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Associations Between Coping Style and Perceptions of Web-Delivered Physical Activity Messages Among Women In Midlife with Cardiovascular Health Risks

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ASSOCIATIONS BETWEEN COPING STYLE AND PERCEPTIONS OF WEB-DELIVERED PHYSICAL ACTIVITY MESSAGES AMONG WOMEN IN MIDLIFE WITH CARDIOVASCULAR HEALTH RISKS

by

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Dedications

This dissertation is dedicated to Connor Head for being my rock and best friend, Kathryn Pierce and Stephen Loggia for being my biggest supporters, Elaine Koza for always giving me strength, faith, and big laughs during challenging times, Karen Pasko Pace for her endless financial sacrifice for my education…

and ultimately to Walter Pasko, for whom this research and my passion for understanding the experiences of individuals with chronic illness was originally inspired.

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Abstract

Kristen Marie Pasko
ASSOCIATIONS BETWEEN COPING STYLE AND PERCEPTIONS OF WEB-DELIVERED PHYSICAL ACTIVITY MESSAGES AMONG WOMEN IN MIDLIFE WITH CARDIOVSASCULAR HEALTH RISKS
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Midlife women are at unique risk for cardiovascular disease (CVD) and benefit from increasing physical activity (PA). Many PA interventions involve social support, though fail to address related processes such as social comparison. Desire for specific types of social support and comparison may represent emotion-focused versus problem-solving coping, though little is known about women's preferences for/responses to these coping opportunities. The present study examined women's selections of PA content in a digital environment. Over 7 days, women in midlife ≥1 CVD risk factor (N = 60, M_{Age} = 50.70, SD = 5.89) wore a PA monitor and visited a proprietary website. General stress (not PA/health stress) positively predicted both emotion-focused (F1, 56] = 6.0, p = 0.02) and problem-solving coping (F[1, 56] = 5.29, p = 0.03). PA/health stress was positively associated with perceived helpfulness of emotion-focused content (r[56] = 0.26, p = 0.05), and negatively associated with problem-solving content (r[56] = -0.19, p = 0.16). Only emotion-focused content was associated with increased step count across 7 days (F[6, 162] = 2.19, p = 0.047, partial η^2 = 0.08), though not active exercise minutes (F[6, 162] = 0.94, p = 0.47, partial η^2 = 0.03). Findings suggest PA interventions in this population may benefit from tailoring based on coping preference, threat perception, desired outcome, and maintain flexibility given multiple unique psychosocial stressors.

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Chapter 1

Literature Review

Cardiovascular disease (CVD) remains the top cause of death in the United States (Centers for Disease Control and Prevention, 2022a), and women in midlife (i.e., ages 40-60) are at the highest risk for this illness relative to any other subpopulation in the country (Stramba-Badiale et al., 2006). As this group already makes up a significant portion of the U.S. population and is projected to increase in size through 2060 (Vespa et al., 2020), effective CVD prevention efforts are needed that address the unique characteristics of women in midlife. Specifically, there are a myriad of physiological, psychological, and social factors that put women in midlife at unique risk for CVD.

Physiological changes impacting CVD risk may begin during young adulthood, such as health conditions developed during pregnancy; these include gestational hypertension or diabetes, gestational preeclampsia/pregnancy complications, eclampsia/seizures around the time of giving birth, preterm delivery, and retaining excess weight post-delivery (Lykke et al., 2009; Linné, Barkeling & Rössner, 2004). These conditions are associated with increased risk of developing CVD in midlife and older adulthood. Menopause is also a significant, independent contributor to CVD-related physiological changes for women during midlife. The American Heart Association's Prevention Science Committee of the Council of Epidemiology and Prevention and the Council on Cardiovascular and Stroke Nursing recently released a comprehensive synthesis of the relations between the menopause transition and CVD risk. According to this statement, the menopause transition includes a variety of physiological changes that increase risk for CVD, including hormonal changes (i.e., endogenous sex hormones),

body composition changes (i.e., lipids, lipoproteins, fat distribution), and vascular functioning changes (structural and functional; El Koundary, 2017; El Koundary et al., 2020).

CVD-related psychological risk factors in women during midlife also include stress as well as symptoms of depression and anxiety. Stress is often at least partially due to menopause-related increase in vasomotor symptoms such as hot flashes, impacted sexual functioning, and psychological symptoms of poor concentration (Blümel et al., 2004). Depressive disorders are more likely to occur among women compared to men and this risk increases specifically during midlife (Joynt, Whellan & O'Connor, 2003). Depressive symptoms can occur at 2- to 5-times greater rates perimenopause compared to premenopause, which is related to hormonal changes (El Koundary et al., 2019; 2020). Depression may directly increase CVD risk or work indirectly, via factors such as ability to engage in sufficient glycemic control (Kim, 2012). Similarly, anxiety symptoms are more likely to occur during the menopause transition for women in midlife without previous history of anxiety, which is associated with an unfavorable cardiac autonomic profile (Bromberger et al., 2013; Fu et al., 2018). Specifically, anxiety may lead to increased sympathetic and decreased parasympathetic activity (Thayer & Lane, 2007).

Lastly, evidence has supported social risk factors for CVD during midlife, including socioeconomic status and psychosocial stressors unrelated to menopause (Gold et al., 2013; El Koundary et al., 2020). Primary psychosocial stressors include social/family dynamic changes. For instance, women in midlife are often referred to as the "sandwich generation," as they are regularly caregiving for their children/grandchildren and expected to be caregivers for their parents (Vlachantoni et al.,

2020). Although gender roles are shifting in many countries, the socialized belief that women must bear the primary burden of caregiving and deprioritize their own needs (i.e., physical activity, health) remains present (DiGiacomo et al., 2011; Hendry et al., 2010; Thébaud, Kornrich, & Ruppanner, 2021).

1.1 Midlife as an Opportunity for Health Behavior Change

Fortunately, midlife has also been identified as a time ripe for personal growth (Jung, 1971). Many individuals experience midlife as a period to reflect on the first half of their life and how this has been consistent with their values thus far, and they perceive pressure to make changes in the second half of their life to fill any gaps. The Midlife in United States (MIDUS) longitudinal study suggests that midlife often represents a balance or bridge (i.e., between decline and development, earlier and later life periods, older and younger generations; Barry, 2014). This period also involves balance between decline and development, such that individuals may come to terms with the closing of their previous life chapter and associated loss or change, and use this period to inform growth in their next stages of life. This time may allow individuals to act as a link between older and younger generations (i.e., between their children and parents; Lachman, Teshale & Agrigoaei, 2015).

Additionally, midlife may be considered prime across areas of life, as it often brings established finances, career, family. and personal development (i.e., improvements in confidence; Lachman, Teshale & Agrigoaei, 2015). Thus, midlife may present a teaching opportunity with respect to overall health and wellness and specifically with respect to behavioral prevention of CVD. Adults in midlife may experience unique

motivation to make cardioprotective behavioral changes with greater focus on their future growth or legacy, perceived need to make healthier choices to be available for other generations, or ability to shift focus to personal development.

1.2 Physical Activity in Context of CVD Risk for Women in Midlife

One of the main behaviors that prevents against CVD is maintaining adequate intensity and frequency of physical activity (Banach et al., 2023). The American Heart Association recommends 150 minutes of moderate exercise divided into five bouts per week or 75 minutes of vigorous activity divided into 3 bouts per week (Tian & Meng, 2019). Even lower-intensity activity and small increases in activity (i.e., increased overall steps, reduced sedentary time) are also associated with greater cardiovascular health (Ramakrishnan et al., 2021). Physical activity induces neurohormonal and structural alterations and unbinds fatty acids which ultimately improves blood pressure and cholesterol (Kelly et al., 2012).

As a result, meeting activity guidelines would help manage the common precursors to CVD (i.e., type 2 diabetes mellitus, hyperlipidemia, hypertension, metabolic syndrome) and thus, is frequently recommended by physicians as part of CVD prevention (Omura et al., 2017). However, many women in midlife struggle to engage in adequate physical activity (Watson, Carlson, & Gunn, 2016). Perceived barriers to engaging in physical activity among the general adult population include poor motivation, lack of social support, lack of access or resources, and fear of injury for physical activity (Herazo-Beltrán et al., 2017). Women in midlife share these barriers and report additional barriers such as lack of time, lack of others to exercise with, and fatigue (Justine et al.,

2013), and there are several physical activity interventions specifically developed for women in midlife.

1.3 Social Support for Physical Activity Among Women in Midlife

A significant portion of physical activity interventions for women in midlife include social support as a key behavior change technique (i.e., BCT; method of behavioral change activation) to promote physical activity in intervention (Arigo et al., 2022). Broadly, social support includes comforting words/actions or assistance to others via instrumental support (i.e., tangible acts), informational support (i.e., providing advice, information, or resources), emotional support (i.e., compassionate statements), and accountability support (i.e., checking in on whether goals are met; Mohr, 2011; Cohen et al., 2004). This can come from a variety of sources such as individuals or groups, family, friends, or community members. Social support can be also operationally defined in a variety of ways, including actual provided support, assumed support, imagined support, or virtual support (Ozbay et al., 2008). Importantly, *perceived quality of* social support shows the greatest association with health outcomes, relative to concepts such as access to supportive resources (Uchino et al., 2018; Cohen, Underwood & Gottlieb, 2000).

Much empirical support exists for the association between social support and health outcomes broadly (Barth, Schneider & von Känel, 2010; Philogene et al., 2009; Grey et al., 2020; Yıldırım, & Tanrıverdi, 2021). For example, one 148-study meta-analysis reported a 50% greater likelihood of survival with greater social support, regardless of factors such as age, sex, or initial health status (Holt-Lunstad, Smith, & Layton, 2010). Social support components in physical activity interventions (i.e.,

supportive tips, words of emotional encouragement, or tangible assistance with physical activity) has demonstrated benefits such as greater attendance at exercise classes, greater increases in vigorous activity, and improved self-regulation (compared to intervention without social support components; Zhang, Brackbill & Centolla, 2015; Grim, Hertz & Petosa, 2011). According to longitudinal data, social support for physical activity can also directly reduce the risk of cardiovascular concerns (i.e., cardiovascular incidents, CVD risk; Ginting et al., 2016). Specifically, this reduced CVD risk from social support is due in part to reduced activity in the cardiovascular system and hypothalamic pituitary-adrenocortical axis and/or the stress-modulating pathway (Lett et al., 2005).

According to the American Heart Association's Study of Women's Health Across the Nation, women in midlife had significantly greater odds of engaging in recommended levels of physical activity (i.e., at least 150 minutes of moderate to vigorous or 75 minutes of vigorous exercise for more than 1 week for 2 hours per week over 4 consecutive months with moderate to vigorous heart rate increase) if they perceived higher rewards in their social roles and relationships – an association which held longitudinally as well as cross-sectionally (Stewart et al., 2020). Further, greater stress related to social roles in this study was associated with lower odds of effective glycemic control (i.e., <100 mg/dL without medication) and of a healthy body mass index (i.e., <25 kg/m^2; Stewart et al., 2020). Thus, it seems likely that one role of social support is that it acts as a buffer against stress (Roy et al., 2021). Further, women in midlife rate connection with others as highly important and social support interventions as necessary and beneficial (Im et al., 2008). Women across the lifespan tend to utilize social connection for different functions compared to men such that relationships may have

more complexity and involve stronger social ties (Costa-Cordella et al., 2021). Given that midlife can include psychosocial transition and stressors for women, it is not surprising that women in midlife cite social support as especially important for general wellbeing (Degges-White & Kepic, 2019).

Given its importance to women in midlife and demonstrated positive effects on physical activity, social support shows continued promise as a behavior change technique for physical activity interventions among women in midlife. The Behavior Change Technique Ontology defines *social support* broadly as "a behavior change technique that changes behavior by enlisting help of other people." Since this ontology was updated in July 2023 (after the initial proposal of the present study), social support was split into 16 different sub-labels and definitions to represent the multifaceted nature of this technique (Marques et al., 2023). For example, the definition for the sub-definition of "advise to seek instrumental support" is "a social support BCT that changes behaviour by the source suggesting that the person find practical social assistance to perform a behaviour" (Marques et al., 2023). Social support is often utilized as a BCT in health interventions for women in midlife, particularly those delivered via web-based platforms. Such online physical activity interventions for this population have been demonstrated to be desirable given that they are often more affordable compared to in-person interventions and offer greater accessibility and flexibility. This could be optimal for addressing population-specific time constraints such as child or parent caregiving in addition to careers for some women (Infurna, Gerstorf, & Lachman, 2020).

In a recent scoping review of BCTs in physical activity interventions for women in midlife, social support was cited as included in 45% of studies; however, these studies

rarely provided adequate information about *how* social support was facilitated, nor did they measure the *perceptions* of support from participants (Arigo et al., 2022). The trend of incorporating social support as an intended behavior change technique to promote physical activity may be an indicator of a larger pattern seen in social support literature: social support is assumed to be sufficiently activated with the simple addition of a group format (i.e., support will happen if women are present with each other during program meetings, relative to meeting individually with a program facilitator).

