chu et al., 2015; Wanner et al., 2017). Additionally, the use of show/cue cards has shown to have no significant impact on questionnaire validity (Rudolf et al., 2020). The GPAQ is a six to 16 item measure, with length being dependent on individual responses to five core dichotomous—Yes/No—response items that ask about involvement in: vigorous-intensity activity at work; moderate-intensity activity at work; walking or bicycle use to travel to and from places; vigorous-intensity sports, fitness, or recreation (leisure) activities; and moderate-intensity sports, fitness, or recreation (leisure) activities. If participants indicate *'Yes'* to involvement on any of these items, they are then asked to indicate number of days in a typical week that they engage in the activity and how much time

(hours/minutes) they spend on a typical day doing the activity. To measure sedentary behavior, item 16 in the questionnaire asks all participants to indicate how much time (hours/minutes) they spend on a typical day sitting or reclining. Total physical activity scores are calculated by summing the minutes of moderate and vigorous activity reported. Total sedentary behavior scores are calculated by converting participant responses to item 16 from hours and minutes to only minutes. The GPAQ has been demonstrated as a valid measure of moderate-to-vigorous physical activity (Cleland et al., 2014; Metcalf et al., 2018). Of note, under reporting of sedentary behavior may occur (Cleland et al., 2014). Participants will also be prompted in three additional items created for this study to think about the year prior to the death of their loved one and rate their engagement frequency in 1) high-intensity physical activity, 2) moderate-intensity, and 3) low-intensity physical activity during that year on an 11-point scale ranging from 0 (*Not at all*) to 10 (*Daily or more than once per day*).

Eating Behaviors and Diet Quality. Hunger, Smith, and Tomiyama (2020) explain that in eating and diet research using metrics such as food choice is an acceptable option. However, due to the debate on the scientific nature of food frequency questionnaires, 24-hour recalls, and other forms of food frequency assessments (see Archer et al., 2013; Archer et al., 2018), along with the inconsistency in research examining the relationship between eating behaviors and health outcomes, this study followed a HAES approach and examine both eating behavior and diet quality.

Eating behavior was measured using the Intuitive Eating Scale-2 (IES-2; Tylka & Kroon Van Diest, 2013). The IES-2 is a 23-item self-report measure that presents a series of statements related to eating behaviors and asks participants to indicate the degree to which they agree with each statement. Response options are on a 5-point scale ranging from 1

(*Strongly Disagree*) to 5 (*Strongly Agree*). Example items include *"I rely on my hunger signals to tell me when to eat"* and *"I am able to cope with my negative emotions (e.g., anxiety, sadness) without turning to food for comfort."* Total IES-2 scale scores are calculated by first reverse scoring items 1, 2, 4, 5, 9, 10, and 11 and then summing all items and dividing by 23 to create an average score, with higher scores indicating more intuitive eating engagement. The measure demonstrated good internal consistency ($\alpha = .82$) in the present study. Participants were also prompted in an additional item created for this study to think about the year prior to the death of their loved one and rate their eating behaviors during that year on an 11-point scale ranging from 0 (*Very Poor*) to 10 (*Excellent*).

Diet quality was assessed using the Rapid Eating Assessment for Participants – Shortened Version (REAP-S; Segal-Isaacson et al., 2004). The REAP-S is a 16-item measure that assesses intake of whole grains, calcium-rich foods, fruits and vegetables, fat, saturated fat and cholesterol, sugary beverages and foods, sodium, and alcoholic beverages. Participants are asked to score each item on a 3-point scale where 1 = *usually/often*, 2 = *sometimes*, and 3 = *rarely/never*. Total scores are calculated by summing all items and can range from 16 to 81, where higher scores indicate higher diet quality. A study conducted in 2018 examining the relationship between the REAPS and other indicators of diet quality (e.g., nutrient density of diet, dietary potential renal acid loads, urine pH, plasma vitamin C concentrations) supported the use of the REAP-S as a tool for assessing diet quality (Johnston et al., 2018). Internal consistency was not assessed for this scale since measures such as the REAPS-S often do not have good reliability due to the wide range of indicators/behaviors examined. Participants were also prompted in an additional item created

for this study to think about the year prior to the death of their loved one and rate their diet quality during that year on an 11-point scale ranging from 0 (*Very Poor*) to 10 (*Excellent*).

Grief-Related Experiential Avoidance. Grief-related experiential avoidance was measured using the Anxious Avoidance subscale of the Depression and Anxious Avoidance in Prolonged Grief Questionnaire (DAAPGQ; Boelen & van den Bout, 2010). At this time, no independent measures of grief-related experiential avoidance exist. However, past research (e.g., Boelen & Eisma, 2015; Boelen & van den Bout, 2010) has used this subscale as a measure of experiential avoidance in the context of grief. This subscale includes four items. Example items include "*I avoid to dwell on the fact that [--] is dead and will never return*" and "*I avoid to dwell on painful thought and memories connected to his/her death*." Items are rated on an 8-point scale ranging from 1 (*not at all true for me*) to 8 (*completely true for me*). Scores are calculated by summing all items and can range from four to 32 with higher scores indicated higher levels of grief-related experiential avoidance. The measure demonstrated good internal consistency ($\alpha = .84$) in the present study.

Grief-Related Rumination. The Utrecht Grief Rumination Scale (UGRS; Eisma et al., 2012) is a 15-item self-report measure of grief-specific rumination; including recurrent, repetitive, and self-focused thoughts about the causes and consequences of the death and related negative feelings. This measure was originally created in Dutch, but has been translated and found both reliable and valid in English (Eisma et al., 2014). Participants are asked how frequently in the past month they engaged in each of the rumination items. Example items include,*"…wonder why this had to happen to you and not someone else?*" and *"…think about the unfairness of this loss*?" Each item is rated on a scale ranging from 1 (*never)* to 4 (*very often*). Total scores are calculated by summing all items, and can range

from 15 to 75 with higher scores indicating higher frequency of grief-related rumination. The measure exhibited excellent internal consistency (α = .95) in the present study.

Data Analysis Plan

Power and Sample Size. Power analyses were conducted using G*Power (Faul, 2008) to calculate the sample size necessary to detect a small effect size with a model including at least five predictor variables. Results of sample size analyses are presented in Table 3. Estimated sample sizes ranged from 311 to 697. Due to constraints related to finances and time, the goal was to collect data from 400 participants.

Table 3. *Sample sizes needed with five predictor variables and an effect size of* f^2

	Power of .80	Power of .70
α	*N*	*N*
0.05	395	311
0.01	588	484
0.005	670	559
0.004	697	584

Specific hypothesis and exploratory question analyses plans were as follows:

Hypothesis 1*:* Pearson correlations were conducted to examine the associations between grief symptom severity and the six post-death "Big 4" modifiable health behavior indicators (i.e., tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality).

Exploratory Question 1: A series of regression analyses were conducted examining whether the relationships between grief severity (IV) and the six post-death "Big 4" modifiable health behavior indicators (DVs) maintain after controlling for engagement in the six "Big 4" modifiable health behavior indicators prior to death of their loved one (covariate). A separate analysis

was conducted for each of the six "Big 4" health behavior indicators, for a total of six analyses.

Hypothesis 2: Pearson correlations were conducted to examine the associations between emotion regulation variables (i.e., experiential avoidance and rumination) and the six post-death "Big 4" modifiable health behavior indicators (i.e., tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality).

Exploratory Question 2: A series of regression analyses were conducted examining whether the relationships between emotion regulation variables (IV) and the six post-death "Big 4" modifiable health behavior indicators (DVs) maintain after controlling for engagement in the six "Big 4" modifiable health behavior indicators prior to death (covariate). A separate analysis was conducted with each of the six "Big 4" health behavior indicators, for a total of six analyses.

Hypothesis 3: A series of double moderation analyses were conducted using the PROCESS macro (Hayes, 2018) examining whether emotion regulation variables (i.e., experiential avoidance, rumination) moderate the relationships between grief symptom severity and the six "Big 4" health behavior indicators (i.e., tobacco/nicotine use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality). A separate double moderation model was run for each of the six "Big 4" health behavior indicators with both emotion regulation variables as moderators using PROCESS macro model 2 (see figure 2), for a total of six models. Any demographic information demonstrated as significantly associated in preliminary

analyses were added as covariates to the model. Initial moderation analyses were run with 95% confidence interval (CI) level. However, in order to protect against inflation of type I error, moderation models with significant moderation effects were also run with CIs adjusted to the 99% CI level. Adjusting CI level from 95% to 99% increases the precision of the model (Altman, 2005).

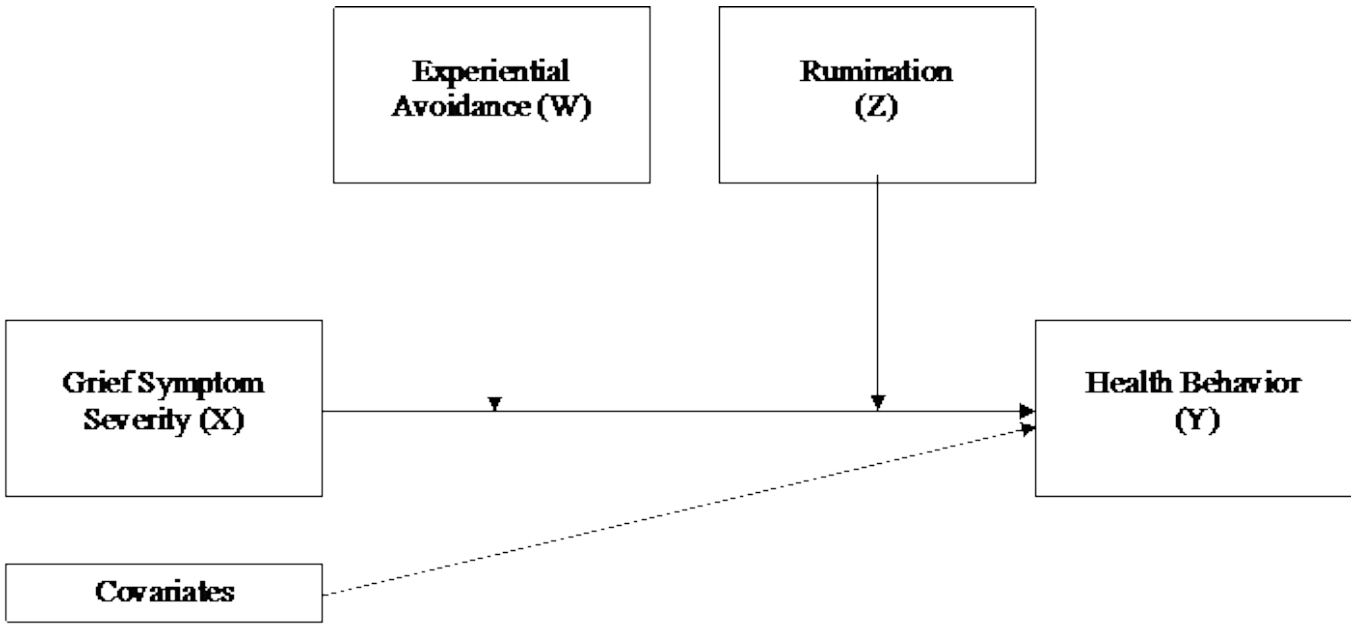

Figure 2. Graphical representation of double moderation model.