Critically, however, physical activity interventions for women in midlife are only modestly effective, including those that attempt to activate social support (Murray et al., 2017). It is possible that social support is not as universally effective as it is assumed to be, or that simply offering groups is suboptimal for activating support – especially given extant mixed results across health outcomes (Yan, 2018; Prins, 2019; De Vogli, Chandola & Marmot, 2007; Hakulinen et al., 2015). It has been suggested that the positive effects of social support are often overestimated or assumed without proper measurement (Yan, 2018). These limitations of existing work have made it challenging for interventions involving social support to be compared effectively and has ultimately hindered researchers' ability to identify active ingredients for facilitation of the behavior change technique of social support (Arigo et al., 2022). Further, this limitation has led to lack of clarity with respect to assessment of perceived of social support in interventions.

1.4 The Role of Social Comparison

One proposed contributor to the effectiveness of social support for promoting healthy behavior is *social comparison*. Similar constructs such as social control have

often been examined as contributing factors to the effectiveness of social support. For instance, social support efforts are occasionally perceived negatively and as a means for loved ones to exert personal control over the individual's health behaviors, and negative social interactions can result in *un*healthy behaviors (Arigo, Brown, Shank, & Young, 2023; Arigo, Pasko, & Mogle, 2019; Helgeson et al., 2004). However, social cognitions such as social comparison appear to be much less commonly examined as a contributor to social support (Costa-Cordella et al., 2021).

Social comparison is a basic cognitive process that occurs when an individual assesses themselves against another person (Festinger, 1954), which can occur in a variety of domains (i.e., beliefs, wealth, employment status, appearance, health; Wheeler & Miyake, 1992). Comparisons often occur in response to situations in which there is a perceived lack of objective information about how one is doing in reference to others. However, individuals tend to prefer and more frequently utilize social comparisons even when objective information is available (Klein, 1997). Social comparisons can also occur in multiple directions. The perception that another person (i.e., the comparison target) is doing better, worse, or about the same as the self would be categorized as upward, downward, and lateral comparisons, respectively (Wood, Taylor & Lobel, 1985). Social comparisons have a variety of general as well as health-specific benefits, including efforts that lead to greater motivation for self-improvement behaviors, work engagement, and perceived self-worth while coping with illness (Meier & Schäfer, 2018; Meltzer & Rourke, 2005; Pavlova et al., 2017).

However, there appears to be some stigma around making social comparisons; some individuals express concern that engaging in this process is negative (Helgeson &

Taylor, 1993), including a subset of women in midlife with elevated CVD risk (Arigo, Mogle, Brown, & Gupta, 2021). Downward comparisons are often perceived most negatively, as some perceive that this process reflects negative judgment of others and therefore, negative personal characteristics of the comparer. Interestingly, social comparisons may function differently in the general population or about general stressors, compared to the chronic illness population or health stressors. For example, downward comparisons are used more often than upward by the general population, while this is not necessarily the case for those with chronic illnesses. Some evidence suggests that, for individuals with chronic illnesses, there may be a preference for upward comparisons specifically on the dimension of coping, but preference for someone slightly worse off (downward comparison) on the dimensions of physical appearance or performance (Arigo, Cornell, & Smyth, 2018; Bennenbroek et al., 2022).

This discrepancy is likely due to the perception of a comparison target as representing a potential future outcome for the comparer. The perceived threat of a poor outcome (activated by a downward comparison) is likely to be higher for an individual with a chronic illness, compared to a less serious or non-life threatening stressor. This in turn leads to the preference for contact with an individual who represents the possibility of future health improvement (upward comparison target). Individuals with health concerns may use social comparison as a method of coping with their illness (i.e., adaptation based on others' methods of medication management, engagement with treatment/health behavior management or psychological adjustment; Terol et al., 2020).

1.5 Social Support, Social Comparison, and Coping

Efforts to seek distinct types of social support or to make distinct types of social comparisons may reflect broader efforts to cope with stress. As described by Lazarus and Folkman's Transactional theory of Stress and Coping, the stress experience is not solely about the external stress stimulus or the internal response. The *transaction* is the interaction and/or co-acting relationship between the external environment and internal *appraisal* and response (Lazarus & Folkman, 1984; Biggs, Brough & Drummond, 2017). This process begins during the daily process of scanning the environment for stressors. The individual will determine whether stressors are present via appraisal (i.e., assessment of threat posed by potential stressors). Primary appraisal occurs when the individual ascribes a meaning to the transaction, while secondary appraisal takes place when the individual decides what resources or options are present to resolve the stressor (Lazarus & Folkman, 1984; Biggs, Brough, & Drummond, 2017). Identification of a threatening stressor can result in increased emotional distress, which may cue either problem-solving coping strategies (i.e., coping that directly changes an aspect of the stressor) or emotion-focused strategies (i.e., coping that changes the emotions related to the stressor; Lazarus & Folkman, 1984).

Thus, with respect to coping, seeking emotional social support may enable mood regulation via emotion-focused coping, while informational or instrumental support may facilitate self-improvement via problem-solving. Consistent with this idea, lack of emotional support-seeking from personal relationships has been associated with increased negative emotional experiences (Helgeson et al., 2001). Further, increased instrumental support-seeking has been associated with increased desire to engage in problem-solving

(Kliewer et al., 1990). Social comparison is likely a means of broader coping with stressful circumstances with the goals of either emotional regulation or problem-solving (Lazarus & Folkman, 1984).

Specifically, the theory of Stress and Coping was further extended with Taylor and Lobel's perspective that when individuals are under stress, they are pulled between *two different coping needs*: regulating their emotions (i.e., improving mood) and problem-solving actions towards the stressor (i.e., obtaining related information that allows one to engage in self-improvement strategies to bolster their situation; Taylor & Lobel 1989; cf. Arigo, Suls & Smyth, 2014). Taylor and Lobel argued that while downward social comparisons may accomplish the goal of emotion regulation, upward social comparisons may accomplish the goal of problem-solving (Taylor & Lobel, 1989).

Specifically, downward comparisons have been defined as a means of emotional coping, as individuals may experience mood-enhancing benefits in the short term (i.e., feeling more positive because one perceives they are doing better than another in some domain; Pomery, Gibbons & Stock, 2012; Wills, 1981). Conversely, upward comparisons have been described as a means of self-improvement, as one may obtain information on how to make changes to resemble the target individual (Bandura, 1998; Halliwell, 2012). Buunk (1994) later found strong correlational support for these assertions, such that individuals who reported more negative affect also reported engagement in downward comparisons, and conversely, those with positive affect reported upward comparisons. Further, these associations were stronger with higher levels of reported uncertainty and stress. Buunk (1994) also found experimental support to show that the facilitation of

upward comparison resulted in preference for greater control and self-improvement in the workplace.

Of note, the Theory of Stress and Coping presents a dichotomous view of coping processes, whereas frameworks such as the Coping Circumplex Model (Stanislawski, 2019) place coping on a continuum. While there remains a debate about classifications for the broad variety of coping categories, each of these models acknowledge that individuals may feel pulled to engage in both emotion-focused and problem-solving coping. Additionally, a significant subset agrees on the emphasis of avoidant coping in addition to emotion-focused and problem-solving, including the Coping Circumplex model (Stanislawski, 2019), the Task-Oriented, Emotion-Oriented, and Avoidance-Oriented Coping (Endler & Parker, 1999), and one of the most common measures of coping at present: the Brief COPE (Carver, 1997). Researchers currently define avoidant coping as as "avoidance of thinking about the problem (e.g., by engaging in substitute activities), reducing efforts to solve the problem, postponing task, or giving up attempts to attain goal" (Stanislawski, 2019).

Importantly, the Stress and Coping model may be more applicable to online than in-person interventions, where there may be a limited set of content options for facilitating coping processes. Therefore, it may be useful to conceptualize seeking certain forms of social support and social comparison as predominantly emotion-focused or problem-solving focused, with the acknowledgement that avoidant coping may also be important to explore and there may be some fluidity between categories.

1.6 Coping, Perceived Risk, and Perceived Helpfulness of Support and Comparison

Patterns of preference for emotion-focused versus problem-solving focused coping may be more predictable for individuals if the stressor's threat level is clear (i.e., low vs. high perceived threat). However, if the stressor is more ambiguous (i.e., stress about lower-level threat risk factors for higher risk chronic illness and/or stress about meeting related health behavior management goals), navigating coping needs may present a unique challenge. These coping questions may be especially relevant for women in midlife with CVD risk conditions. This group tends to perceive CVD as less threatening than other illnesses such as cancer and struggles to accurately perceive their CVD risk (Benjamin et al., 2017; Mosca et al., 2009;). These individuals also may not be significantly concerned about risk factors alone and may not make connections between the importance of physical activity in buffering this risk.

For example, a woman in midlife with heightened risk for CVD due to conditions such as hypertension and prediabetes who struggles to engage in sufficient physical activity may perceive her current threat as low, given that she has only been diagnosed with a precursor to a life-threatening illness, or she may perceive her current threat as higher given that she is now closer to a life-threatening illness. For this hypothesized individual, it is possible that when she is faced with decisions in how to cope with her current health status (i.e., behavioral management via physical activity), she must prioritize either the emotion regulation or problem-solving goal, depending on her appraisal of the stressor.

This pull between two coping goals may also impact the perception of social support. Taylor and Lobel hypothesized that social comparison processes may, in part, explain why there has been mixed evidence with respect to relations between social support and health outcomes (Buunk & Hooren, 1992; Taylor & Lobel, 1989). Returning to the hypothesized woman in midlife who struggles to meet her physical activity goal, if she perceives a desire to improve her mood related to this (i.e., via seeking encouragement or downward social comparison), she may feel more emotionally regulated and perceive greater support or helpfulness in the moment, though may not have tools to engage in self-enhancement or learn new ways to allow her to meet her physical activity goals in the future. Similarly, if she struggles to meet her activity goals but perceives a need to learn new ways of being active (i.e., via seeking accountability or upward social comparison), she may perceive less direct support or helpfulness in the moment but may ultimately end up with greater physical activity. Thus, if perceived supportiveness or helpfulness is conflated with the need to "feel good," this may be one reason why social support is associated with mixed outcomes and may be an important opportunity for intervention (i.e., psychoeducation on how different kinds of support may be useful).

Consistent with Social Problem-Solving Theory, some individuals may also be more vulnerable to ineffective problem-solving (D'Zurilla & Goldfried, 1971). These individuals may be higher in *negative problem orientation*, meaning that they possess a tendency to perceive problems through a threatening lens, lack confidence in their ability to problem solve, and experience negative emotion in response (Nezu & Nezu, 2001). Thus, it is possible that there is not only a concern for preference for "feeling good" when

coping with stressors, but also an overall difficulty with threat perception, self-efficacy for coping, and distress tolerance. This deficit in effective coping is a result of lack of sufficient learning experiences and can be addressed with problem-solving training (D'Zurilla & Goldfried, 1971). To determine whether such training might address a specific deficit to help promote physical activity among women in midlife with elevated CVD risk, it is important to determine whether negative problem orientation is associated with physical activity-related coping efforts in this population.

1.7 Coping Among Women in Midlife

Lazarus and Folkman's Theory of Stress and Coping has been used previously to understand coping among women in midlife (e.g., across the health status change of menopause; Simpson & Thompson, 2009). Consistent with this theory, the ability of women in midlife to adapt to a stressor was contingent on their appraisal of the event and their coping style used (Simpson & Thompson, 2009). This study also demonstrated that higher levels of stress among women in midlife were associated with more frequent seeking of traditionally defined support (i.e., emotion-focused). It was suggested by these data and prior literature that emotion-focused coping is more common among women compared to other coping types such as problem-solving and avoidance strategies and specifically more common with increasing age. However, a previous meta-analytic review reported that problem-solving coping was associated with the best overall health outcomes, compared to other types of coping (Penley, Tomaka & Wiebe, 2002).

As noted, perceptions of social support (vs. other operationalizations of support, e.g., access to resources) are most predictive of health outcomes. Thus, it is important to

determine whether certain kinds of support may be more strongly desired and positively perceived, while other kinds of support may be more effective for the desired outcome (i.e., promotion of physical activity). In other words, is it possible that emotion-focused coping or coping that makes an individual feel good results in greater perceived support but less engagement with outcomes of interest than problem-solving efforts, which may make an individual feel less supported but allow for self-improvement to occur. There is need for a greater understanding of how women in midlife cope with stress and what types of experiences they perceive as most stressful, threatening, or uncertain (Simpson & Thompson, 2009). Such patterns of appraisal in women in midlife have been difficult to capture this far. Assessment of appraisal, together with the use of a research design that captures coping in the context of daily life, would be particularly informative (Stone & Neale, 1984).

In a similar vein, although global measures of social support, social comparison, coping, and problem orientation may be useful in understanding these experiences, they are also limited by retrospective recall bias across a range of complex social situations (Sliwinski et al., 2018). These global measures also fail to take contextual factors into account (i.e., how support is sought or received in the moment), which is likely more useful in understanding nuance in ideal social support conditions (Crockett & Duran, 2018). Research designed to understand coping in its immediate context, as well as barriers to and facilitators of effective social support, is needed to inform improvements to health behavior interventions for women in midlife.