CHAPTER 4

RESULTS

Hypothesis 1

Regarding Hypothesis 1, associations between grief symptom severity and the six post-death "Big 4" modifiable health behavior indicators (i.e., tobacco use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality) are presented in Table 4. In contrast to the original hypothesis, tobacco use was not significantly associated with grief symptom severity. As expected, however, there was a significant, positive association between grief symptom severity and alcohol use. In contrast to the original hypotheses, grief symptom severity was positively associated with physical activity levels and negatively associated with sedentary behavior. As expected, grief symptom severity was negatively associated with eating behavior and diet quality.

Exploratory Question 1

To address the first exploratory question, regression analyses were used to examine the extent to which participants' pre-death self-ratings of the six "Big 4" modifiable health behavior indicators influence the demonstrated relationships between grief symptom severity and post-death health behavior engagement. As seen in Table 5, the association between grief symptom severity and post-death tobacco use remained not significant after accounting for pre-death tobacco use. Grief symptom severity was no longer significantly associated with post-death alcohol use or physical activity, and remained not significantly associated with post-death health behavior engagement after accounting for participants' pre-death health behavior engagement for alcohol use and physical activity.

Table 4

Descriptive statistics and correlations for main model variables

Variable	*M*/*n*	*SD*/%	1	2	3	4	5	6	7	8	9
1. Grief severity	31.10	9.92	–								
2. Experiential avoidance	20.89	6.47	.56**								
3. Rumination	40.75	13.75	.74***	.50***							
4. Tobacco use	141.13	642.94	-.04	.03	.06						
5. Alcohol use	43.79	115.95	.15**	.11*	.17***	.03					
6. Physical activity	2370.32	1799.66	.20***	.23***	.20***	.07	.06				
7. Sedentary behavior	615.16	936.13	-.37***	-.28***	-.35***	.01	-.13**	-.16***			
8. Eating behavior	3.37	.48	-.18***	-.05	-.07	-.02	.06	.08	-.03		
9. Diet quality	24.27	3.93	-.30***	-.24***	-.29***	-.06	-.08	-.14**	.08	.10*	–
10. Age	36.82	10.07	-.08	-.08	-.06	-.04	-.04	.01	.11*	.00	.19***
11. White	339	79.80	-.08	-.03	-.03	.09	.15**	.02	.11*	-.01	.09
12. Asian/Asian American	40	9.40	.05	.01	-.01	-.06	-.11*	-.12*	-.04	-.07	-.12*
12. Partnered	308	72.50	.14**	.15**	.15	.04	.10*	.11*	-.16**	.03	-.07
13. Male	215	50.60	.09	.03	-.01	-.10*	.03	.04	-.07	.09	-.04
14. Female	203	47.80	-.07	-.00	.01	.10*	.03	-.05	.09	-.09	.03
15. Violent death	193	45.40	.32**	.33**	.37**	-.06	.19**	.14**	-.28**	.02	-.18***
16. Degree of exposure	2.28	1.93	.46**	.32**	.45**	.05	.22**	.25**	-.28**	-.05	.12**

*$p < .05$, **$p < .01$, ***$p < .001$

Note. Cell sizes vary due to missing data. For partnered variable, 1 = participants who indicated they were married or in a relationship and 0 = participants who answered the relationship item but did not indicate having a partner(s). For violent loss variable, 1 = death types of murder/homicide, suicide, overdose, accident, and natural disaster and 0 = illness related deaths.

Table 5
Regressions with grief symptom severity and pre-death engagement

Variable	B	SE B	β	*t*	*p*
Tobacco use					
Grief severity	-4.27	3.70	-.07	-1.15	.25
Pre-death smoked tobacco use	44.87	22.35	.11	2.01	.05
Pre-death smokeless tobacco use	-79.78	32.60	-.16	-2.45	.02
Pre-death nicotine vape use	90.24	29.52	.19	3.06	<.00
Alcohol use					
Grief severity	.90	.58	.08	1.56	.12
Pre-death alcohol use	21.79	4.53	.24	4.81	<.00
Physical activity					
Grief severity	6.17	4.70	.07	1.31	.19
Pre-death high-intensity activity	53.99	18.36	.18	2.94	<.00
Pre-death mod-intensity activity	67.91	20.02	.20	3.39	<.00
Sedentary behavior					
Grief severity	-49.40	8.76	-.27	-5.64	<.00
Pre-death high-intensity activity	-143.05	34.24	-.25	-4.18	<.00
Pre-death mod-intensity activity	-1.61	37.33	-.00	-.04	.97
Eating Behavior					
Grief Severity	-.01	.00	-.18	-3.78	<.00
Pre-death eating behavior	.04	.01	.20	4.20	<.00
Diet Quality					
Grief severity	-.12	.02	-.30	-6.39	<.00
Pre-death diet quality	.15	.08	.09	2.00	.05

Note. Cell sizes vary due to missing data.

Grief symptom severity remained significantly associated with post-death sedentary behaviors, $F(3,421) = 32.813$, $p < .001$, $R^2 = .19$, eating behavior, $F(2, 417) = 16.347$, $p < .001$, $R^2 = .07$, and diet quality, $F(2,418) = 22.58$, $p < .001$, $R^2 = .10$, while controlling for participants' reported pre-death behavior.

Hypothesis 2

In regard to Hypothesis 2, associations between emotion regulation variables (i.e., experiential avoidance and rumination) and the six post-death "Big 4" modifiable health behavior indicators (i.e., tobacco use, alcohol use, physical activity, sedentary behavior, eating behaviors, and diet quality) are also presented in Table 4. No statistically significant association was found between experiential avoidance and tobacco use. Experiential

avoidance had statistically significant positive association with alcohol use and physical activity, and statistically significant negative associations with sedentary behavior and diet quality. No statistically significant association was found between experiential avoidance and eating behaviors. No statistically significant association was found between rumination and tobacco use. Rumination had statistically significant positive associations with alcohol use and physical activity, and significant negative associations with sedentary behavior and diet quality. No significant associations were found between rumination and eating behaviors

Exploratory Question 2

Regression analyses were also used to examine the second exploratory question regarding whether the relationships between emotion regulation variables and the six post-death "Big 4" modifiable health behavior indicators would maintain after controlling for pre-death health behaviors (covariate). The association between the emotion regulation variables and post-death tobacco use remained non-significant after accounting for pre-death tobacco use. Neither of the emotion regulation variables remained significantly associated with post-death alcohol use after accounting for participants' pre-death engagement. As seen in Table 6, experiential avoidance remained significantly associated with post-death physical activity, $F(4,420) = 19.517$, $p < .001$, $R^2 = .16$**,** after accounting for pre-death behavior. However, rumination was no longer associated with post-death physical activity. Both emotion regulation variables remained significantly associated with post-death sedentary behavior, $F(4, 420) = 23.971$, $p < .001$, $R^2 = .19$, after controlling for pre-death behavior. The association between emotion regulation variables and post-death eating behavior was no longer significant after accounting for pre-death eating behavior. Both emotion regulation

variables remained significantly associated with post-death diet quality, $F(3,417) = 17.65$, $p < .001$, $R^2 = .11$, after accounting for pre-death behavior.

Table 6
Regressions with emotion regulation variables and pre-death engagement

Variable	*B*	*SE B*	β	*t*	*p*
Tobacco use					
Experiential avoidance	.58	5.66	.01	.10	.92
Rumination	2.93	2.77	.06	1.06	.29
Pre-death smoked tobacco use	39.26	22.28	.10	1.76	.08
Pre-death smokeless tobacco use	-105.44	32.32	-.21	-3.26	<.00
Pre-death nicotine vape use	84.84	29.58	.18	2.87	<.00
Alcohol use					
Experiential avoidance	.26	.98	.01	.26	.79
Rumination	.82	.47	.10	1.75	.08
Pre-death alcohol use	21.26	4.50	.23	4.73	<.00
Physical activity					
Experiential avoidance	23.54	7.51	.16	3.13	<.00
Rumination	-1.75	3.79	-.03	-.46	.65
Pre-death high-intensity activity	51.30	18.38	.17	2.79	<.00
Pre-death moderate-intensity activity	69.99	19.81	.21	3.53	<.00
Sedentary behavior					
Experiential avoidance	-34.94	14.19	-.13	-2.46	.01
Rumination	-23.27	7.16	-.18	-3.25	<.00
Pre-death high-intensity activity	-139.59	34.72	-.24	-4.02	<.00
Pre-death mod-intensity activity	-8.95	37.42	-.01	-.24	.81
Eating Behavior					
Experiential avoidance	-.00	.00	-.02	-.31	.76
Rumination	-.00	.00	-.07	-1.28	.20
Pre-death eating behavior	.04	.01	.21	4.31	<.00
Diet Quality					
Experiential avoidance	-.09	.03	-.14	-2.63	.01
Rumination	-.07	.02	-.23	-4.32	<.00
Pre-death diet quality	.20	.08	.12	2.63	<.00

Note. Cell sizes vary due to missing data.

Hypothesis 3

As presented in Figure 2, to address Hypothesis 3, double moderation analyses were evaluated using the PROCESS macros for SPSS (model 2) to investigate whether the emotion regulation variables moderate the relationships between grief symptom severity and the six post-death "Big 4" health behavior indicators.

Prior to running moderation analyses, associations between outcome constructs of interest and demographic variables were analyzed in preliminary analyses to determine the need to control for certain variables within models (see Table 4). Monthly tobacco use was negatively associated with male-identifying participants where male participants engaged in less use, $r(423) = -.10$, $p = .04$, and positively associated with female-identifying participants, where female participants engaged in more use, $r(423) = .10$, $p = .04$. Monthly alcohol use was negatively associated with Asian identifying participants, where identifying as Asian was associated with less alcohol use, $r(423) = -.11$, $p = .02$, and positively associated with White identifying participants, $r(423) = .15$, $p = .002$, and partnered participants, $r(412) = .10$, $p = .04$, where identifying as these groups was associated with more use. Weekly physical activity was negatively associated with Asian/Asian American identifying participants, $r(423) = -.12$, $p = .02$, and positively associated with partnered participants, $r(412) = .11$, $p = .03$, where identifying with these groups was associated with less and more engagement in physical activity, respectively. Sedentary behavior was positively associated with age, $r(391) = .11$, $p = .04$, and White identifying participants, $r(423) = .11$, $p = .02$, where higher age and identifying as White were associated with more reported sedentary behavior. Being partnered was negatively associated with sedentary behavior, where having a partner was associated with less reported sedentary behavior, $r(412) = -.16$, $p = .001$. Eating behavior was not significantly associated with any of the demographic variables. Diet quality was positively associated with age, where older age was associated with better diet quality, $r(393) = .19$, $p < .001$, and identifying as Asian/Asian American, was negatively associated, where identifying as Asian/Asian American was associated with worse diet quality, $r(422) = -.12$, $p = .02$.

Associations between outcome constructs of interest and death-related variables were also analyzed to determine the need to control for certain variables within models. Only two of the death-related variables (i.e., violent death, degree of exposure to death) demonstrated significant associations with model variables. Violent death was significantly associated with alcohol use, sedentary behavior, physical activity, and diet quality, where experiencing a violent loss was associated with more alcohol use, $r(421) = .19$, $p < .001$, less sedentary behavior, $r(424) = -.28$, $p < .001$, more physical activity, $r(424) = .14$, $p < .001$, and worse diet quality, $r(422) = -.18$, $p < .001$. Degree of exposure to death was significantly associated with alcohol use, physical activity, sedentary behavior, and diet quality, where more exposure to the death was associated with more alcohol use, $r(408) = .22$, $p < .001$, less sedentary behavior, $r(408) = -.28$, $p < .001$, more physical activity, $r(408) = .25$, $p < .001$, and worse diet quality, $r(406) = -.12$, $p = .01$. Each of these relevant variables were added as covariates to their respective models.

Tobacco Use. Despite non-significant regression analyses, moderation analyses with tobacco use were still run, in order to examine the presence of interaction effects. The overall model including covariates was statistically significant, $F(7, 417) = 2.25$, $p = .03$, $R^2 = .04$, where 4% of the variance in post death tobacco use was explained by the model. In regard to main effects, grief symptom severity, $b = 7.22$, $t(417) = .67$, $p = .50$, experiential avoidance, $b = 15.48$, $t(417) = 1.02$, $p = .31$, and rumination, $b = 18.27$, $t(417) = 1.93$, $p = .05$, did not account for a significant proportion of the variance in post death tobacco use. Identifying as female, $b = 142.58$, $t(417) = .65$, $p = .51$, and identifying as male, $b = 43.60$, $t(417) = .20$, $p = .84$, were not significant adjustors in the model. Grief x experiential avoidance, $F(1, 417) =$

.80, p = .37, grief x rumination, $F(1, 417) = 1.32$, p = .25, and grief x experiential avoidance x rumination, $F(2, 417) = .01$, p = .13, interactions were not observed in the model.

Alcohol Use. For alcohol use, the overall model including covariates was statistically significant, $F(10, 388) = 4.10$, $p < .001$, $R^2 = .10$, where 10% of the variance in post-death alcohol use can be explained by the variables included in the model. In regard to main effects, grief symptom severity, b = -.14, $t(388) = -.08$, p = .73, experiential avoidance, b = 1.38, $t(388) = .55$, p = .94, and rumination, b = -1.26, $t(388) = -.79$, p = .43, did not account for a significant proportion of the variance in post-death alcohol use. Having a partner, b = 3.91, $t(388) = .29$, p = .77, identifying as Asian/Asian American, b = -18.23, $t(388) = -.76$, p = .45, and identifying as White, b = 30.46, $t(388) = 1.82$, p = .07, were not significant adjusters in the model. Grief x experiential avoidance, $F(1, 388) = .47$, p = .49, grief x rumination, $F(1, 388) = 1.21$, p = .96, and grief x experiential avoidance x rumination, $F(2, 388) = .62$, p = .54, interactions were not observed in the model.

Physical Activity. In regard to physical activity, the overall model including covariates was statistically significant, $F(9, 389) = 6.18$, $p < .001$, $R^2 = .13$, where 13% of the variance in physical activity can be explained by the variables included in the model. In regard to main effects, grief symptom severity accounted for a significant proportion of the variance in post-death physical activity, b = -48.08, $t(389) = -3.18$, p = .002. Experiential avoidance did not account for a significant proportion of the variance in post-death physical activity, b = -11.95, $t(389) = -.55$, p = .58, and rumination did not account for a significant proportion of the variance in post-death physical activity, b = -22.48, $t(389) = -1.64$, p = .10. Having a partner did not significantly adjust the model for post-death physical activity, b = 31.04, $t(389) = .27$, p = .78, nor did identifying as Asian or Asian American, b = -323.67,

$t(389) = -1.90$, $p = .06$, or the death being violent, $b = -125.31$, $t(389) = -1.28$, $p = .20$. Degree of exposure to the death did significantly adjust the model, $b = 62.77$, $t(389) = 2.34$, $p = .02$. The grief x experiential avoidance, $F(1, 389) = 3.03$, p = .08, and grief x rumination, $F(1, 389) = 3.83$, $p = .05$, interactions were not statistically significant. However, a statistically significant grief x experiential avoidance x rumination interaction was observed, $F(2, 389) = 6.70$, $p = .001$, $\Delta R^2 = .03$.

To probe this interaction, conditional effects for the model were analyzed where the moderators were examined in combination across low (one *SD* below the mean), average (mean), and high (one *SD* above the mean) levels. See Table 7 for significant conditional effects. Results revealed that, at high levels of experiential avoidance and high levels of rumination, there is a positive relationship between grief symptom severity and post-death physical activity, $b = 23.95$, $SE = 9.67$, $t(389) = 2.48$, $p = .01$. Across the remaining combinations of different levels of the moderators, grief symptom severity was not associated with post-death physical activity (all p's > .05).

When the model was analyzed at the 99% CI level, the CI of the previously significant conditional effect (when experiential avoidance and rumination levels were high) contained zero, suggesting that the effect was not statistically significant at high levels of experiential avoidance and rumination when restricting CIs to account for multiple comparisons.

Table 7
Significant conditional effects of the grief symptom severity on health behaviors at values of the emotion regulation moderators

Variable							
Experiential Avoidance	Rumination	Effect	*SE*	*t*	*p*	*LLCI*	*ULCI*
Physical Activity							
High	High	23.95	9.67	2.48	.01	4.93	42.97
Sedentary Behavior							
Average	Low	-49.40	14.43	-3.43	<.00	-77.78	-21.01
High	Low	-72.16	18.31	-3.94	<.00	-108.17	-36.16
High	Average	-41.55	15.55	-2.67	.01	-72.14	-10.96
Eating Behavior							
Low	Low	-.02	.00	-6.25	<.00	-.0324	-.0169
Low	Average	-.02	.00	-3.72	<.00	-.0252	-.0078
Average	Low	-.02	.00	-4.98	<.00	-.0265	-.0115
Average	Average	-.01	.00	-2.98	<.00	-.0180	-.0037
High	Low	-.01	.00	-2.73	.01	-.0229	-.0037

Note. Low indicates one *SD* below the mean, average is the mean, and high indicates one *SD* above the mean.

Sedentary Behavior. For sedentary behavior, the overall model including covariates was statistically significant, $F(10,363) = 11.49$, $p < .001$, $R^2 = .24$, where 24% of the variance in sedentary behavior can be explained by the variables included in the model. In regard to main effects, grief symptom severity did not account for a significant proportion of the variance in post-death sedentary behavior, $b = -34.82$, $t(363) = -1.23$, $p = .22$. Experiential avoidance did account for a significant proportion of the variance in post-death sedentary behavior, $b = 88.78$, $t(363) = 2.23$, $p = .03$, and rumination also accounted for a significant

proportion of the variance in post-death sedentary behavior, b = -87.96, $t(363)$ = -3.47, p < .001. Having a partner significantly adjusted the model, b = 502.26, $t(363)$ = 2.45, p = .01. Similarly, the death being violent also significantly adjusted the model, b = 487.94, $t(363)$ = 2.62, p = .01. Age did not significantly adjust the model, b = 11.70, $t(363)$ = 1.38, p = .17, nor did identifying as White, b = 361.69, $t(363)$ = 1.60, p = .11, or one's degree of exposure to the death, b = -82.05, $t(363)$ = -1.62, p = .11.

Although there was no main effect for grief symptom severity on post-death sedentary behavior, statistically significant grief x experiential avoidance, $F(1, 363) = 7.47$, p = .01, ΔR^2 = .02, and grief x rumination, $F(1, 363) = 10.49$, p = .001, ΔR^2 = .02, interactions were found in the model. A statistically significant grief x experiential avoidance x rumination interaction was also observed, $F(2, 363) = 6.16$, p = .002, ΔR^2 = .03.

To probe these interactions, conditional effects for the model were analyzed where the moderators were examined in combination across low (one *SD* below the mean), average (mean), and high (one *SD* above the mean) levels. There were three significant conditional effects demonstrated (see Table 7). At average levels of experiential avoidance and low levels of rumination, there was a significant negative relationship between grief symptom severity and post-death sedentary behavior, b = -49.40, SE = 14.43, $t(379)$ = -3.42, p < .001, where increased grief symptom severity was associated with decreased sedentary behavior. At high levels of experiential avoidance and low levels of rumination, there was a significant negative relationship between grief symptom severity and post-death sedentary behavior, b = -72.16, SE = 18.31, $t(379)$ = -3.94, p < .001, where increased grief symptom severity was associated with decreased sedentary behavior. Finally, at high levels of experiential avoidance and average levels of rumination, there was a significant negative relationship

between grief symptom severity and post-death sedentary behavior, b = -41.55, SE = 15.55, $t(379)$ = -2.67, p = .01, where increased grief symptoms severity was associated with decreased sedentary behavior.

When the model was analyzed at the 99% CI level, the CIs of the main effect for experiential avoidance and the partner covariate now contained zero, suggesting that the effects were not statistically significant when restricting CIs to account for multiple comparisons. However, all of the CIs for the previously significant conditional effects did not contain zero, suggesting that they remained statistically significant after restricting CIs to account for multiple comparisons.