1.8 Aims of the Present Study

The overarching goal of the present pilot study was to take initial steps toward improving on the current understanding of how women in midlife with increased CVD risk, who also experience multiple stressors (i.e., menopause, caregiving), select and perceive web-based physical activity content. Specifically, it was unknown how their selection and perceptions align with social support and comparison processes, which may reflect emotion- versus problem-solving coping efforts. To gain a better understanding of these processes, we recruited 62 women in midlife (i.e., age 40-60) with risk for CVD (e.g., pre/diabetes, pre/hypertension, high cholesterol, metabolic syndrome, current or recent smoker) to complete 7 days of data collection. This included daily use of a study-specific website meant to support physical activity (i.e., including social support messages and health profiles of other women in midlife meant to induce social comparison), use of a physical activity monitor, and completion of end-of-day surveys.

Using the conceptual framework shown in Figure 1, the first aim of this study was to describe women's overall perceived stress (or appraisals) about their health and physical activity at baseline. The second aim was to describe their selections of website content that may reflect in-the-moment emotion-focused versus problem-solving coping processes, with respect to the frequencies of selections in each category across days. The third aim was to examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and the *overall frequencies of selecting content* that may reflect emotion- versus problem-solving coping processes. Similarly, the fourth aim was to examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and their in-the-moment *perceptions of the*

helpfulness of content that may reflect emotion- versus problem-solving coping processes. The fifth aim was to determine whether baseline problem orientation was associated with website content selections or their perceived helpfulness. The final aim was to test for an association between the frequencies of viewing content that may reflect emotion- versus problem-solving coping processes and women's physical activity engagement over 7 days.

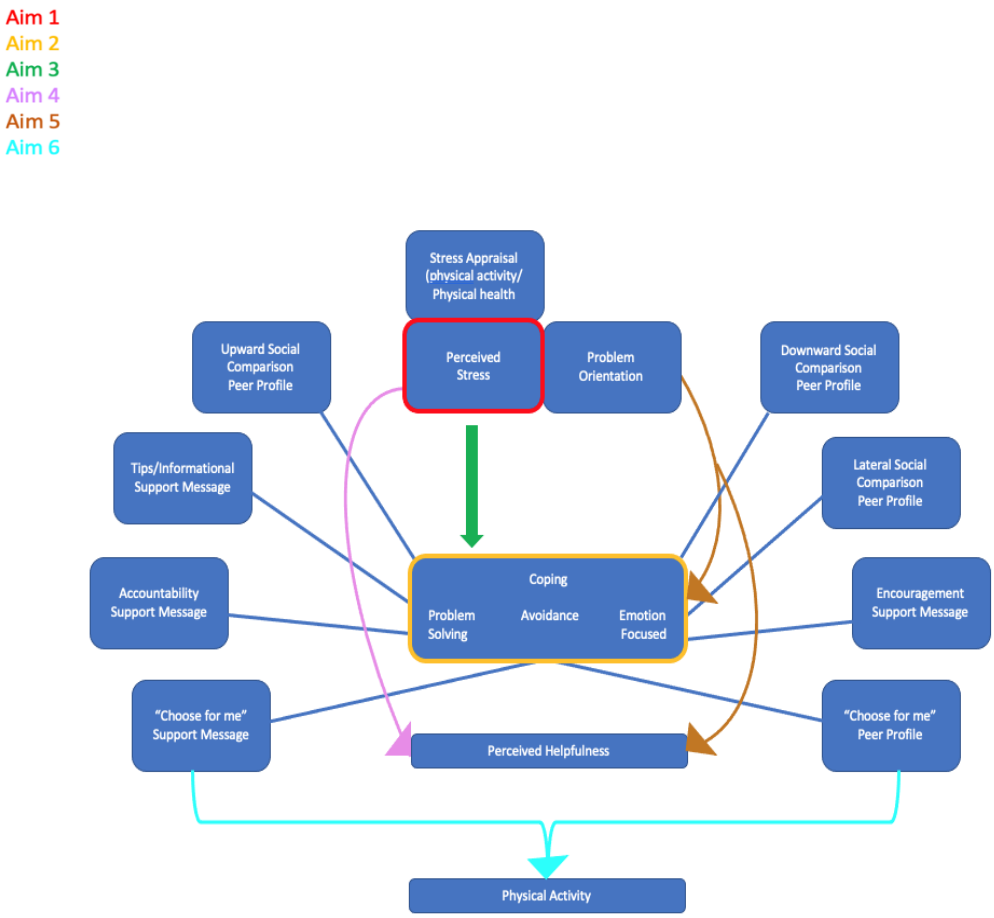

Figure 1. Conceptual framework for present study

Chapter 2

Methods

2.1 Recruitment and Participants

Women ages 40-60 (inclusive) were eligible to participate if they reported at least one of the following cardiovascular risk factors: prehypertension or hypertension, prediabetes or type 2 diabetes, high cholesterol (hyperlipidemia or hypercholesterolemia), metabolic syndrome, that they currently smoked, or that they quit smoking within the prior 3 months. Where relevant, participants self-identified based on their report of a diagnosis from their physician.

Recruited individuals were asked to provide relevant information from the most recent blood work collected via their medical record during screening: hemoglobin A1C, fasting blood sugar level, high and low-density lipoprotein cholesterol, triglycerides, and blood pressure. Eligibility also required fluency in English and access to a computer or smartphone (for website use and completing end-of-day surveys).

Participants were recruited via web advertisements, Rowan University announcement emails to the campus community, and existing participant databases. Given success with these recruitment methods alone and the need to balance ongoing study management activities and anticipated burden of in-person recruitment, local clinical and community partner recruitment was not engaged as originally planned. As in the research team's prior work, advertisements were designed to maximize inclusiveness (e.g., using images of women from diverse backgrounds).

2.1.1 Sample Size Determination

The pre-identified target sample size of $N = 60$ is appropriate for pilot-level data collection, as it is more than three times the recommended sample size for such studies (i.e., 10% of final sample size; Hetzog, 2008). Expecting small-to-moderate effect sizes was appropriate for the present study, given median effect sizes for research in social, clinical, and multidisciplinary areas of psychology reported in recent reviews (i.e., *d*s = 0.30-0.36; Schäfer & Schwartz; 2019). With a recruited sample size of 62 participants (60 who completed all study procedures), a two-tailed linear bivariate regression at an alpha level of 0.05 without additional covariates is powered at 0.34 and 0.99 to detect small ($d = 0.20$) and moderate ($d = 0.50$) effect sizes, respectively, according to G*Power (Faul, Erdfelder, Buchner et al., 2007).

2.2 Participants and Procedures

All study procedures were approved by Rowan University's Institutional Review Board under a larger protocol. The original protocol involved the development of the study website, as well as initial data collection to assess feasibility and acceptability of the website and associated behaviors (e.g., physical activity). IRB amendments were submitted by the author (KP) to accommodate the present study, which utilized the website content for the novel purpose of examining selection patterns of website content as they pertain to coping style (i.e., emotion-focused vs. problem-solving). Study measures and individual questions were added to the protocol to allow for this expanded investigation (see measures in Appendix A).

Interested individuals completed a short telephone screening call during which they received information about participation and were invited to ask questions about the study. Those who were deemed eligible and remained interested were scheduled for an orientation session (conducted remotely via Zoom) and were be asked to complete a baseline survey prior to this session (via Qualtrics; see measures in Appendix A, below). A total of 62 women completed the baseline survey and enrolled in the study. Two participants withdrew from the study due to lack of time; thus 60 participants completed all study procedures (see Figure 3; M_{Age} = 50.70, *SD* = 5.89).

The majority of participants identified as white (71.2 %), followed by Black (20.3%), "other" (5.1%; wrote in "mixed" race"), and South Asian (3.4%). Additionally, 8.3% of participants identified as Hispanic or Latina. Most women in this sample reported relatively high socioeconomic status (55.9% earning 75-100,000+ total in household, 28.9% earning 50-75,000, 11.9% earning 25-50,000, 3.4% earning up to 25,000). Further, most participants completed some college or higher education (45% with graduate/professional degree, 33.93% with Bachelor's degree, 15% with some college, 6.7% with GED). Participants overwhelmingly were married (69.5%) with children (79.7%); 60% of participants reported having regular caregiving responsibilities for children/grandchildren and 11.9% endorsed active caregiving of a parent or other loved one. Regarding menopause, participants ranged across status (pre: 33.3%, peri: 23.3%, post: 30.0%, ceased menstruation due to surgery or other factors: 13.3%). Over half of the participants had BMIs that fell into the obese category (53.3%) and the most-

commonly endorsed CVD risk factors included high cholesterol (30%) and hypertension (26%). Descriptive information for the sample demographics and available blood work can be found in Tables 1 and 2, respectively.

Table 1

Participant Demographics

	Full sample	
	n	*%*
Racial Identification		
Black	12	20.3
White	42	71.2
South Asian	2	3.4
"Other" (e.g., more than one race)	3	5.1
Ethnic Identification		
Hispanic/Latina	5	8.3
Not Hispanic/Latina	55	91.7

	Full sample	
	n	%
Marital status		
Never Married	6	10.2
Married	41	69.5
Widowed	1	1.7
Divorced	8	13.6
Children		
Has children	47	79.7
Does not have children	12	20.3
Caregiving		
Regularly cares for children/grandchildren	36	60.0
Regularly cares for parent/other loved one	7	11.9
Highest educational level		
High school graduate/GED	4	16.7
Associate's degree, partial college, technical	9	15.0
Bachelor's degree	20	33.3
Graduate of professional degree	27	45.0

	Full sample	
	n	*%*
Household Income		
$0-25,000	2	3.4
$25,000-50,000	7	11.9
$50,000-75,000	17	28.8
$75,000-100,000	33	55.9
BMI		
Healthy Weight	9	15.0
Overweight	19	31.7
Obese	32	53.3
Menopausal Status		
Pre	20	33.3
Peri	14	23.3
Post	18	30.0
Other (i.e., ceased menstruating due to surgery)	8	13.3

	Full sample	
	n	*%*
CVD Risk Factors*		
Pre/hypertension	26	43.3
Pre/Type 2 Diabetes	16	26.7
Metabolic Syndrome	6	10.0
Current Smoker	5	8.3
Quit smoking in past 3 months	7	11.7

Note. $N = 60$. Participants were on average 50.70 years old ($SD = 5.89$). *Participants could indicate more than one risk factor; not out of 100%.

Table 2

Descriptive Statistics for Recent Self-Reported Blood Work

Variable	*n*	*M*	*SD*	Min	Max
1. Hemoglobin A1C (%)	19	7.18	7.18	5.0	14.0
2. Fasting Blood Sugar	20	102.95	29.02	64.0	188.0
3. High-Density Lipoprotein Cholesterol (mg/dL)	25	57.36	15.63	30.0	97.0
4. Low-Density Lipoprotein Cholesterol (mg/dL)	24	127.59	39.58	44.0	187.6
5. Triglycerides (mg/dL)	24	123.37	64.31	52.0	280.0
6. Systolic Blood Pressure	27	125.30	19.62	68.0	163.0
7. Diastolic Blood Pressure	27	80.48	13.44	63	125.0

Those who did not already own a personal physical activity monitor or preferred not to use their personal monitor for study purposes received a physical activity monitor in the mail prior to this session (32/60; 53.3%), with return postage pre-paid. As outlined in Figure 2, women who enrolled completed 7 subsequent days of data collection,

including (1) wearing the physical activity monitor, (2) daily interactions with the study website (in the morning), and (3) brief surveys at the end of each day. At the end of 7 days, participants returned for a brief exit interview with staff via Zoom to share their study experiences. Both orientation sessions and exit interviews were led by the author, with the assistance of other study staff (e.g., when appointments needed to be scheduled on practicum days). The protocol for the interview was an abbreviated version of the original script such that participants were asked to share about their broad experience with the study website and overall data collection. They were asked to return their physical activity monitor via pre-paid mailing if they did not use a personal monitor, and subsequently received compensation electronically (i.e., ClinCard). Participants received $10 for completing the baseline survey and orientation session, $30 for completing 7 days of data collection, and $10 as a bonus if they completed >80% of daily study activities (see Arigo et al., 2020).

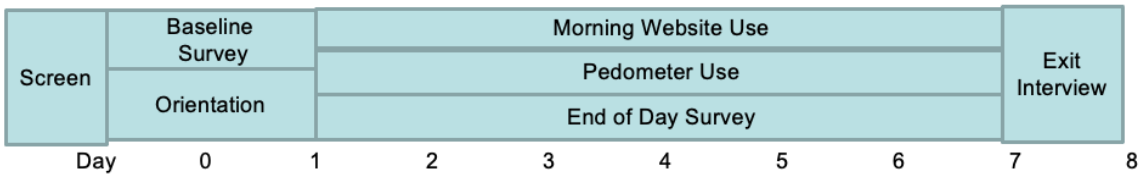

Figure 2. Study timeline and components

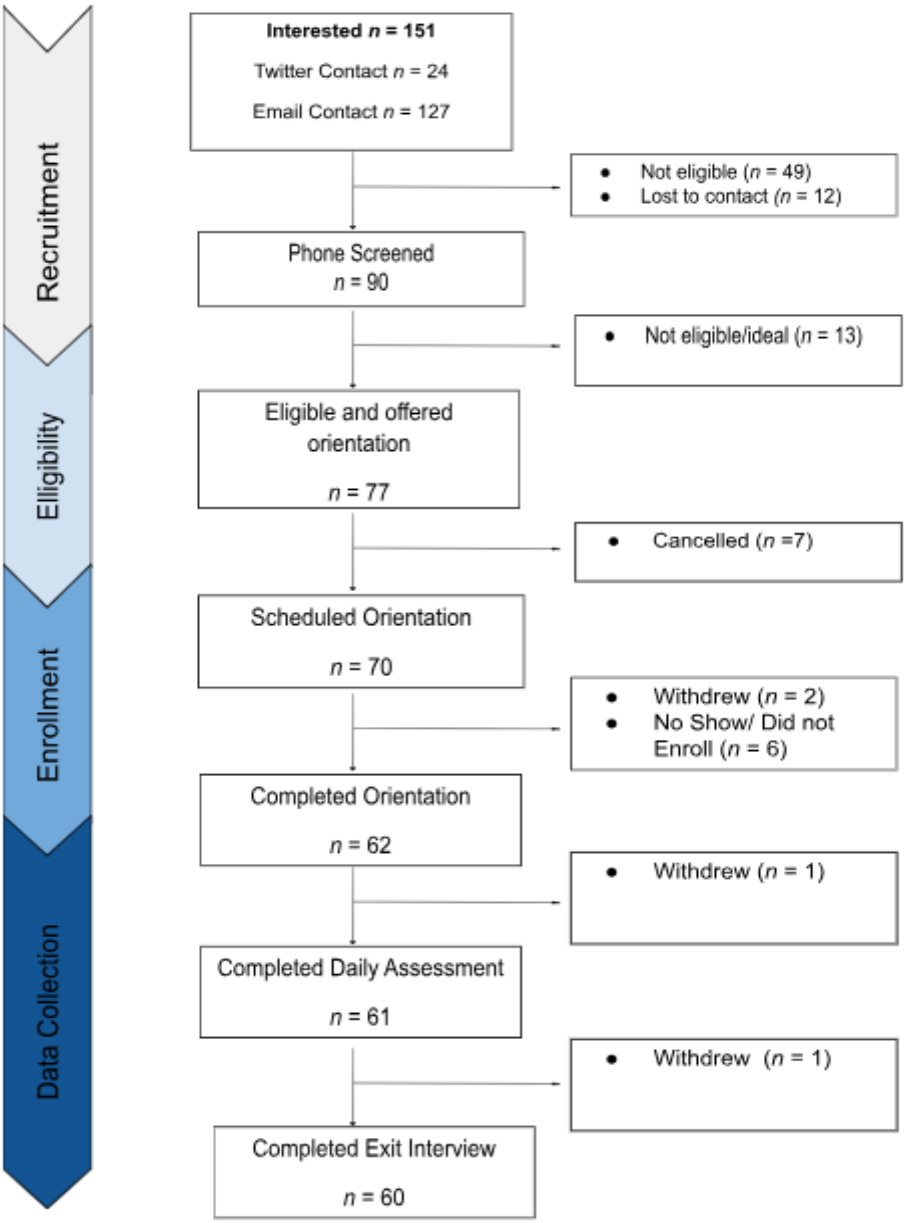

Figure 3. Recruitment and retention flowchart

2.2.1 Study Website

Participants were asked to use a proprietary website for 7 days of data collection each morning (Arigo et al., 2022; 2023). This website previously demonstrated feasibility, functionality, and acceptability from a sample of eligible women in midlife (*N* = 32; Mage = 52; 2 identified as Latina, 11 identified as Black, 16 identified as White, 2 identified as East Asian, and 1 identified as American Indian). The author (KP) and study staff sent automated calendar invitations each morning at the same time (based on the participant's typical wake time) that included a personalized website link. Some participants required additional technology support (i.e., re-sending the link due to difficulty finding in email, instruction on how to accept the calendar invitation). Once logged into the site by clicking on this link, participants were asked to submit their physical activity goals for the day, with respect to total steps and "active minutes" (i.e., moderate-to-vigorous-intensity activity or structured exercise).

As described below, they were then asked to select one of three peer profiles to view; peers differed with respect to their typical activity level, ranging from not very physically active to very active, with an additional option for "no preference – choose for me." Next, they were asked to select one of three support messages including tips for being more active, encouragement, and accountability; there was also an option for "no preference." Participants had an additional opportunity to see either one more peer profile or message as well as to give feedback on the helpfulness or supportiveness of the profiles and messages. Profiles and messages are described further below.

2.2.2 Peer Profiles (Representing Social Comparison Targets)

Participants chose among fictional peer profiles of women in midlife in an attempt to facilitate social comparison processes. Profiles included a photo, brief background information about the peer (age, career, child or parent caretaking responsibilities), and their physical activity (average activity, barriers, favorite type of exercise; see Figure 4). As noted, peers ranged in physical activity level (i.e., highly active/upward target, moderately active/lateral target, not-so-active/downward target). In addition, physical activity information (average steps per day, average active minutes) in each profile was adapted based on total step count and active minutes submitted by each participant from the prior day's end-of-day survey. For example, if a participant chose to see a highly active, moderately active, or not very active peer, the physical activity data for the peer profile would be 130%, 95-105%, and 68% of the participant's activity from the previous day, respectively. Additionally, participants had the option to click "no preference – choose for me." In this case, a target profile (highly active, moderately active, or not very active) was randomly selected. If there was no physical activity data provided on a participant from the previous day, profile data was adjusted with previously established ranges.

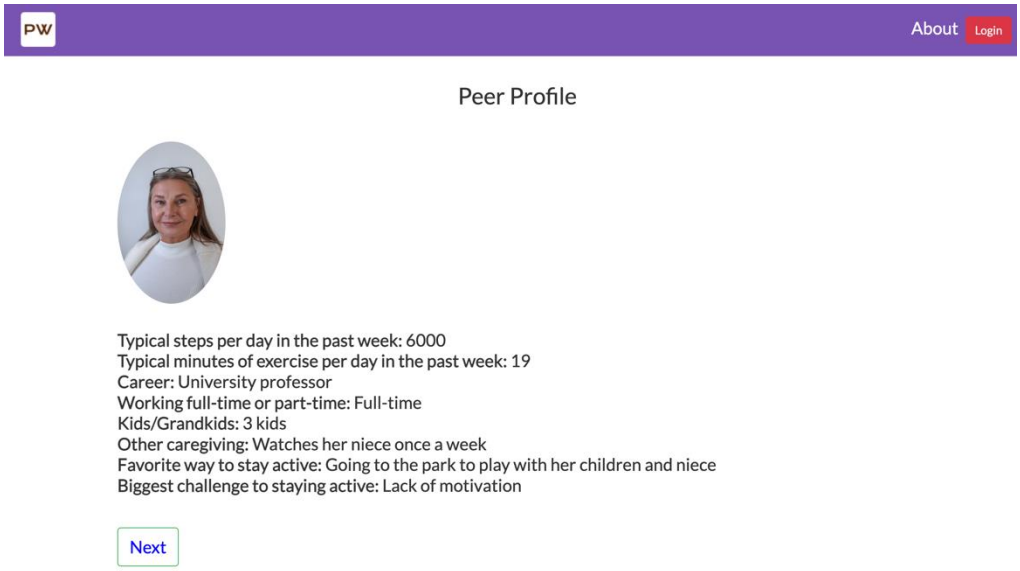

Figure 4. Example Peer Profile on Study Website

2.2.3 Messages (Representing Sources of Social Support)

Participants were next asked to select a message to support their physical activity and could choose from the following categories: tips, accountability, and encouragement (see Figure 5). Tips included information or suggested ways of increasing physical activity (e.g., "With so much going on in your busy schedule, it can be hard to find time to exercise. Here are some ways to be more active during your normal activities: Walk up and down the stairs 3 times in a row while at home, Walk in place while talking on the phone or scrolling through social media, Take 2-minute walking or standing breaks for each hour of sitting/screen time."). Accountability included suggested methods of maintaining progress given personal goals or standards (e.g., "Make it easy to follow through with your physical activity plans! Add time to be active on your calendar and show up like you would with any other appointment. This makes it clear that you have a

commitment to yourself and to your health"). Encouragement included traditionally supportive or motivating phrases (e.g., "Trying to be healthy can be stressful, especially when you have so much going on. Be patient with yourself, but stick to it. Think about times when you've been successful with getting yourself to be active when you didn't want to. This adds up in the long run!").

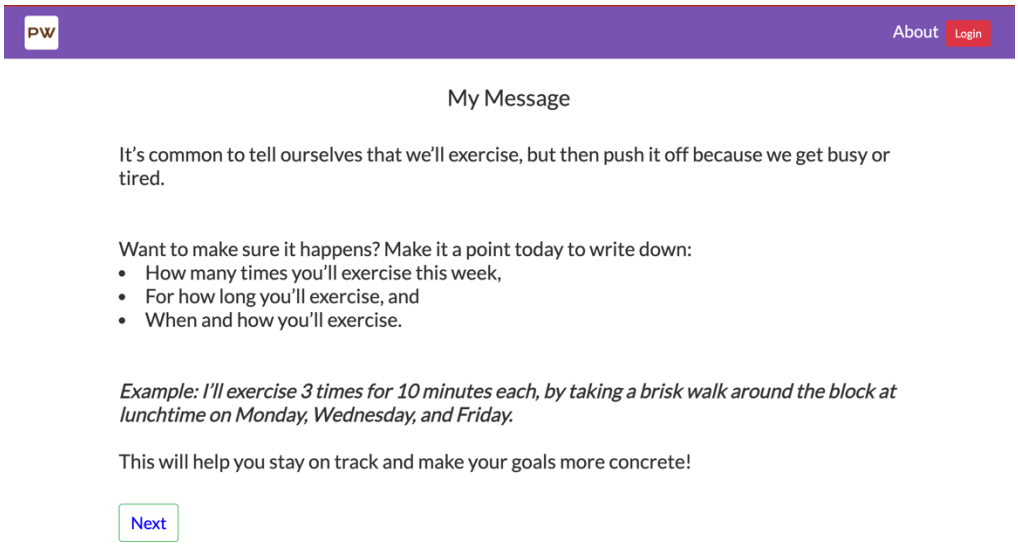

Figure 5. Example Support Message on Study Website

Participants also had the opportunity to select "no preference – choose for me," which resulted in receiving a message from the category that had been selected least recently. Finally, participants were asked if they would like to view more content. If they selected yes, they were asked to choose from any kind of message, to see another peer, or no preference. Those who chose to see another peer were randomly shown another profile. If they declined more content, they were be taken to a final screen where they indicate their physical activity implementation intentions for the day.

2.3 Global Measures (Assessed at Baseline)

2.3.1 Demographic Information

Participants were asked to report demographic identifiers via baseline survey, including age, race, ethnicity, cardiovascular risk factors, menopause status, household income, marital status, height, and weight (to calculate body mass index).

2.3.2 Medical Information

Participants were asked to provide values from their most-recent bloodwork obtained from their primary care provider including their hemoglobin A1C (%), fasting blood sugar (mg/dL), high- and low-density cholesterol (mg/dL), triglycerides (mg/dL), systolic and diastolic blood pressure. This acted as a validity check for eligibility and provided descriptive information of the sample related to cardiovascular risk.

2.3.3 Perceived Stress

Participants were asked to complete the Perceived Stress Scale (PSS-10; Cohen, Kamarck, & Mermelstein, 1983; see Appendix A), which is a widely used and validated measure of stress. This general measure of stress has been validated in a variety of populations (i.e., undergraduate/ graduate students, police officers/technical workers, chronic mental health and medical patient populations; Lee, 2012). This measure includes questions such as “In the last month, how often have you been upset because of something that happened unexpectedly?” and “In the last month, how often have you found that you could not cope with all the things that you had to do?”. This measure uses

a 5-point Likert scale including responses from *never* (1) to *very often* (5). The PSS has been reported to have moderate convergent validity with other measures of stress appraisal and at least relatively high reliability (Cronbach's alpha >70 across 12 studies; Lee, 2012; Cohen, Kamark & Mermelstein, 1983). The present sample had an alpha of 0.92 for all items, 0.92 for the perceived helplessness sub-scale and 0.83 for the perceived lack of self-efficacy sub-scale.

Total scores for this measure served as descriptive information about participants' stress experiences broadly. Two additional questions using the same format and response options as the PSS-10 were used to assess stress specific to physical activity and overall health (i.e., "In the last month, how often have you been stressed about the following? (A) Your physical activity engagement, (B) Your physical health"). Response options ranged on a 5-point Likert scale from *never* (1) to *very often* (5). Scores for questions about physical activity/health stress (PAHS) were summed to form a total score, which were examined for its association with total PSS score and used to test study aims. These questions were adapted from the PSS-10 to provide a brief, more specific assessment of stress related to CVD risk and related physical activity behavior (see Appendix A). Cronbach's alpha for the researcher-developed PAHS questions was 0.67. Although low, this measure was developed for purposes of this study and scores between 0.6-0.8 are considered acceptable (Shi, Mo & Sun, 2012).