Eating Behaviors. In regard to post death eating behaviors, the overall model was statistically significant, $F(5, 416) = 10.42$, $p < .001$, $R^2 = .11$, where 11% of the variance in eating behaviors can be predicted by the variables included in the model. In regard to main effects, grief symptom severity, b = -.05, $t(416)$ = -6.85, $p < .001$, and rumination, b = -.02, $t(416)$ = -2.36, p = .02, were significant predictors of post death eating behaviors. Experiential avoidance was not a significant predictor of post-death physical activity, b = -02, $t(416)$ = -1.77, p = .08. Grief x experiential avoidance, $F(1, 416) = 6.23$, p = .01, ΔR^2 = .01, and grief x rumination, $F(1, 416) = 10.32$, p = .001, ΔR^2 = .02, interactions were found in the model. A statistically significant grief x experiential avoidance x rumination interaction was also observed, $F(2, 416) = 15.59$, $p < .0001$, ΔR^2 = .07.

To probe these interactions, conditional effects for this model were analyzed where the moderators were examined in combination across low (one *SD* below the mean), average (mean), and high (one *SD* above the mean) levels. There were five significant conditional effects demonstrated (see Table 7). At low experiential avoidance levels and low rumination

levels, there was a significant negative relationship between grief symptom severity and post-death eating behavior, b = -.02, SE = .00, t(416) = -6.25, p < .001, where increased grief symptom severity was associated with decreased eating behavior. Similarly, at low experiential avoidance levels and average rumination levels, there was a significant negative relationship between grief symptom severity and post-death eating behavior, b = -.02, SE = .00, t(416) = -3.72, p < .001, where increased grief symptom severity was associated with decreased eating behavior. At average experiential avoidance levels and low rumination levels, there was a significant negative relationship between grief symptom severity and post-death eating behavior, b = -.02, SE = .00, t(416) = -4.97, p < .001, where increased grief symptom severity was associated with decreased eating behavior. Similarly, at average experiential avoidance levels and average rumination levels, there was a significant negative relationship between grief symptom severity and post-death eating behavior, b = -.01, SE = .00, t(416) = -2.98, p = .003, where increased grief symptom severity was associated with decreased eating behavior. Finally, at high experiential avoidance levels and low rumination levels, there was a significant negative relationship between grief symptom severity and post-death eating behavior, b = -.01, SE = .00, t(416) = -2.73, p = .01, where increased grief symptom severity was associated with decreased eating behavior.

When the model was analyzed at the 99% CI level, the CI of the main effect for rumination now contained zero. However, all of the CIs for the previously significant conditional effects did not contain zero, suggesting that they remained statistically significant after restricting CIs to account for multiple comparisons.

Diet Quality. For diet quality, the overall model including covariates was statistically significant, F(9, 368) = 6.09, p < .001, R^2 = .13, where 13% of the variance in diet quality

can be explained by the variables included in the model. In regard to main effects, grief symptom severity, b = -.07, t(368) = -1.11, p = .27, experiential avoidance, b = -.05, t(368) = -.50, p = .62, and rumination, b = -.06, t(368) = -1.07, p = .29, were not predictors of post-death diet quality. Age significantly adjusted post-death diet quality, b = .05, t(368) = 2.58, p = .01, whereas identifying as Asian/Asian American did not significantly adjust the model, b = -.85, t(368) = -1.16, p = .25. Violent loss, b = .26, t(368) = .61, p = .55, and degree of exposure to the death, b = .05, t(368) = .39, p = .69, were not significant adjusters to the model. Grief x experiential avoidance, F(1, 368) = .00, p = .97, grief x rumination, F(1, 368) = .15, p = .70, and grief x experiential avoidance x rumination, F(2, 368) = .11, p = .90, interactions were not observed in the model.

CHAPTER 5

DISCUSSION

Rates of bereavement have demonstrated increases in part due to the impact of the COVID-19 pandemic on the rise in death rates since 2020 (Tang & Xiang, 2021; Verdery et al., 2020). Relatedly, compared to other causes of death, COVID-19-related deaths have been associated with higher rates of probable PGD compared to other natural deaths (Gang et al., 2022). Recent increases in drug-involved overdose deaths (CDC, 2021c) and homicide rates (Ahmad & Cisewski, 2023) undoubtedly further contribute to increases in the U.S. bereavement rate. Though most bereaved individuals will not meet formal criteria for PGD, many individuals will experience significant PGD symptoms following the death of their loved one. Regardless of formal PGD diagnosis, many bereavement experiences impact individuals' physical health in addition to mental health. Indeed, within the first five years following the death of a loved one, bereaved individuals demonstrate excess mortality rates and elevated risks of developing a variety of physical health issues (e.g., cirrhosis, cancer, lower respiratory tract diseases; Erlansen et al., 2017).

Although many studies examine the health of bereaved individuals in comparison to non-bereaved individuals, little is understood regarding differences in health within bereaved populations. Specifically, few studies have examined the effect of grief severity on health behavior engagement. Maladaptive emotion regulatory processes are key contributors to understanding differences in grief symptom severity for those meeting criteria for PGD (Eisma & Stroebe, 2021). In efforts to regulate heightened emotional experiences (e.g., yearning, emotional pain, emotional numbing, intense loneliness), individuals with PGD may be more likely to engage in maladaptive coping via health risk behaviors, which leads to

increased risk of developing physical health problems. Better understanding differences in the health behavior engagement of bereaved individuals may aid in explaining excess mortality rates and incidents of physical health concerns. The present study aimed to examine the relationship between grief severity and the six “Big 4” modifiable health behaviors following bereavement, with a particular focus given to further understanding the moderating role of emotion regulatory processes in these relationships.

Overall, results supporting the original hypotheses that grief severity would be associated with each of the six "Big 4" modifiable health behaviors were mixed in that all but one (i.e., tobacco use) of the examined modifiable health behaviors demonstrated significant associations. Of the five significant associations found, three aligned with the original hypotheses (i.e., alcohol use, eating behavior, diet quality) and two did not (i.e., physical activity, sedentary behavior). Similarly, results regarding hypothesized associations between emotion regulation variables and each of the six ”Big 4” modifiable health behaviors were mixed. Tobacco use and eating behavior were not significantly associated with either emotion regulation process. Of the significant associations demonstrated with experiential avoidance, two aligned with our original hypotheses (i.e., alcohol use, diet quality) and two did not (i.e., physical activity, sedentary behavior). Similarly, of the significant associations demonstrated with rumination, two aligned with the original hypotheses (i.e., alcohol use, diet quality) and two did not (i.e., physical activity, sedentary behavior).

When examining the moderating roles of emotion regulation variables in the relationship between grief symptom severity and post-death modifiable health behaviors, the overall models for each post-death health behavior demonstrated significance. However, moderation effects were only evidenced in three of the models (i.e., physical activity,

sedentary behavior, eating behavior). Below key findings from each of the examined modifiable health behaviors are discussed individually.

Grief Severity, Emotion Regulation, and Tobacco Use

Overall, we found tobacco use was not associated with grief symptom severity nor either of the emotion regulation variables in any of the analyses. Findings align with Franks and colleagues (2002) whose research demonstrated no significant difference in tobacco use or quit rates in the two years following spousal bereavement. Interestingly, findings related to post-death tobacco use did not support Neria and colleagues' (2007) previous findings demonstrating increases in cigarette smoking in those with clinically significant levels of grief 2.5 to 3.5 years post-death or Parisi and colleagues' (2019) finding that complicated grief predicted increases in smoking. There may be multiple reasons for this incongruency including the sample being nationwide and inclusive of a breadth of types of death losses versus being geographically-specific and limited to a sudden, unexpected death type.

In regard to relevant demographic information, identifying as female was associated with more monthly tobacco use and identifying as male was associated with less monthly tobacco use in the sample. These data do not align with national trends in the U.S., where men are more likely than women to smoke cigarettes (Cornelius et al., 2022). However, previous research demonstrates women experience stronger cravings than men in response to stress (Lerman et al., 2014) and that higher cortisol levels are predictive of smoking relapse in women (Tanner et al., 2015). Although exploratory findings did not find an association between pre-death tobacco use and post-death use, higher frequency of tobacco use associated with female identifying individuals in this bereaved sample may be related to the inherent stress experienced following the death of a loved one. Due to the well-known health

risks associated with tobacco use, more research is needed to understand the underlying mechanisms and decision-making processes of bereaved individuals who continue engaging in tobacco use following the death of their loved one. Better understanding motivators of use could inform intervention efforts and decrease bereaved individuals' risk of mortality and associated health concerns.

Grief Severity, Emotion Regulation, and Alcohol Use

Although preliminary analyses found grief symptom severity, experiential avoidance, and rumination as positively associated with post-death alcohol use, these associations did not remain significant within the moderation analyses, and no significant interaction effects were demonstrated in the model. Similarly, the demographic variables (i.e., being partnered, identifying at Asian/Asian American, identifying as White) and death-related variables (i.e., violent death, degree of exposure to the death) demonstrating significant associations with these constructs of interest during preliminary analyses were no longer significant in the moderation model.

Post-death alcohol use-related findings appear to align with the mixed results in the extant alcohol and grief literature. Although preliminary analyses align with previous research demonstrating significant positive associations between PGD symptom severity and alcohol use (Eddinger et al., 2019), exploratory analyses suggest such associations are better explained by pre-death alcohol use. Since this measure of pre-death alcohol use was collected retrospectively using a non-validated scale, the conclusions drawn from these results are limited. Future longitudinal studies with measurement time points before and after the death could provide a clearer picture. Additionally, it may be important to examine risky drinking behavior (e.g., binge drinking, heavy alcohol use) or other alcohol-related problems (e.g.,

DUI, health-related consequences to drinking) in addition to quantity measures. Within the current sample, on average, participants who reported consuming alcohol reported consuming almost 44 drinks per month, which is about 10 drinks per week, if evenly distributed. Per the U.S. Department of Health and Human Services and U.S. Department of Agriculture's *Dietary Guidelines for Americans 2020-2025,* drinking in moderation is defined as limiting intake to two or less drinks per day for men and one or less drinks per day for women, and consuming less is better for one's health than consuming more (U.S. Department of Agriculture and U.S., Department of Health and Human Services, 2020). Heavy alcohol use is defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as drinking four drinks on any day or more than 14 drinks per week for men, and drinking more than three drinks on any day or more than seven drinks per week for women (NIAAA, 2007). However, the Substance Abuse and Mental Health Services Administration (SAMHSA) defines heavy alcohol use as binge drinking on five or more days in the past month (i.e., during the same occasion consuming five or more drinks for males and four or more drinks for females on at least one day in the past month; SAMHSA, 2022). Definitions for heavy drinking outside of the gender or sex binary are not provided. Although the current sample's average reported alcohol use clearly suggests that average alcohol users in this sample may have been consuming more alcohol than recommended, we are not able to determine instances of binge drinking behaviors. Examining drinking behavior patterns pre- and post-death as they relate to grief severity and emotion regulation processes may provide better insight.

Grief Severity, Emotion Regulation, and Physical Activity

Originally it was hypothesized that when emotion regulation variables were high, they would strengthen a negative relationship between grief symptom severity and physical activity, where increased grief symptom severity would predict decreased physical activity. This was not the case in the results. Indeed, preliminary analyses found grief symptom severity, experiential avoidance, and rumination were positively associated with post-death physical activity. When analyzed simultaneously in the moderation model, grief symptom severity maintained a positive main effect on post-death physical activity. Neither emotion regulation variable demonstrated significant main effects, nor were there significant interaction effects between each emotion regulation variable and grief symptom severity in the model. However, a significant interaction effect was demonstrated between all three constructs when analyzed at the 95% CI level. Specifically, when both experiential avoidance and rumination were high, more severe grief symptom severity was associated with greater physical activity. In additional analysis at the 99% CI level, the CI of this conditional effect crossed zero, which suggests the significant findings at the 95% CI level should be interpreted with caution. In regards to demographic variables (i.e., being partnered, identifying as Asian/Asian American) and death-related variables (i.e., violent death, degree of exposure to the death) that were significantly associated with the constructs of interest during preliminary analyses, the degree of exposure to the death was the only covariate that remained a significant adjuster in the moderation model at the 95% CI level. At the 99% CI level, no demographic or death-related variables were associated with physical activity.

Results may partially explain the mixed findings demonstrated in the current bereavement and physical activity literature (see Stahl & Schulz, 2014), as previous studies

did not account for grief severity or emotion regulation processes. Findings suggest that individuals who are more distressed and avoidant may be more inclined to engage in activities to stay active and keep their minds off of grief-related content. Alternatively or additionally, these individuals might be focusing on engaging in more activities perceived as healthy (e.g, physical activity) to keep their minds off of grief, reminders of the death, and/or the loss. Physical activity may be used in this way as a coping behavior. Indeed, a recent study examining New York healthcare workers during the COVID-19 pandemic found physical activity/exercise was the most common coping behavior endorsed (Shechter et al., 2020). A systematic review of physical activity in the treatment of PTSD demonstrates that physical activity reduces depressive and PTSD symptoms among people with PTSD (Rosenbaum et al., 2015), but such randomized controlled trials with PGD have yet to be explored. One study suggests that due to the various losses experienced during the COVID-19 pandemic, people feel guilt for grieving their losses and subsequently were more likely to use avoidant coping mechanisms (Scheinfeld et al., 2021). Interestingly, a qualitative study of parentally bereaved youth found outdoor physical activity to have meaning for them in four overall ways including sense of freedom, distraction/escapism, retaining memories, and family cohesion (Brewer & Sparkes, 2011). It is possible that participants in this study reporting higher levels of experiential avoidance and rumination may be more likely to engage in physical activity for such beneficial yet potentially avoidant purposes. Future research examining similar themes in bereaved adult populations as it results to physical activity following the death of a loved one could be beneficial.

The higher degree of exposure to the death variable remaining a significant covariate in the model further supports this hypothesis. Individuals who have more exposure to the

death may experience distressing imagery related to the death scene or circumstances of the death. Intrusive thoughts, imagery, and ruminations related to the circumstances of their loved one's death may be particularly distressing in traumatic loss survivors, and have been associated with mental health outcomes including PTSD, depression, and PGD (Baddeley et al., 2015). Engaging in experiential avoidance strategies via physical activity may aid in reducing distress and promote resilience in bereaved individuals. Physical activity has been demonstrated to buffer against mental health concerns and promote resilience following major life stressors (e.g., Szuhany et al., 2023). Indeed, a recent qualitative study examining the role of physical activity following the death of a parent as a young person (i.e., 10 to 24 years old) found that engaging in physical activity can provide a sense of freedom, alleviate grief outcomes, build resilience, enable social support, and create a stronger sense of self (Williams et al., 2023).

In regards to exploratory analyses, when accounting for pre-death physical activity, experiential avoidance was the only construct of interest that remained a significant predictor of post-death physical activity. Although, these findings must be interpreted with caution due to their exploratory nature, they suggest further longitudinal investigation into the role of emotion regulation processes – particularly experiential avoidance – in relation to physical activity in the context of bereavement is warranted. Furthermore, they suggest the potential utility of targeting pre-death physical activity in soon to be bereaved individuals in efforts to promote sustained physical activity and, consequentially, resilience following the death.

Grief Severity, Emotion Regulation, and Sedentary Behavior

Originally, we hypothesized there would be more reported sedentary behavior at higher levels of grief and that those relationships would be conditional as a function of

emotion regulation variables, but that was not the case. Preliminary analyses found grief symptom severity, experiential avoidance, and rumination were negatively associated with post-death sedentary behavior. When analyzed simultaneously in the moderation model, the main effect between grief symptom severity and sedentary behavior was no longer significant. However, the emotion regulation variables maintained significant negative effects. Furthermore, interaction effects were demonstrated such that grief symptom severity was negatively associated with sedentary behavior under three conditions: 1) average experiential avoidance and low rumination levels, 2) high experiential avoidance and low rumination levels, and 3) high experiential avoidance and low rumination levels. Of note, when modeled using the 99% CI level, the CIs for the main effect of rumination crossed zero, suggesting the significance of this main effect should be interpreted with caution.

Results suggest that if an individual is prone to engaging in higher levels of experiential avoidance, and they are not particularly prone to rumination as an avoidance strategy, then they may seek to engage in activities to stay busy or distract themselves to cope with their grief. Similar to the physical activity literature, engaging in such emotion regulation processes may promote resilience by limiting sedentary behavior. Alternatively or additionally, these findings may suggest that individuals might perceive having more tasks necessary to engage in depending on the presence of secondary losses (e.g., child care support, financial responsibilities, house work).

In regard to relevant covariates demonstrated in preliminary analyses, having a partner and violent death type were significant adjusters to the model. However, when run at the 99% CI level, being partnered was no longer indicated as an adjuster to the model. Age and White racial identity were not significant adjusters to the model at 95% or 99% CIs.

Regarding having a partner, these findings may align with findings that lack of social support to be one of the statistically significant contributing factors to sedentary lifestyle (Martins et al., 2020). However, it is important to note that the present study did not have a measure of social support and the presence or absence of a partner in one's life does not necessarily equate to one's level of social support. Indeed, a recent study suggests lower sedentary behavior in couples is affected by factors such as relationship satisfaction and perceived use of negative social control (Siwa et al., 2023). Nonetheless, one study comparing married to single individuals found that married individuals were less likely to engage in sedentary behavior (i.e., watch TV for more than three hours per day) in participants older than 30 years old (Cavazzotto et a., 2022). Similarly, a study of 520 couples in Korea examining spousal concordance regarding lifestyle factors and chronic diseases among couples visiting primary care providers found high concordance rates in low physical activity (Jun et al., 2020). In individuals prone to engage in experiential avoidance, it is possible that having a partner may partially play a protective role and promote resilience by limited sedentary behaviors. However, more research is needed to determine the conditions under which this may be the case. Furthermore, it will be important in future studies to give additional attention to whether partners could play a role in excessive avoidance strategies if not allowing the space and time necessary for the bereaved to process their grief. In regard to violent death type as a significant adjustor in the model – similar to our findings related to physical activity – individuals who are violently bereaved may demonstrate less sedentary behavior due to their increased engagement in experiential avoidance strategies in efforts to reduce their likely heightened levels of distress and possible posttraumatic stress symptoms.

In exploratory analyses, grief symptom severity and both emotion regulation variables remained significantly associated with post-death sedentary behaviors while controlling for participants' reported pre-death sedentary behavior. Unlike exploratory analyses involving physical activity, these findings suggest that targeting pre-death sedentary behaviors may be less impactful than focusing on interventions that emphasize emotion regulation processes.

Grief Severity, Emotion Regulation, and Eating Behaviors

Overall, the original hypothesis that there would be a negative relationship between grief symptom severity and eating behaviors, and that this relationship would be moderated by emotion regulation behaviors was partially supported. Preliminary analyses showed that higher grief severity was associated with less intuitive eating behavior post-death. These findings align with previous research that suggests individuals may engage in overeating under emotionally charged or stressful circumstances in efforts to regulate emotions and reduce stress (e.g., Adam & Epel, 2007; DeSteno et al., 2013; de Ridder et al., 2017; Ferrer et al., 2015; Kuntsche et al., 2017). However, neither of the emotion regulation variables was independently associated with post-death intuitive eating behavior.

When modeled simultaneously, grief and rumination demonstrated significant negative main effects but experiential avoidance did not show any significant main effects. Of note, when modeled using the 99% CI level, the CIs for the main effect of rumination crossed zero, suggesting the significance of this main effect should be interpreted with caution and attention should be placed on the significant interactions between the emotion regulation factors. In regard to interaction effects, there were five conditions where the negative relationship between grief and intuitive eating was significant: 1) low experiential

avoidance and low rumination levels, 2) low experiential avoidance and average rumination levels, 3) average experiential avoidance and low rumination levels, 4) average experiential avoidance and average rumination levels, and 5) high experiential avoidance and low rumination levels.

Generally, the negative impact of grief on intuitive eating behaviors was more pronounced at lower levels of rumination, whereas at high levels of rumination there is not a significant interaction, and grief is not associated with decreased intuitive eating. These results appear to go against the assertion that engaging in overeating serves a function of emotion regulation when under emotional distress in the context of grief. However, upon examining the content of our rumination measure items (see Appendix A), it is possible that higher levels of rumination could indicate engaging in more adaptive forms of perseverative cognitions which actually facilitate processing the reality of the death and integrating it into their autobiographical narrative and potentially provided more sufficient levels of emotion regulation. Individuals who reported lower levels of rumination, on the other hand, may not be engaging in deeper levels of contemplation and meaning making related to the death. Consequently, when they do engage in rumination there may be this amplifying effect of distress experienced, which leads to more overeating in efforts to regulate the emotional distress.

Interestingly, the negative impact of grief on intuitive eating behaviors was pronounced across almost all levels of experiential avoidance, suggesting the possible presence of the aforementioned phenomena of individuals engaging in overeating in efforts to regulate emotional distress. However, this relationship was not pronounced when rumination was high, which may further support the previously stated assertion regarding the

potentially adaptive role higher levels of rumination may serve as it relates to the grief-related forms of rumination captured in the measure used. Additionally, this relationship was not pronounced when experiential avoidance was high and rumination was average. An alternative explanation to these null findings could be that at high levels of rumination and avoidance, individuals may generally be more inclined to engage in eating for comfort regardless of severity of grief or reactive distress. Thus, no effect would be evident. However, previous research suggests experiential avoidance partially explains the relationship between negative emotions and emotional eating (Litwin et al., 2017). Furthermore, decreased experiential avoidance has been associated with improvements in dysfunctional eating (Cavicholi et al., 2019). It appears that perhaps the additional interaction with adaptive forms of rumination may further explain such improvements. Alternatively, it is possible that intuitive eating may be impacted by grief for reasons other than emotion regulation. For example, in response to grief-related distress, these individuals may be evidencing appetite suppression as a physiological symptom of grief (e.g., not attending to hunger cues, not trusting their body to tell them when they are hungry). Additional studies are needed to examine the relationship between individual grief symptoms and intuitive eating behaviors.