2.3.4 Self-Reported Coping

In addition to the behavioral measure of coping, participants were asked to complete the Coping Inventory to Problems Experienced Inventory (Brief-Cope), 28-item measure of coping which has shown adequate validity (Carver, 1997; see Appendix A). This measure includes items such as "I've been trying to come up with a strategy about what to do" and response options range on a 4-point Likert scale from *I haven't been doing this at all* to *I've been doing this a lot*. This measure was used in the baseline survey as a global measure of coping across emotion-focused, problem-solving, or avoidance-focused methods. Cronbach's alpha for this sample was 0.89, 0.78, and 0.72 for problem-solving, emotion-focused, and avoidance coping sub-scales, respectively.

2.3.5 Self-Efficacy for Managing Health Concerns

Participants were asked to complete the Self-Efficacy for Managing Chronic Disease measure as an assessment of their self-efficacy for managing their health and/or physical activity stress related to their cardiovascular risk factors (Lorig et al., 2001; see Appendix A). This is a 6-item measure with questions such as "How confident do you feel that you can keep any other symptoms or health problems you have from interfering with the things you want to do?" with a 10-point Likert scale ranging from *not at all* to *totally confident*. It has shown good validity across 10 studies ($\alpha = 0.88$; Ritter & Lorig). For the present sample, $\alpha = 0.94$. Sensitivity analyses were performed to assess appropriateness for addition to analyses as a covariate (see Appendix D).

2.3.6 Negative Problem Orientation

Participants' social problem-solving orientation was assessed with the Negative Problem Orientation Questionnaire (NPOQ; Gosselin, Pelletier, and Ladouceur; 2001; see Appendix A). This is a 12-item measure including questions such as "I have a tendency to see problems as a danger", with response options ranging on a 5-point Likert scale from *not at all true of me* to *extremely true of me*. This measure was chosen compared to a broader measure of problem orientation given focus on perception of high threat and to minimize burden of the baseline survey for participants. It has demonstrated good convergent and divergent validity and excellent internal consistency (α =.90; Gosselin, Pelletier, and Ladouceur; 2001). For the present sample, α = 0.94.

2.4 Behavioral and Perceptions Measures (Assessed Daily)

2.4.1 Website Content Selections: Behavioral Measure of Coping

Website content was dichotomized to represent two primary forms of coping: problem-solving and emotion-focused, with an additional *avoidance coping* category for when participants select "choose for me" for exploratory purposes; see Appendix B. Problem-solving content included the selection of accountability messages, tip messages, and upward social comparison peer profiles, given that they are likely to support self-improvement goals (Taylor & Lobel, 1989; see Figure 6). Emotion-focused content included encouragement messages as well as lateral or downward profiles, given that these are likely to promote positive emotional experiences (Taylor & Lobel, 1989; see

Figure 6). Selections of "no preference" for either peer profiles or messages was considered avoidance coping given that this may represent a lack of behavioral effort to directly manage emotions or deal with physical activity/health stressors (Cronkite & Moos, 1995). Participants were asked to choose from message and profile content to see twice during their morning website use during each of their 7 days of participation. Each selection of problem-solving, emotion-focused, or avoidance-based content counted as one point which will ultimately was summed to determine frequency of selection of each of the three categories. Scores for the frequencies for selecting problem-solving, emotion-focused, or avoidance-based content (i.e., "choose for me") therefore could range from 0-14.

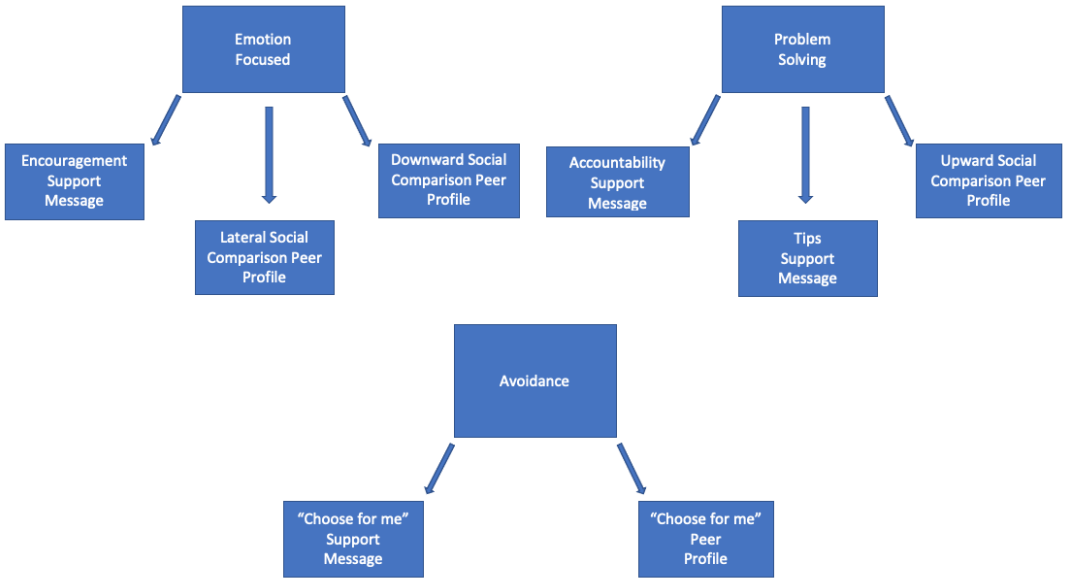

Figure 6. Website Content by Coping Type

2.4.2 Perceptions of Website Content

Participants were asked to rate website content during their morning website use, immediately after viewing each set of selected content (see Appendix B). After viewing their first peer profile, they were asked "After reading the description of your peer: how much do you feel inspired, confident, or hopeful about your own physical activity?" with a 5-point Likert response options ranging from *not at all* (1) to *very much* (5). This score acted as a measure of perceived support or helpfulness from peer profile. After viewing their first message, they were asked "how helpful was this message today?" with a 5-point Likert response options ranging from *not at all* (1) to *very much* (5). This score acted as a measure of perceived support or helpfulness from messages.

2.4.3 Physical Activity

Participants were asked to use either a personal or study-administered physical activity monitor. For those who elect to use their personal monitor, staff collected information about the device and the activity outcomes assessed (e.g., steps, minutes of moderate-to-vigorous-intensity activity, sedentary time). Those who use a study-administered monitor were mailed an Accusplit ax2720mv pedometer to be worn on waist or hip, with return postage prepaid. Participants were asked to input their step count and active physical activity minutes (i.e., time spent engaging in moderate-to-vigorous-intensity activity) in the study website at the start of the day and totals for steps and active minutes in their end of day survey, based on either the reading from their personal physical activity monitor or study-provided pedometer (See Appendix C). For the present

study, daily physical activity was defined as the total number of steps per day entered into the end-of-day survey; total number of active minutes were examined in an exploratory manner.

2.5 Data Analysis Plan

SPSS Statistics version 27 was used to identify patterns of missingness and to ensure that assumptions are met for each set of analyses. Specifically, assumptions of Pearson correlation, linear regression, and moderation were assessed including appropriateness of data (i.e., variable type), linearity, outliers, homoscedasticity, normal distribution of errors, and homogeneity of variance (Laerd Statistics, 2015). Linearity was assessed via scatterplot and visual inspection of slope. Outliers were examined via case wise diagnostics and assessed for any data entry, measurement-related, or otherwise usual values; no outliers were present or required removal. Homoscedasticity was examined by visual scatter plot inspection and distribution of errors were assessed via Normal P-P plots with insufficient need for data transformation. Homogeneity of variance was assessed with Levene's test. Assumptions of repeated measures ANOVA included appropriateness of data (i.e., level), outliers, normal distribution of errors, as well as sphericity (Laerd Statistics, 2015). Once again, no significant outliers were present/needed addressing. Normality was confirmed with the Shapiro-Wilk test. Lastly, sphericity was checked via Mauchly's test with the standard ANOVA output, with assumption met (ps > 0.05).

Descriptive statistics were obtained for demographic information, including age, height and weight (used to calculate BMI), and racial/ethnic identifiers, as well as for key variables of interest (i.e., blood work values, stress, selections of website content, perceived helpfulness of website content, and daily physical activity). To address Aim 1, descriptive statistics were used to characterize the sample with respect to self-reported risk perception (i.e., level of perceived health and physical activity stress; means, standard deviations, ranges) and its association with overall perceived stress on the PSS. To address Aim 2, frequencies were used to describe selections of messages and peer profiles with respect to emotion-focused, problem-solving, and avoidance coping. Descriptive information was also obtained for self-reported coping and problem orientation at baseline.

For Aim 3, simultaneous linear regression was used to test for relations between baseline stress about meeting physical activity and health goals and the total frequencies of website content sections, in the categories of problem-solving and emotion-focused coping selections (i.e., sum frequency across 7 days that content from each coping category was selected as primary/initial daily website prompts). A similar approach was used to test for relations baseline stress and avoidance coping. Simultaneous regression was used given that there was no theoretical rationale for stepwise or hierarchical order of variable entry. Additionally, Pearson correlations were used to examine relations between baseline stress and self-reported coping, as well as negative problem orientation at baseline, in an exploratory manner.

Pearson correlation was also used to address Aim 4, to test relations between baseline stress about meeting physical activity/health goals and perceptions of helpfulness for facilitating their activity in each category (e.g., emotion-versus problem-solving coping), with comparison of effect size. This approach was repeated for Aim 5, to examine associations between problem orientation and perceptions of helpfulness for facilitating their activity in each category. To address Aim 6, repeated measures ANOVAs was used to test for relations between the collapsed frequencies of viewing emotion-focused and problem-solving website content selections, respectively (i.e., initial selections only) and physical activity across time (7 days), with comparison of effect sizes (R^2). Sensitivity analyses were performed with the self-efficacy for managing chronic medical concerns variable to determine whether this is an appropriate covariate across analyses.

2.5.1 Aims, Analyses, and Hypotheses

Aim 1: Describe women's overall perceived stress (or appraisals) about their health and physical activity at baseline.

Analysis: Descriptive statistics (means, standard deviations, ranges)

Hypothesis: Not applicable (descriptive)

Aim 2: Describe selections of website content that may reflect in-the-moment emotion-focused versus problem-solving coping processes, with respect to the frequencies of selections in each category across days.

Analysis: Frequencies (mean, standard deviation)

Hypothesis: Not applicable (descriptive)

Aim 3: Examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and the *overall frequencies of selecting content* that may reflect emotion- versus problem-solving coping processes.

Analysis: Linear regression

Hypothesis: Baseline physical activity/health stress will:

A) Be moderately positively correlated with overall stress level,
B) Positively predict the frequency of days that emotion-focused content is selected (initial selections only), and
C) Negatively predict the frequency of days that problem-solving content is selected (initial selections only)

Aim 4: Examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and their in-the-moment *perceptions of the helpfulness of content* that may reflect emotion- versus problem-solving coping processes.

Analysis: Pearson correlation

Hypothesis: Baseline physical activity/health stress will be more strongly positively associated with perceived helpfulness or supportiveness of emotion-focused content compared to problem orientation, and this will be based on comparison of effect size (Copay et al., 2007).

Aim 5: Determine whether baseline problem orientation was associated with website content selections or their perceived helpfulness.

Analysis: Pearson correlation

Hypothesis: Not applicable (exploratory)

Aim 6: Test for an association between the frequencies of viewing content that may reflect emotion- versus problem-solving coping processes and women's physical activity engagement over 7 days.

Analysis: Individual repeated measures ANOVAs

Hypothesis: The overall frequency of selecting content will differentially predict physical activity across 7 days, such that more (vs. less) frequent use of problem-solving selections will be more strongly and positively associated with physical activity behavior than more (vs. less) use of emotion-focused selections, based on comparisons of effect size (R^2).

Chapter 3

Results

3.1 Descriptive Statistics

With respect to study aim 1, descriptive information was obtained for women's overall perceived stress (or appraisals) about their health and physical activity at baseline. Participants in this sample endorsed moderate general stress (M = 16.26, SD = 7.61) per cut off scores (low: 0-13, moderate: 14-26, high: 27-40; Cohen, Kamarck, & Mermelstein, 1983). This average was slightly higher compared to a normed sample between ages of 45-64 (M = 15, SD = 7; Taylor, 2015). On average, physical activity/health stress (PAHS) was 6 out of a possible 10 points, SD = 1.77. With respect to coping styles as measured by the Brief-COPE, scores for a self-reported tendency to engage in problem-solving coping (M = 2.41, SD = 0.08) were higher than scores for emotion-focused coping (M = 2.09, SD = 0.51), and avoidance coping scored lowest (M = 1.46, SD = 0.36). Although minimal studies to date provide useful context on negative problem orientation (NPO) as measured by the NPOQ among women in midlife, a non-clinical sample of college women (M = 25.45, SD = 9.3) suggests the present study had slightly lower scores than average (M = 21.12, SD = 8.29; Robichaud & Dugas, 2003). Additionally, self-efficacy for managing chronic health concerns was higher than expected (M = 7.45, SD = 2.09), compared to a normed sample of individuals with at least 1 chronic illness (M = 5.17, SD = 2.22; Lorig et al., 2001).

Regarding aim 2, descriptive information for all behavioral selections (i.e., on the physical activity-promoting website) was obtained (see Table 3). Although global reports

of coping preferences via the Brief-COPE suggested slight favoring of problem-solving over emotion-focused coping, behavioral demonstrations of coping suggested that emotion-focused coping was most frequent (M = 5.02, SD = 2.55), followed by problem-solving (M = 4.0, SD = 3.1), and avoidance (M= 3.32, SD = 2.19). Additionally, emotion-focused content was rated highest on average for helpfulness (M = 14.62, SD = 7.90) compared to problem-solving (M = 8.97, SD = 4.50) and avoidance coping (M = 8.92, SD = 6.96). Full frequencies for website content selections can be seen in Table 4.

Table 3

Descriptive Statistics and Correlations for Main Study Variables

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Physical Activity/ Health Stress	58	6.07	1.77	—											
2. Perceived Stress	58	16.01	7.42	0.44**	—										
3. Negative Problem Orientation	59	20.94	8.62	0.44**	0.62**	—									
4. Health Self-Efficacy	57	7.45	2.09	-0.39**	-0.44**	-0.56**	—								
5. Problem Solving Coping	60	4.63	3.08	-0.01	0.62**	-0.14	0.27*	—							
6. Emotion- Focused Coping	60	5.02	2.55	0.16	0.31*	0.39**	-0.31*	-0.61**	—						
7. Avoidance Coping	60	3.32	2.19	-0.23	0.06	-0.187	-0.12	-0.47**	-0.17	—					
8. Problem Solving Helpfulness	60	8.97	11.31	-0.19	-0.42**	-0.20	0.25	0.86**	-0.61**	-0.25	—				
9. Emotion Focused Helpfulness	60	14.62	7.90	0.26	0.15	0.37**	-0.19	0.88**	0.87**	-0.34**	-0.51**	—			
10. Avoidance Helpfulness	60	8.92	6.16	-0.24	-0.12	-0.28*	0.02	-0.45*	-0.34**	0.88**	-0.09	-0.34**	—		
11. Steps	32	5397	1615	-0.12	-0.18	-0.21	0.30	0.03	-0.22	0.16	0.20	-0.08	0.16	—	
12. Active Minutes	32	19.87	15.24	-0.34	-0.28	-0.32	-0.11	0.03	-0.36*	0.48**	0.28	-0.34	0.48**	0.32	—

*$p < 0.05$, ** $p < 0.01$

Table 4

Frequencies for Website Selections

Content Type	*M*	*SD*	Min	Max	Variable	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Problem-solving	4.63	3.08	0	13	1. Very Active Peer (Upward Comparison) Profile	7	9	16	16	14	14	16
					2. Tips Support Message	13	14	20	16	12	14	13
					3. Accountability Support Message	14	12	10	11	19	15	16
Emotion-Focused	5.02	2.55	0	10	4. Somewhat Active Peer (Downward Comparison) Profile	15	11	10	16	9	8	12
					5. Somewhat Active Peer (Lateral) Profile	23	20	15	9	12	13	7
					6. Encouragement Support Message	18	15	16	20	16	20	16
Avoidance	3.32	2.19	0	8	7. Choose for me Peer Profile	14	17	16	17	21	23	20
					8. Choose for me Support Message	12	14	10	9	9	9	8

3.2 Stress, Problem Orientation, and Frequencies of Coping Content (Selected Website Content)

3.2.1 Stress and Frequencies of Coping Content

Regarding aim 3, associations were examined between PAHS and PSS, as well as between women's baseline perceived stress (or appraisals) about health and physical activity and the *overall frequencies of selecting content* that may reflect emotion- versus problem-solving coping processes. As hypothesized, scores on the study-developed PAHS measure were significantly positively correlated with the validated PSS measure ($r[56] = 0.44$, $p < 0.001$; see Figure 7). Inconsistent with hypotheses, however, PAHS scores did not predict any behavioral measure of coping (ps = 0.08- 0.97, see Tables 5-7). In contrast, exploratory analyses showed that general stress as measured by the PSS was predictive of some coping categories. Scores on the PSS significantly predicted the frequency of emotion-focused coping ($F1, 56] = 6.0$, $p = 0.02$), and predicted the frequency of problem-solving coping ($F[1, 56] = 5.29$, $p = 0.03$). Effect sizes were medium and the effect size for emotion-focused coping was minimally larger compared to NPO (accounted for 10% and 9% of variance, respectively [R^2]). PSS scores did not significantly predict avoidance coping ($F[1, 56] = 0.20$, $p = 0.67$) and PAHS scores did not significantly predict any of the Brief-COPE scales (ps = 0.06- 0.72).

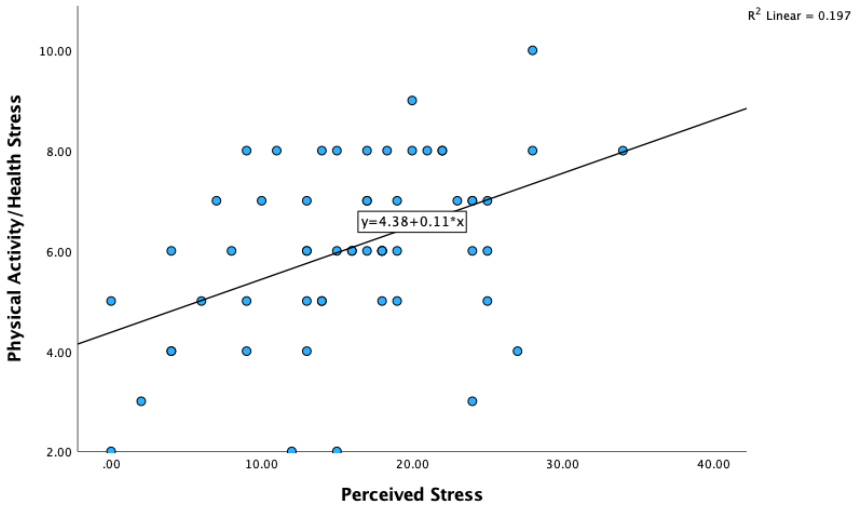

Figure 7. Correlation between Perceived Stress and Physical Activity/Health Stress

Table 5

Simultaneous Linear Regression of Emotion-Focused Content

Predictor	β	*SE*	95% CI		*P*	R^2
			LL	*UL*		
Physical Activity/Health Stress	0.16	0.19	-0.15	5.92	0.22	0.03
Perceived Stress	0.011	0.04	0.20	0.20	0.02*	0.10

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 6

Simultaneous Linear Regression of Problem-Solving Content

Predictor	β	*SE*	95% CI		*p*	R^2
			LL	*UL*		
Physical Activity/Health Stress	-0.01	0.23	-0.48	0.46	0.97	0.00
Perceived Stress	-0.30	0.05	-0.23	-0.02	0.03*	0.09

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 7

Simultaneous Linear Regression of Avoidance Content

Predictor	β	*SE*	95% CI		*p*	R^2
			LL	*UL*		
Physical Activity/Health Stress	-0.02	0.61	-0.61	0.04	0.08	0.05
Perceived Stress	0.06	0.04	-0.06	0.10	0.67	0.003

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

3.2.2 Stress and Problem Orientation

NPO significantly predicted PAHS, (F[1, 56] = 13.0, $p < 0.001$), accounting for a substantial proportion of variance (R^2 = 18.8%.). For this reason, NPO was considered for additional sensitivity analyses (i.e., when examining aim 5; see Appendix D).

3.2.3 Problem Orientation and Frequencies of Coping Content

Given considerable overlap between PAHS and NPO, exploratory analyses were completed to understand relations between NPO and selections of coping content and perceived helpfulness (continued below). NPO did not significantly predict problem-solving or avoidance coping (ps = 0.16- 0.30), though did significantly predict emotion-focused coping, (F[1, 57] = 10.15, p = 0.002, R^2 = 0.15).

3.2.4 Interim Summary

PAHS was significantly, positively associated with PSS, highlighting the co-occurrence of general and health-specific stress. PAHS did not significantly predict scores on the Brief -COPE subscales, nor any category of behavioral coping. However, PSS did predict both emotion-focused and problem-solving coping, though was only marginally more predictive of emotion-focused compared to problem-solving coping.

3.3 Stress and Perceived Helpfulness of Coping Content

3.3.1 Emotion-Focused Coping

Regarding aim 4, associations were examined between women's baseline perceived stress (or appraisals) about health and physical activity and their in-the-moment *perceptions of the helpfulness of content* that may reflect emotion- versus problem-solving coping processes. It was hypothesized that PAHS would be more strongly positively associated with perceived helpfulness of emotion-focused coping compared to problem-solving coping. Findings demonstrated a positive association between PAHS and helpfulness ratings for emotion-focused coping content ($r[56] = 0.26$, $p = 0.05$; see Figure 8). Additional mean-centered moderation analyses were performed to better understand frequency of coping type selection with perceived helpfulness across levels of PAHS. The overall model examining the moderating effect of PAHS on relations between frequency of selecting emotion-focused content and perception of content helpfulness was significant ($F[3, 54] = 73.69$, $p < .001$, $R^2 = 0.81$; see Table 8). Main effects of emotion-focused coping frequency ($b = .58$, $p = 0.43$) and of PAHS ($b = -1.14$, $p = 0.78$) were not significant. However, results showed a significant moderating effect of PAHS on the relation between selecting emotion-focused coping content and perceiving it as helpful ($b = 0.35$, $p = 0.005$), with the interaction adding a significant change in R^2 ($p < 0.05$, $\triangle R^2 = 0.03$). As illustrated in Figure 9, for participants with high PAHS (1 SD above mean), there was a significant positive linear relation between selection of emotion-focused coping content and perception of helpfulness ($b = 3.29$, $SE = 0.29$, $p < 0.001$). Participants with low PAHS showed a significant, though weaker,

positive linear relation between selection of emotion-focused coping content and perception of helpfulness (b = 2.07, SE = 0.28, p < 0.001).

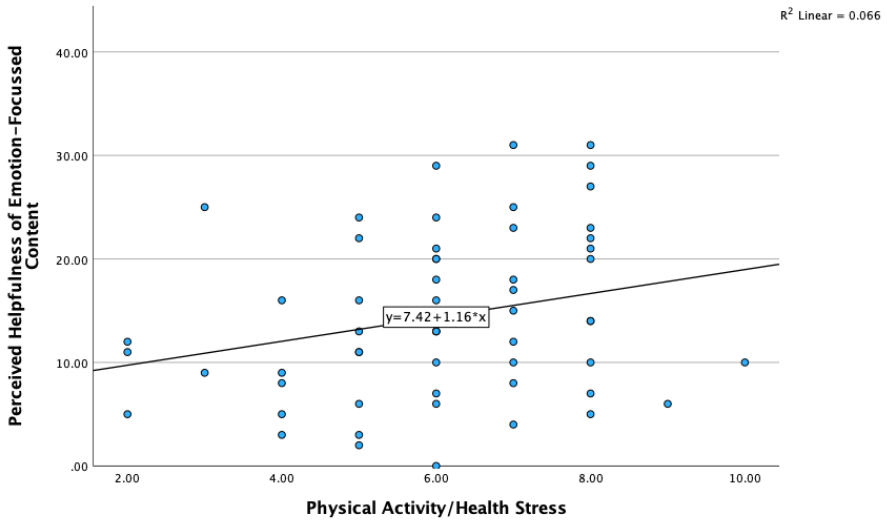

Figure 8. Correlation between Physical Activity/Health Stress and Perceived Helpfulness of Emotion-Focused Content

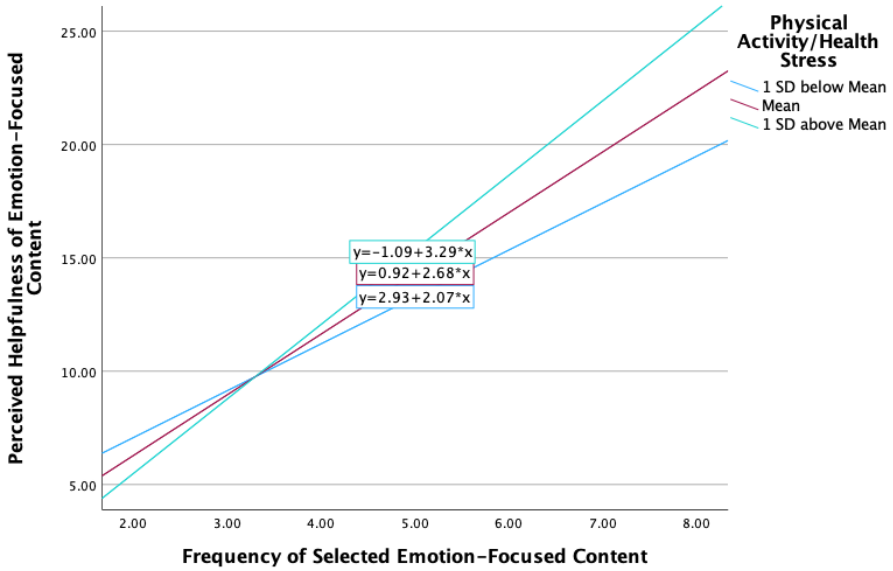

Figure 9. Relation between Frequency of Selecting and Perceiving Emotion-Focused Content as helpful by Physical Activity/Health Stress