Regarding relevant covariates, intuitive eating behavior was the only health behavior construct that did not demonstrate significant relationships with any of the examined potential covariates. In our exploratory analyses, grief symptom severity remained significantly associated with post-death eating behavior, while controlling for participants' reported pre-death intuitive eating behavior. The association between emotion regulation variables and post-death intuitive eating behavior remained non-significant after accounting

for pre-death intuitive eating. These findings suggest the occurrence of a unique relationship between grief and eating behaviors regardless of one's eating behaviors prior to bereavement, and that perhaps this relationship can be further explained by components of grief other than emotion regulation. Of note, the pre-death eating behaviors measure was single item and developed for the purposes of this study. Additional research in needed to more clearly examine these relationships.

Grief Severity, Emotion Regulation, and Diet Quality

Although preliminary analyses found grief symptom severity, experiential avoidance, and rumination are associated with better post-death diet quality, these associations did not remain significant within the moderation analyses, and no significant interaction effects were demonstrated. Similarly, the death-related variables (i.e., violent death, degree of exposure to the death) demonstrating significant associations during preliminary analyses were no longer significant in the moderation model. Likewise, identifying as Asian or Asian American was no longer significant in the moderation model, despite the significant association in preliminary analyses. Age remained the only significant adjustor to the model, where older age was associated with better post-death diet quality.

Interestingly, the age related finding does not align with previous research demonstrating nutritional risk and involuntary weight loss following late-life bereavement (Stahl & Schulz, 2014) and prevalent meal skipping in bereaved elders (Smagula et al., 2019). More generally, results also do not follow trends shown in the general diet quality literature. Indeed, one study of a nationally representative sample of 5,614 community-dwelling older adults over 54 years old in the U.S. found that only 10.7% had a good quality diet and less than 50% of their sample met dietary guidelines and nutritional goals for most

food groups and nutrients (Choi et al., 2021). This study found low socio-economic status, less psychosocial resources, and limited healthy food access as key contributors to having suboptimal diet quality (Choi et al., 2021). Although we did not measure access to psychosocial resources and healthy food access in this study, we do know that only 9.4% (*n* = 40) of the sample described their household as "low income" and that most self-described as "middle income" (51%, *n* = 218). Thus these findings likely do not capture the portion of U.S. population that experiences poor diet quality due to barriers to healthy food access. Furthermore, the oldest reported age in this sample was 67 years old, which is a relatively young sample that fails to capture a large portion of older adults. Indeed, recent research has shown a significant increase in the proportion of older adults (65 years and older) in the U.S. with poor diet quality (going from 51% to 61%) and a significant decrease in the proportion with intermediate diet quality (going from 49% to 39%; Long et al., 2022). In the context of bereavement and health, despite lack of significant findings in the model, attention to diet quality remains important – particularly in older populations and individuals with barriers to resource access. Indeed, a recent nationally representative longitudinal sample of adults over 50 years old evaluating the onset of health problems in relation to diet quality found that older adults adhering to healthier diet had significantly lower risk of developing limitations in their daily living activities, lower risk of developing depression, and more favorable health outcomes (Zhao & Andreyeva, 2022).

Overall, post-death diet quality results do not clearly align with previous research. Null findings related to experiential avoidance in the moderation model were not fully unexpected since the healthy eating and food literature generally examines experiential avoidance in relation to eating behaviors (e.g., binge eating, emotional eating) rather than

diet quality or food choice (e.g., Cavicchioli et al., 2019; Litwin et al., 2017). Consequently, significant preliminary findings showing increases in experiential avoidance associated with decreased diet quality are less expected. A recent study examining weight-loss interventions targeting weight-related experiential avoidance found greater weight-related experiential avoidance at baseline to be associated with lower diet quality at follow-up (Wooldridge et al., 2022). This study proposed individuals' experiential avoidance manifested as consuming unhealthy foods ("comfort foods") in efforts to gain more perceived control over thoughts and emotions (Wooldridge et al., 2022). However, given the null moderation model findings, this proposed role of experiential avoidance does not appear consistent within the context of grief. Although not directly related, experiential avoidance has been associated with higher levels of food cravings and shown to mediate the relationship between food craving and emotional eating (Fahrenkamp et al., 2019). Although the model findings suggest experiential avoidance does not have a direct influence on the relationship between grief and diet quality, our significant preliminary association findings suggests there is a relationship between grief-related experiential avoidance and diet quality. Given the significant model findings related to eating behaviors, it may be beneficial for future studies to explore food cravings and the indirect role of grief-related experiential avoidance.

Moderation model findings related to rumination and grief were less anticipated. Similar to previous emotion regulation literature demonstrating associations with increases in unhealthy eating or decreases in healthy food intake (e.g., vegetable consumption; Clancy et al., 2016; Riley et al., 2018), increases in rumination were associated with worse diet quality in our sample. Although the relationship between grief symptom severity and diet quality has not been examined in previous studies, several bereavement studies have reported findings

such as unintentional weight loss (Wilcox et al., 2003), decreased BMI (Ezendam et al., 2019), decreased fruit and vegetable consumption (Wilcox et al., 2003), decreased fruit intake and increased sugared beverage intake (Ezendam et al., 2019), meal skipping in bereaved elders (Smagula et al., 2019), and reduced appetite during acute bereavement (Buckley et al., 2009). Preliminary association results indicating increased grief was associated with worse diet quality align with these previously. However, the null moderation model findings do not. Interestingly, in the exploratory analyses, grief symptom severity, experiential avoidance, and rumination maintained significant associations with post-death diet quality, while controlling for participants' reported pre-death diet quality. Given the variety of factors (e.g., resource access) that affects one's reported diet quality, it may be possible that the constructs of interest for this study serve more indirect roles.

Limitations

Limitations to interpretating these findings have been discussed within each specific health behavior subsection above. Despite the potential for this project to contribute valuable information in various areas of research, several methodological limitations also exist. Notably, the cross-sectional data collection design limits the interpretation of data. Although the analyses included a test for moderation, causal or temporal inferences cannot occur. While the study design assisted in the speed of attaining data, it does not allow for the establishment or manipulation of causation or longitudinal relationships. Furthermore, the pre-death health behavior measures were retrospective and thus highly susceptible to recall errors. Significant findings should be verified in future research with longitudinal (e.g., pre- vs. post-death) and/or between subject (e.g., bereaved vs. non bereaved groups) designs.

The use of exclusively self-report survey measures is another methodological limitation. Monomethod bias poses concern. Collecting and combining multiple measures of a single construct would thwart this concern and strengthen possible conclusions drawn from findings. Additionally, although previous health behavior research has demonstrated close accuracy between some self-report measures and other methods of obtaining self-report (e.g., daily diary entry; Poikolainen et al., 2002), more objective methods exist (e.g., cigarette butt collections, activity tracker phone applications). Future research could attempt to use more objective measures of the proposed health constructs in order to extend findings of this project.

The use of online survey administration is an additional limitation of this project. Although online administration allows for a larger sample and wider population reach across geographic locations in the U.S., it also limits access for individuals who are unable to afford internet access and/or live in areas where there is limited or no internet access. Other potential concerns include capturing data from participants who do not actually meet inclusion criteria, despite screening efforts; and limited control over the environment of survey administration, which poses risk for environmental factors to impact data.

Relatedly, the demographic and individual characteristic data of this sample demonstrate clear limitations regarding the generalizability of the findings. Although there appears to be an even distribution between sex when conceptualized on the binary (i.e., female vs. male), the lack of intersex participants and limited indication of any gender identities (e.g., cisgender, agender, genderqueer) suggests a likely failure in capturing the experiences of individuals in the trans and gender diverse community. With the high rates of death experienced (e.g., suicide, homicide) and the prevalence of various health concerns

faced (e.g., lack of access to care, disordered eating behaviors) by this community, it is crucial for future research to prioritize recruitment of sex and gender diverse individuals, as well as explore factors that may be more prevalent or unique to their experience. Similar limitations exist within this sample regarding the over representation of White, non-Hispanic, and able-bodied identities. Overall, more efforts must be made to prioritize research for and by individuals from historically oppressed groups, whose experiences with bereavement and grief continually fail to be captured. Although this author shares identities with some of the aforementioned groups, they are a non-Hispanic, White person who was raised with Western ideologies, and approached this project with their own lens, as well as the Westernized, individualistic lens that is dominant in much of the current literature focusing on the pathological conceptualization of grief. All findings must be interpreted and generalized with this inherent bias considered.

Additionally, regarding capturing a representative sample, another factor important to note concerns the clinical severity level of grief in the sample. Although the average time since loss of the sample (M = 1.6 yrs.) meets the threshold for PGD criteria (i.e., 12 months) and the average grief symptom severity scores (M = 31.10) meets the PG-13-R conceptualized cut-off for syndromal levels of grief (i.e., total score of 30), the standard deviations of these averages (1.5 yrs. and 9.92, respectively) suggests the severity of scores represented here may be considered normative from a Western, clinical perspective. Additionally, this study did not collect data regarding rates of treatment-seekers in the sample. Future research examining health behaviors of bereaved individuals during narrower windows of time since bereavement (e.g., acute bereavement within first year of death, over a year since loss, over five years since loss) and of treatment seeking vs. non-seeking

individuals will be necessary to clarify key target periods for interventions. Furthermore, longitudinal research examining grief severity, emotion regulation, and health behaviors in a bereaved sample would be crucial in more clearly delineating the relationships between these constructs. Such longitudinal data would allow for the exploration and development of structural equation models to better understand how these constructs relate to longer term health outcomes of bereaved individuals and how to best intervene in possible development or progression of disease.

In addition to longitudinal designs, future research should explore subgroups of individuals who engage in high risk behaviors across the "Big 4" and/or examine the existence of high risk behavior profiles amongst bereaved individuals. Such insights may aid in identifying bereaved individuals at higher risk for negative health outcomes and allow for further tailoring of screening efforts and interventions.

Finally, due to time and financial constraints of this study, qualitative data were not collected from participants. A mixed methods approach could provide deeper insight into participant experiences. Future research interviewing bereaved individuals about their perceptions regarding the influence of grief and emotion regulation processes on engagement and/or disengagement in various health behaviors would provide insight regarding individual views on the relationships between these constructs and/or elucidate other factors that may be more salient or additionally contributing to these relationships.