Table 8

Moderation of Relations between Frequency of Selecting Emotion-Focused Content and Perception of Helpfulness by Physical Activity/Health Stress

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Frequency of Selecting Emotion-Focused Content	0.58	0.74	[-0.89, 2.06]	0.79	54	0.43
Physical Activity/Health Stress	-1.14	0.63	[-2.41, 0.13]	-1.80	54	0.08
Frequency of Selecting Emotion-Focused Content X Physical Activity/Health Stress	0.35	0.12	[0.11, 0.58]	2.92	54	0.58

3.3.2 Problem-Solving Coping

It was hypothesized that PAHS would have a weaker positive association with perceived helpfulness of problem-solving coping compared to emotion-focused coping. Results showed an insignificant, negative relationship between PAHS and helpfulness of problem-solving coping, ($r[56] = -0.19$, $p = 0.16$, see Figure 10). Further, exploratory moderation analyses were consistent with these findings. The overall model examining the moderating power of PAHS on relations between frequency of selecting problem-solving content and perception of content helpfulness was significant ($F[3, 54] = 74.13$, $p < 0.001$, $R^2 = 0.81$; see Table 9). The main effect of problem-solving coping frequency ($b = 4.89$, $p < 0.001$) was significant, while the main effect of PAHS was not ($b = 0.04$, $p = 0.95$). Results showed a significant moderating effect of PAHS on the relation between selecting problem-solving coping content and perceiving it as helpful ($b = -0.31$, $p = 0.005$; see Figure 11), with the interaction adding a bordering significant change in R^2 ($p = 0.05$, $\triangle R^2 = 0.02$). For participants with low PAHS, there was a significant positive linear relation between selection of problem-solving coping content and perception of helpfulness ($b = 3.56$, $SE = 0.28$, $p < 0.001$). In contrast, participants with high PAHS showed a weaker significant positive linear relation between selection of problem-solving coping content and perception of helpfulness ($b = 2.47$, $SE = 0.42$, $p < 0.001$).

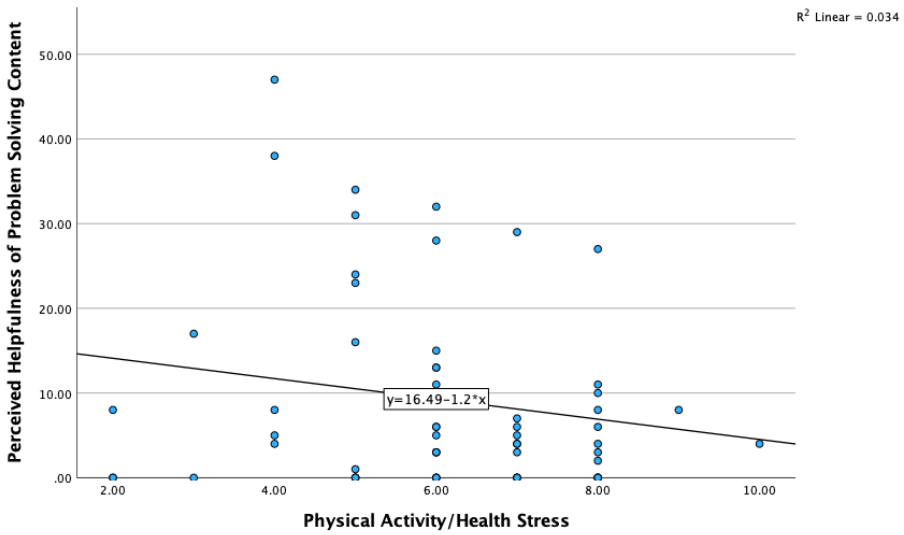

Figure 10. Correlation between Physical Activity/Health Stress and Perceived Helpfulness of Problem-Solving Content

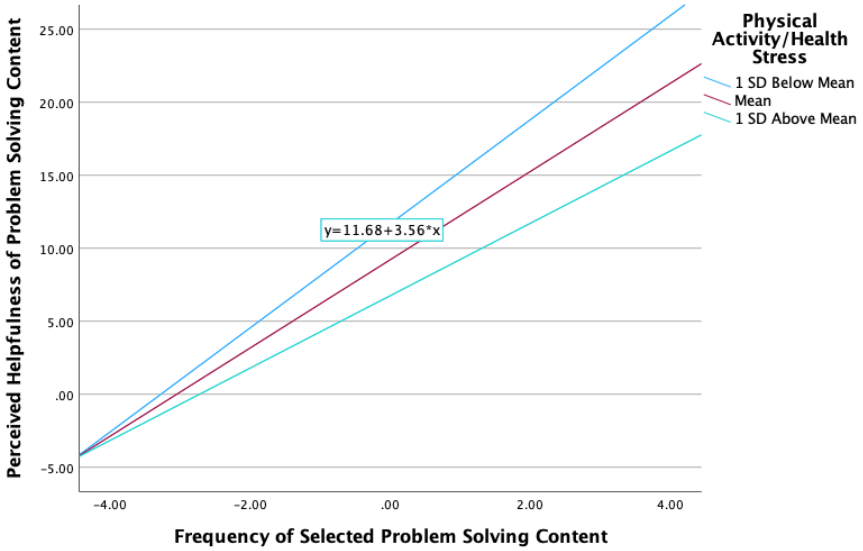

Figure 11. Relation between Frequency of Selecting and Perceiving Problem-Solving Content as helpful by Physical Activity/Health Stress

Table 9

Moderation of Relations between Frequency of Selecting Problem-Solving Content and Perception of Helpfulness by Physical Activity/Health Stress

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Frequency of Selecting Problem-solving Content	4.89	0.85	[3.18, 3.15]	5.75	54	<0.001
Physical Activity/Health Stress	0.04	0.71	[-1.38, 1.49]	0.06	54	0.95
Frequency of Selecting Problem-solving Content X Physical Activity/Health Stress	-0.31	0.15	[-1.38, 1.46]	-2.04	54	0.05

3.3.3 Avoidance Coping

There were no hypotheses about avoidance coping as this was an exploratory category. Results showed an insignificant negative association between PAHS and helpfulness of avoidance coping ($r[57] = -0.24$, $p = 0.07$, see Figure 12). The overall model examining the moderating power of PAHS on relations between frequency of avoidance content and perception of content helpfulness was significant ($F[3, 54] = 58.46$, $p < 0.001$, $R^2 = 0.87$; see Table 10). The main effect of avoidance coping frequency ($b = 2.45$, $p < 0.001$) was significant, though, the main effect of PAHS was not ($b = -0.19$, $p = 0.44$). Results showed an insignificant moderating effect of PAHS on the relation between selecting avoidance coping content and perceiving it as helpful ($b = 0.09$, $p = 0.42$; see Figure 13). For participants with low PAHS, there was a significant

positive linear relation between selection of avoidance coping content and perception of helpfulness (b = 2.30, SE = 0.25, p < 0.001). In contrast, participants with high PAHS showed a slightly weaker significant positive linear relation between selection of avoidance coping content and perception of helpfulness (b = 2.60, SE = 0.29, p < 0.001).

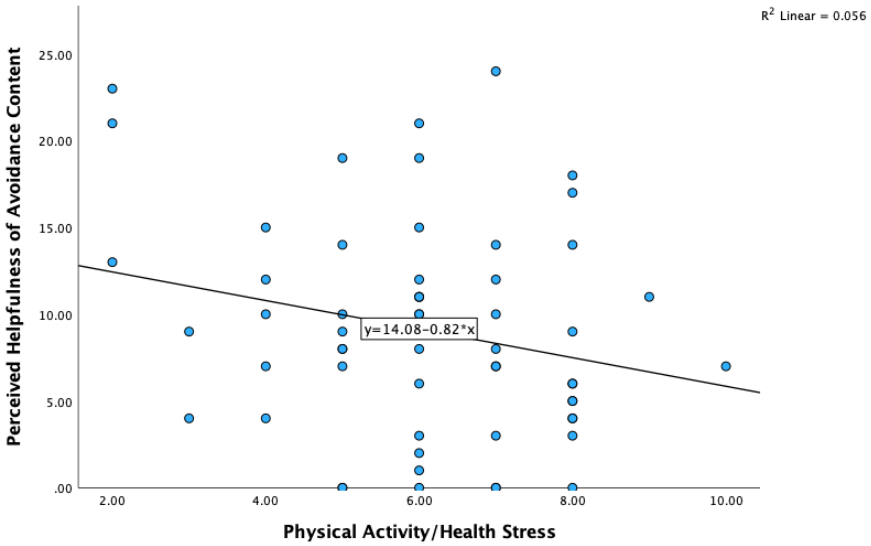

Figure 12. Correlation between Physical Activity/Health Stress and Avoidance Content

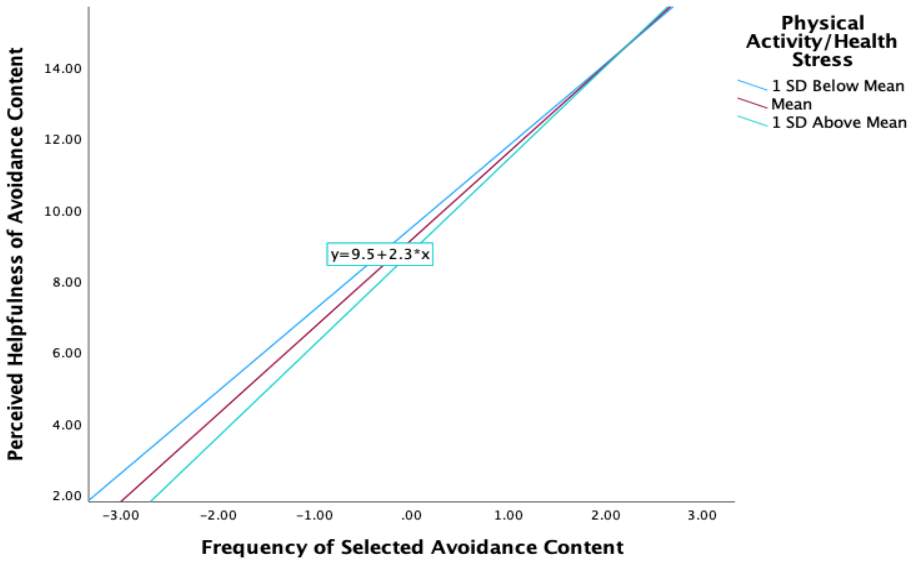

Figure 13. Relation between Frequency of Selecting and Perceiving Avoidance Content as helpful by Physical Activity/Health Stress

Table 10

Moderation of Relations between Frequency of Selecting Avoidance Content and Perception of Helpfulness by Physical Activity/Health Stress

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Frequency of Selecting Avoidance Content	2.45	0.19	[8.33, 9.99]	12.73	54	<0.001
Physical Activity/Health Stress	-0.19	0.25	[-0.69, 0.30]	-0.77	54	0.44
Frequency of Selecting Avoidance Content X Physical Activity/Health Stress	0.09	0.11	[-0.13, 0.30]	0.81	54	0.42

3.3.4 Interim Summary

PAHS was significantly positively associated with perceived helpfulness of emotion-focused content, had insignificant negative associations with helpfulness of problem-solving content, and helpfulness of avoidance content. Further, PAHS significantly moderated both relations between selecting and perceiving content as helpful for both emotion-focused and problem-solving coping (moderation for avoidance coping was insignificant). Interestingly, those with higher PAHS (compared to average and low PAHS) reported emotion-focused content as more helpful and problem-solving content as less helpful.

3.4 Problem Orientation and Perceived Helpfulness of Coping Content

3.4.1 Emotion-Focused Coping

With respect to aim 5, associations were explored between baseline negative problem orientation and website content selections or their perceived helpfulness. Analyses with NPO suggested significant positive correlation with perceived helpfulness of emotion-focused coping *(r*[57] = 0.37, $p = 0.004$; see Figure 14). Similar to aim 4, moderation analyses were also used for greater context. The overall model examining the moderating power of negative NPO on relations between frequency of selecting emotion-focused content and perception of content helpfulness was significant (F[3, 55] = 58.68, $p < .001$, $R^2 = 0.76$; see Table 11). The main effect of emotion-focused coping frequency (b =2.67, $p = 0.43$) was significant, while the main effect of negative NPO ($b = 0.02$, $p = 0.75$) was insignificant. Results showed no moderating effect of negative NPO on the

relation between selecting emotion-focused coping content and perceiving it as helpful (*b* = 0.02, *p* = 0.49; see Figure 15).