Possible Implications

While this study is limited in drawing causal inferences, findings provide theoretical and applied implications within academic and clinical settings. Theoretically, these results aid in further understanding the mixed findings within the current body of literature

examining health and bereavement. Specifically, this is one of the few studies to examine the role of emotion regulation processes and grief severity in bereaved individuals' health behavior engagement. Indeed, this study elucidates the role of emotion regulation variables as antecedents to engagement and/or disengagement in health risk behaviors within U.S. bereaved populations. Better understanding the presence of relationships between grief-related emotion regulation and modifiable health behaviors further underscores emotion regulation as a critical factor in deepening the understanding of functional differences within a bereaved sample.

There are several applications of these data. First, findings may be used to inform early development and general targets of therapy. Specifically, findings support the targeting of emotion regulation processes in clinical interventions; especially in those bereaved individuals with health issues secondary to grief concerns. If possible, it may be beneficial to begin bolstering emotion regulation skills in individuals who are not yet bereaved but may soon be. In particular, caregivers and family members of patients with chronic and/or life-limiting disease(s) may benefit in multiple ways. Indeed, by building up emotion regulation skills prior to their loved one's death, they may be better equipped to cope with the death and less likely to experience secondary health concerns or progression of pre-existing health concerns. Future studies are needed focusing on the implementation of interventions targeting emotion regulation strategies for caregivers and the longitudinal mental and physical health outcomes for these individuals following the death of their loved one.

If not used to develop new interventions, these findings can inform other general health behavior interventions for individuals presenting with heath behavior related illnesses. For example, when engaging in motivational interviewing techniques with an individual who

is having difficulty with making changes to their eating behaviors, it could be beneficial to incorporate acknowledgement of the individual's grief experience as it relates to possible use of eating behaviors as a form of comfort against grief-related distress. Implementing screeners for families in hospice settings and/or primary care settings may be a feasible, more preventative care approach. For example, physicians and/or nurses could be trained to provide brief screening and facilitate necessary connections to mental health providers for targeted intervention. Not only can these findings be used to encourage and provide education to healthcare workers in hospitals and primary care locations to minimize the impact bereavement has on physical health, but those individuals can then disseminate the information via education to their patients. For example, in primary care settings, when inquiring about familial health history and make up, there are often options to indicate if a family member is deceased. Reviewing this information could be used as a moment to educate patients on the impact of grief and on health behaviors that may increase their risk of similar health concerns and/or the progression of current health issues they may have. Future studies investigating feasibility and acceptability of such secondary interventions are needed.

APPENDIX A. MEASURES

Demographics

1. How do you describe yourself? (Mark all that apply)
   - ☐ Female
   - ☐ Male
   - ☐ Non-binary
   - ☐ Transgender
   - ☐ Cisgender
   - ☐ Genderqueer
   - ☐ Agender
   - ☐ Prefer to self-describe _____
   - ☐ Prefer not to say

2. Please enter your age in years: _____

3. With which racial and ethnic group(s) do you identify? (Mark all that apply)
   - ☐ American Indian or Alaskan Native
   - ☐ Asian
   - ☐ Black or African American
   - ☐ Hispanic, Latino, or Spanish origin
   - ☐ Middle Eastern or North African
   - ☐ Native Hawaiian or Other Pacific Islander
   - ☐ White
   - ☐ Another race or ethnicity not listed above _____
   - ☐ Prefer not to say

4. Please print your specific ethnicities in the space below. Examples of ethnicities include (for example): German, Korean, Midwesterner (American), Mexican American, Navajo Nation, Samoan, Puerto Rican, Southerner (American), Chinese, etc.
   Note, you may report more than one group.

   Ethnicity(s) _____

5. What is the highest level of education that you have completed?
   - ☐ Did not finish high school
   - ☐ Graduated from high school
   - ☐ Attended college but did not complete a degree
   - ☐ Completed an Associate's degree
   - ☐ Completed a Bachelor's degree
   - ☐ Completed a Master's degree
   - ☐ Completed a Doctoral or Professional degree (such as a Medical or Law degree)

6. Would you describe your household:
   - ☐ Low Income
   - ☐ Lower-Middle Income
   - ☐ Middle Income
   - ☐ Upper-Middle Income
   - ☐ High Income
   - ☐ I prefer not to answer

7. What is your current employment status? (Mark all that apply)
   - ☐ Working full-time
   - ☐ Working one part-time job
   - ☐ Working multiple part-time jobs
   - ☐ I am retired
   - ☐ Unemployed, but looking
   - ☐ Unemployed, not looking
   - ☐ I am a student
   - ☐ Other_____
   - ☐ I prefer not to answer

8. What is your relationship status? (Mark all that apply)
   - ☐ Divorced
   - ☐ Serious relationship(s) and living together
   - ☐ Serious relationship(s) and living apart
   - ☐ Single
   - ☐ Married
   - ☐ Separated
   - ☐ Widowed
   - ☐ I prefer not to answer

9. Do you have a long-lasting or chronic condition (physical, visual, auditory, cognitive or mental, emotional, or other) that substantially limits one or more of your major life activities (you ability to see, hear, or speak; to learn, remember, or concentrate)?
   - ☐ Yes
   - ☐ No
   - ☐ I prefer not to answer

   If yes, please indicate the terms that best describe the condition(s) you experience:
   - ☐ Please specify:_____
   - ☐ I prefer not to answer

10. Have you been diagnosed with any disability or impairment?
    - ☐ Yes
    - ☐ No
    - ☐ I prefer not to answer

    If yes, which of the following have been diagnosed? (Mark all that apply)
    - ☐ A sensory impairment (vision or hearing)
    - ☐ A mobility impairment
    - ☐ A learning disability (e.g., ADHD, dyslexia)
    - ☐ A mental health disorder
    - ☐ A disability or impairment not listed above

Characteristics of the Loss and Exposure to it

1. The person who died was my:

2. When did the loss occur?

3. How, or from what, did the person die?

4. Did you see the scene of the death?
   0 = No
   1 = Yes

5. Were you at the scene of injury/death before the deceased was removed?
   0 = No
   1 = Yes

6. Did you see the individual die?
   0 = No
   1 = Yes

7. Were you the first person to discover the deceased?
   0 = No
   1 = Yes

8. Did you see the individual get taken to the hospital?
   0 = No
   1 = Yes

9. Did you learn about the loss immediately or was it kept from you for awhile?
   1 = immediately
   2 = kept from you for a little while
   3 = kept from you for a long while

10. Did you attend the funeral?
    0 = No
    1 = Yes

11. Did you participate in any rituals related to the loss?
    0 = No
    1 = Yes

12. Have you experienced other significant deaths recently?
    0 = No
    1 = Yes

Prolonged Grief – 13 – Revised (PG-13-R)

1. Have you lost someone significant to you? ____ Yes ____ No

2. How many months has it been since your significant other died? ____ months

For each item below, please indicate how you currently feel.

Since the death, or as a result of the death…	**Not at all**	**Slightly**	**Somewhat**	**Quite a bit**	**Over-whelmingly**
3. Do you feel yourself longing or yearning for the person who died?	1	2	3	4	5
4. Do you have trouble doing the things you normally do because you are thinking so much about the person who died?	1	2	3	4	5
5. Do you feel confused about your role in life or feel like you don't know who you are any more (i.e., feeling like that a part of you has died)?	1	2	3	4	5
6. Do you have trouble believing that the person who died is really gone?	1	2	3	4	5
7. Do you avoid reminders that the person who died is really gone?	1	2	3	4	5
8. Do you feel emotional pain (e.g., anger, bitterness, sorrow) related to the death?	1	2	3	4	5
9. Do you feel that you have trouble re-engaging in life (e.g., problems engaging with friends, pursuing interests, planning for the future)?	1	2	3	4	5
10. Do you feel emotionally numb or detached from others?	1	2	3	4	5
11. Do you feel that life is meaningless without the person who died?	1	2	3	4	5
12. Do you feel alone or lonely without the deceased?	1	2	3	4	5

13. Have the symptoms above caused significant impairment in social, occupational, or other important areas of functioning? ____ Yes ____ No

Modified NIDA Quick Screen Item

In the <u>past year</u>, how many times have you used the following? (If the death of your loved one occurred less than 1 year ago, please only think about your use since their death. If the death of your loved one occurred more than one year ago, please think about your use within the last year.)					
	Never	Once or Twice	Monthly	Weekly	Daily/Almost Daily
Alcohol	☐	☐	☐	☐	☐
Smoked tobacco (e.g., cigarettes, cigars)	☐	☐	☐	☐	☐
Smokeless tobacco (e.g., chew, snuff, dip, snus)	☐	☐	☐	☐	☐
Nicotine vape (e.g., juul, e-cigarettes)	☐	☐	☐	☐	☐

Bereavement - Modified NIDA Quick Screen

Thinking about the <u>year prior to your loved one's death</u>, how many times did you use the following?	Never	Once or Twice	Monthly	Weekly	Daily/Almost Daily
Alcohol	☐	☐	☐	☐	☐
Smoked tobacco (e.g., cigarettes, cigars)	☐	☐	☐	☐	☐
Smokeless tobacco (e.g., chew, snuff, dip, snus)	☐	☐	☐	☐	☐
Nicotine vape (e.g., juul, e-cigarettes)	☐	☐	☐	☐	☐

Tobacco/Nicotine Quantity/Frequency Items Modified from the WHO Global Adult Tobacco Survey

Please indicate which form(s) of tobacco and/or nicotine product you use: (check all that apply)
a. Cigarettes (i.e., factory-made cigarettes, hand-rolled cigarettes)
b. Cigar (i.e.,
c. Chewing tobacco (i.e., loose leaf, plug, twist or roll)
d. Snuff (i.e., moist snuff, dry snuff, snus)
e. Juul
f. e-cigarette
g. cartridge vape
k. other _____

In the past 30 days, how many days on average did you use [insert product type]? _____

[If cigarette/cigar]

On average, how many [insert cigarettes/cigars] do you smoke per day on the days you smoke? _____

[If chewing tobacco/snuff]

On average, how many times a day do you use [insert chewing tobacco/snuff] on the day you use? _____

[If juul, e-cigarette, cartridge vape]

On average, how many times per day do you use [insert form] on the days you do use it?
_____

[If other]

On average, how many times per day do you use [insert form] on the day you do use it?
_____

WHO STEPS Instrument Past 30 Day Drinking Consumption Items

1. Have you consumed any alcohol within the past 30 days? Yes/No

2. During the past 30 days, on how many **occasions** did you have at least one standard alcoholic drink? _____

3. During the past 30 days, when you drank alcohol, how many **standard drinks on average** did you have during one drinking occasion? _____

STANDARD DRINK CONVERSION

When asked how much you drink in the following questions use this chart.

ONE STANDARD DRINK IS EQUAL TO:

Standard American BEER (3-5% alcohol) — 12 oz. Can, Bottle or Glass

Microbrew or European BEER (8%-12% alcohol) — 1/2 of a 12 oz. Can or Bottle

WINE (12 – 17% alcohol) — 4 oz. Glass

WINE Cooler — 10 oz. Bottle

HARD LIQUOR (80-proof, 40% alcohol) — 1-1/2 oz. or One Standard Shot

HARD LIQUOR (100-proof, 50% alcohol) — 1 oz.

WINE: 1 Bottle

25 oz. (12 – 17% alcohol) = 5 standard drinks
40 oz. (12 – 17% alcohol) = 8 standard drinks

HARD LIQUOR: 1 Bottle

12 oz. = 8 standard drinks
25 oz. = 17 standard drinks
40 oz. = 27 standard drinks

Global Physical Activity Questionnaire

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

Activity at work	
1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?	□ Yes □ No (if no, go to Q4)
2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days _____
3. How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours _____ Minutes _____
4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?	□ Yes □ No (if no, go to Q7)
5. In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days _____
6. How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours _____ Minutes _____
Travel to and from places	
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.	
7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	□ Yes □ No (if no, go to Q10)
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days _____

9. How much time do you spend walking or bicycling for travel on a typical day? Hours _____ Minutes _____

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure).

10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously? □ Yes □ No (if no, go to Q13)

11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities? Number of days _____

12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? Hours _____ Minutes _____

13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking,(cycling, swimming, volleyball)for at least 10 minutes continuously? □ Yes □ No (if no, go to Q16)

14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities? Number of days _____

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? Hours _____ Minutes _____

Sedentary behavior

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day? Hours _____ Minutes _____

Physical Activity Relative to Death

1. Thinking about the year prior to the death of your loved one, how would you describe your engagement in high-intensity physical activity (e.g.,), with 10 being *Daily or more than once per day* and 0 being *Not at all*? _____

2. Thinking about the year prior to the death of your loved one, how would you describe your engagement in moderate-intensity physical activity (e.g.,), with 10 being *Daily or more than once per day* and 0 being *Not at all*?

3. Thinking about the year prior to the death of your loved one, how would you describe your engagement in low-intensity physical activity (e.g.,), with 10 being *Daily or more than once per day* and 0 being *Not at all*?

Intuitive Eating Scale-2 (IES-2)

For each item, please check the answer that best characterizes your attitudes or behaviors.

1. I try to avoid certain foods high in fat, carbohydrates, or calories.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I have forbidden foods that I don't allow myself to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. I get mad at myself for eating something unhealthy.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. If I am craving a certain food, I allow myself to have it.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. I allow myself to eat what food I desire at the moment.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. I do NOT follow eating rules or dieting plans that dictate what, when, and/or how much to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. I find myself eating when I'm feeling emotional (e.g., anxious, depressed, sad), even when I'm not physically hungry.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. I find myself eating when I am lonely, even when I'm not physically hungry.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. I use food to help me soothe my negative emotions.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. I find myself eating when I am stressed out, even when I'm not physically hungry.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11. I am able to cope with my negative emotions (e.g., anxiety, sadness) without turning to food for comfort.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

12. When I am bored, I do NOT eat just for something to do.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13. When I am lonely, I do NOT turn to food for comfort.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

14. I find other ways to cope with stress and anxiety than by eating.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

15. I trust my body to tell me when to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

16. I trust my body to tell me what to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. I trust my body to tell me how much to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

18. I rely on my hunger signals to tell me when to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

19. I rely on my fullness (satiety) signals to tell me when to stop eating.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

20. I trust my body to tell me when to stop eating.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

21. Most of the time, I desire to eat nutritious foods.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

22. I mostly eat foods that make my body perform efficiently (well).

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

23. I mostly eat foods that give my body energy and stamina.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Scoring Procedure:

1. Reverse score Items 1, 2, 3, 7, 8, 9, and 10
2. *Total IES-2 Scale Score:* Add together all items and divide by 23 to create an average score.
3. *Unconditional Permission to Eat subscale:* Add together Items 1, 2, 3, 4, 5, and 6; divide by 6 to create an average score.
4. *Eating for Physical Rather than Emotional Reasons subscale:* Add together Items 7, 8, 9, 10, 11, 12, 13, and 14; divide by 8 to create an average score.
5. *Reliance on Hunger and Satiety Cues subscale:* Add together Items 15, 16, 17, 18, 19, and 20; divide by 6 to create an average score.
6. *Body-Food Choice Congruence subscale:* Add together Items 21, 22, and 23; divide by 3 to create an average score.

Rapid Eating Assessment for Participants – Shortened Version (REAPS)

In an average week, how often do you:	Usually/ Often	Sometimes	Rarely/ Never	Does not apply to me
1. Skip breakfast?	☐	☐	☐	
2. Eat 4 or more meals from sit-down or take out restaurants?	☐	☐	☐	
3. Eat less than 2 servings of whole grain products or high fiber starches a day? **Serving** = 1 slice of 100% whole grain bread; 1 cup whole grain cereal like Shredded Wheat, Wheaties, Grape Nuts, high fiber cereals, oatmeal, 3-4 whole grain crackers, ½ cup brown rice or whole wheat pasta, boiled or baked potatoes, yuca, yams or plantain.	☐	☐	☐	
4. Eat less than 2 servings of fruit a day? **Serving** = ½ cup or 1 med. fruit or ¾ cup 100% fruit juice.	☐	☐	☐	
5. Eat less than 2 servings of vegetables a day? **Serving** = ½ cup vegetables, or 1 cup leafy raw vegetables.	☐	☐	☐	
6. Eat or drink less than 2 servings of milk, yogurt, or cheese a day? **Serving** = 1 cup milk or yogurt; 1½ - 2 ounces cheese.	☐	☐	☐	
7. Eat more than 8 ounces (see sizes below) of meat, chicken, turkey or fish per day? ***Note:*** 3 ounces of meat or chicken is the size of a deck of cards or ONE of the following: 1 regular hamburger, 1 chicken breast or leg (thigh and drumstick), or 1 pork chop.	☐	☐	☐	☐
8. Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?	☐	☐	☐	☐
9. Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, tostones or fried yuca?	☐	☐	☐	
10. Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low-fat chips or lowfat crackers, air-popped popcorn?	☐	☐	☐	☐
11. Add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?	☐	☐	☐	
12. Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day.	☐	☐	☐	
13. Drink 16 ounces or more of non-diet soda, fruit drink/punch or Kool-Aid a day? ***Note:*** 1 can of soda = 12 ounces	☐	☐	☐	
	YES		**NO**	
14. You or a member of your family usually shops and cooks rather than eating sit-down or take-out restaurant food?	☐		☐	
15. Usually feel well enough to shop or cook.	☐		☐	
16. How willing are you to make changes in your eating habits in 1 2 3 4 5 order to be healthier?	1 ☐ Very willing	2 ☐ 3 ☐	4 ☐	5 ☐ Not at all willing

Eating Relative to Death

1. Thinking about the year prior to the death of your loved one, how would you rate your eating behaviors, with 10 being *Excellent* and 0 being *Very Poor*? _____

2. Thinking about the year prior to the death of your loved one, how would you describe your diet quality, with 10 being *Excellent* and 0 being *Very Poor*? _____

Anxious Avoidance subscale of the Depression and Anxious Avoidance in Prolonged Grief Questionnaire (DAAPGQ)

Please rate how true the following statements are for you using the following scale:

---- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7 ---------- 8 ----

Not at all true for me — **Completely true for me**

I avoid to dwell on the fact that [--] is dead and will never return.	□ 1	□ 2	□ 3	□ 4	□ 5	□ 6	□ 7	□ 8
I avoid situations and places that confront me with the fact that [--] is dead and will never return.	□ 1	□ 2	□ 3	□ 4	□ 5	□ 6	□ 7	□ 8
I avoid to dwell on painful thoughts and memories connected to his/her/their death.	□ 1	□ 2	□ 3	□ 4	□ 5	□ 6	□ 7	□ 8
I deliberately retrieve positive memories related to [--] as a means to avoid thinking about the fact that [--] is dead and will never return.	□ 1	□ 2	□ 3	□ 4	□ 5	□ 6	□ 7	□ 8

Utrecht Grief Rumination Scale (UGRS)

People often think of diverse things after the death of a loved one. In the following questions we would like to know how often you have thought of the following things during the past month.

How frequently in the past month did you…	Never	Sometimes	Regularly	Often	Very often
1. … think about the consequences that his/her death has for you.	☐	☐	☐	☐	☐
2. …analyze what the personal meaning of the loss is for you.	☐	☐	☐	☐	☐
3. …query whether you receive the right support from family members.	☐	☐	☐	☐	☐
4. ….analyze whether you could have prevented his/her death.	☐	☐	☐	☐	☐
5. …ask yourself why you deserved this loss.	☐	☐	☐	☐	☐
6. …try to analyze your feelings about this loss precisely.	☐	☐	☐	☐	☐
7. …ask yourself whether you react normally to this loss.	☐	☐	☐	☐	☐
8. …ask yourself whether his/her death could have been prevented if the circumstances had been different.	☐	☐	☐	☐	☐
9. …ask yourself whether you get adequate support from friends and acquaintances.	☐	☐	☐	☐	☐
10. …ask yourself whether his/her death could have been prevented if others has acted differently.	☐	☐	☐	☐	☐
11. …wonder why this had to happen to you and not someone else.	☐	☐	☐	☐	☐
12. …think about the unfairness of this loss.	☐	☐	☐	☐	☐
13. …try to understand you feelings about the loss.	☐	☐	☐	☐	☐
14. …think how you would like other people to react to your loss.	☐	☐	☐	☐	☐
15. …think how your life has been changed through his/her death.	☐	☐	☐	☐	☐

Scoring instructions

The answer to every item is translated into a number. ‘Never’ is 1 point, ‘Sometimes’ is 2 points, ‘Regularly’ is three points, ‘Often’ is 4 points and ‘Very often’ is 5 points. The total score on grief rumination is calculated by adding all scores of each individual item. Moreover, the list consists of different subscales, which can be calculated separately by adding the scores of the items on each individual scale. Below the names of the scales and their items are listed.

Thoughts about consequences and meaning of the loss 1, 2, 15
Thoughts about social support 3, 9, 14
What it-questions 4, 8, 10
Why questions 5, 11, 12
Thoughts about feelings 6, 7, 13

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