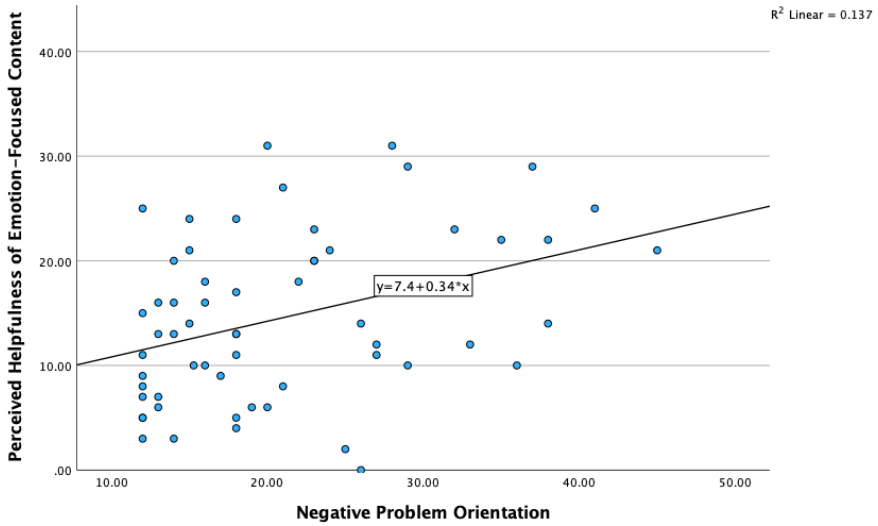

Figure 14. Correlation between Negative Problem Orientation and Perceived Helpfulness of Emotion-Focused Content

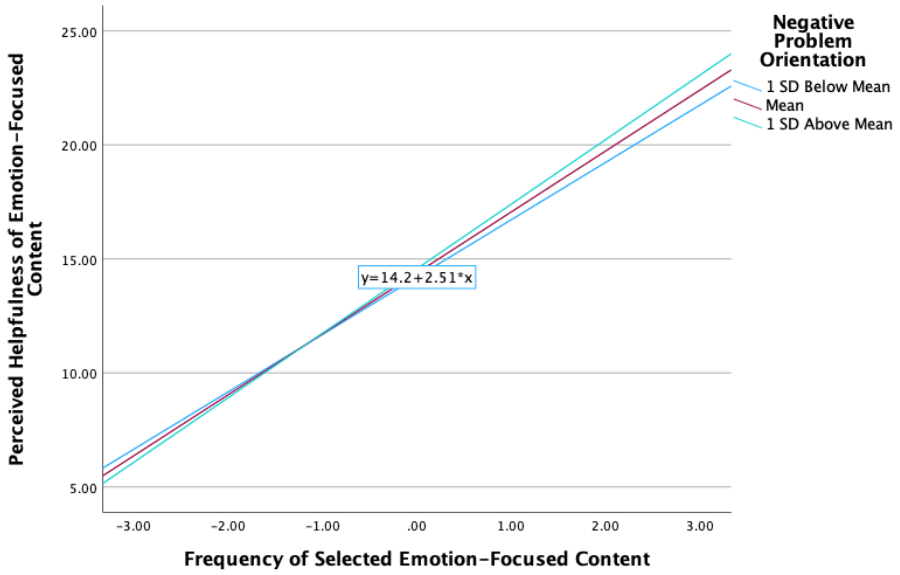

Figure 15. Relation between Frequency of Selecting and Perceiving Emotion-Focused Content as helpful by Negative Problem Orientation

Table 11

Moderation of Relations between Frequency of Selecting Emotion-Focused Content and Perception of Helpfulness by Negative Problem Orientation

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Frequency of Selecting Emotion-Focused Content	2.67	0.22	[2.22, 15.52]	11.93	55	<0.001
Negative Problem Orientation	0.02	0.07	[-0.12, 0.16]	0.31	55	0.75
Frequency of Selecting Emotion-Focused Content X *Negative Problem Orientation*	0.02	0.03	[-0.03, 0.07]	0.69	55	0.49

3.4.2 Problem-Solving Coping

Findings showed an insignificant negative correlation between NPO and helpfulness of problem-solving coping ($r[57] = -0.20$, $p = 0.14$; see Figure 16). The moderation model exploring the relations between selecting and perceiving problem-solving content was helpful across levels of NPO was significant ($F[3, 55] = 65.33$, $p < .001$, $R^2 = 0.78$; see Table 12). Similar to the emotion-focused model, the main effect for selecting problem-solving coping was significant ($b = 3.13$, $p < .001$), while the effect for NPO ($b = -0.16$, $p = 0.78$) was not. The interaction ($b = -0.06$, $p = 0.05$, $\triangle R^2 = 0.002$) was significant (see Figure 17). For participants with low NPO, there was a significant positive linear relation between selection of problem-solving content and perception of helpfulness ($b = 3.63$, $SE = 0.33$, $p < 0.001$). In contrast, participants with high NPO showed a slightly weaker significant positive linear relation between selection of problem-solving coping content and perception of helpfulness ($b = 2.64$, $SE = 0.35$, $p <0.001$).

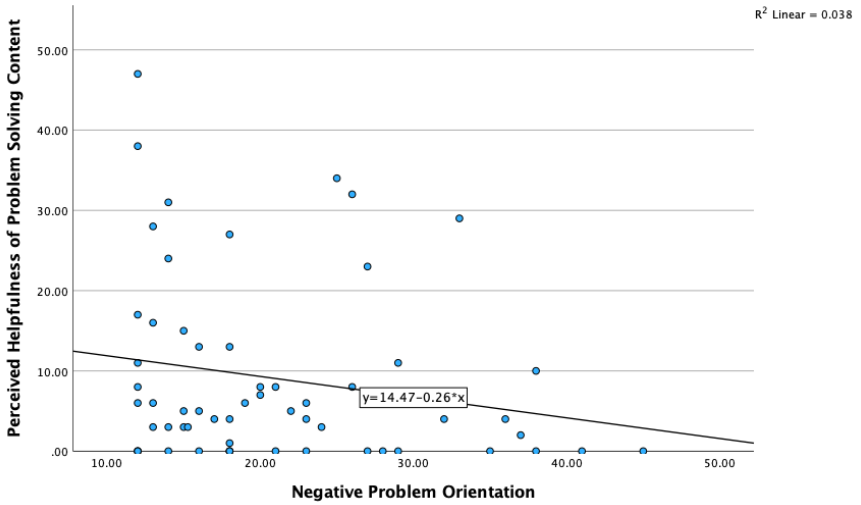

Figure 16. Correlation between Negative Problem Orientation and Perceived Helpfulness of Problem-Solving Content

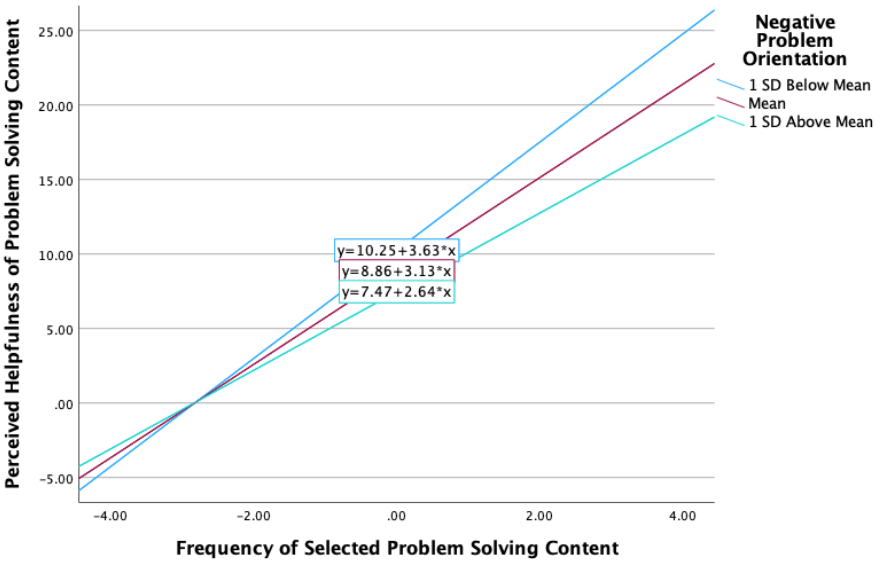

Figure 17. Relation between Frequency of Selecting and Perceiving Problem-Solving Content as helpful by Negative Problem Orientation

Table 12

Moderation of Relations between Frequency of Selecting Problem-Solving Content and Perception of Helpfulness by Negative Problem Orientation

Predictor	*b*	*SE*	*95% CI*	*t*	*df*	*p*
Frequency of Selecting Problem-solving Content	3.13	0.23	[2.66, 3.60]	13.36	55	<0.001
Negative Problem Orientation	-0.16	0.09	[-0.34, 0.02]	-1.81	55	0.08
Frequency of Selecting Problem-solving Content X *Negative Problem Orientation*	-0.06	0.03	[0.12, -0.00]	-2.02	55	0.05

3.4.3 Avoidance Coping

There was a significant negative association between NPO and helpfulness of avoidance coping (r[57] = -0.28, p = 0.03; see Figure 18). The overall model examining the moderating power of NPO on relations between frequency of selecting emotion-focused content and perception of content helpfulness was significant (F[3, 55] = 58.68, p < 0.001, R^2 = 0.76; see Table 13). The main effect of emotion-focused coping frequency (b = 2.67, p < 0.001) was significant. However, the main effect of NPO (b = 0.02, p = 0.75) and interaction (b = 0.02, p = 0.49) were not significant (see Figure 19).

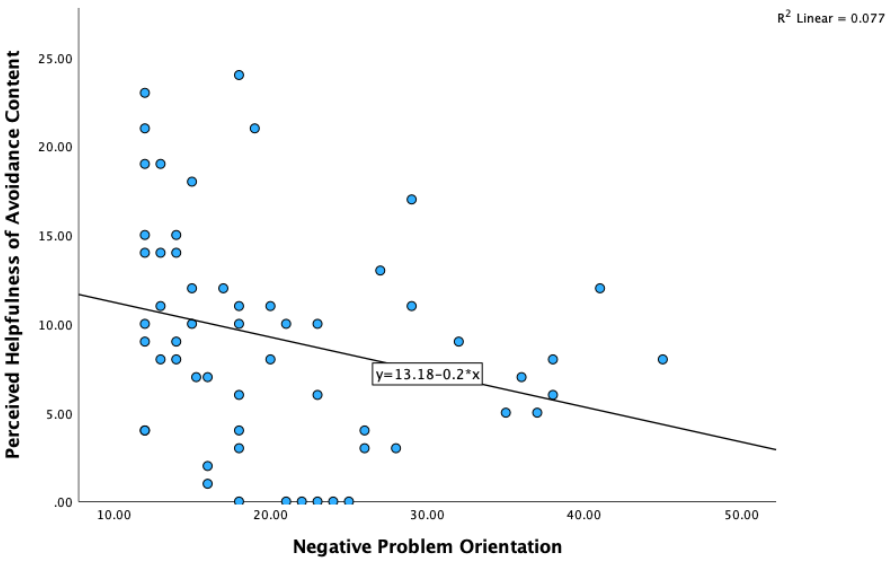

Figure 18. Correlation between Negative Problem Orientation and Perceived Helpfulness of Avoidance Content

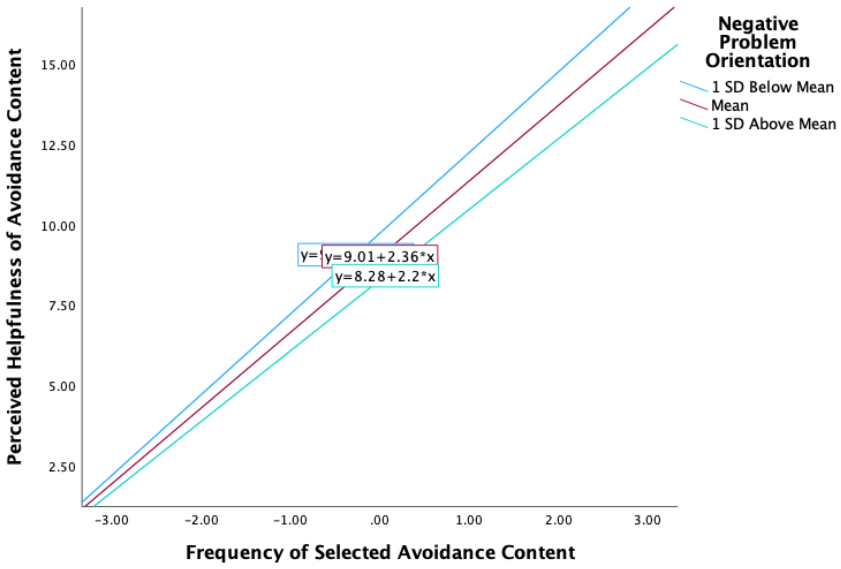

Figure 19. Relation between Frequency of Selecting and Perceiving Avoidance Content as helpful by Negative Problem Orientation

Table 13

Moderation of Relations between Frequency of Selecting Avoidance Content and Perception of Helpfulness by Negative Problem Orientation

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Frequency of Selecting Avoidance Content	2.36	0.19	[1.98, 9.81]	12.31	55	<0.001
Negative Problem Orientation	-0.08	0.05	[-0.18, 0.01]	-1.84	55	0.07
Frequency of Selecting Avoidance Content X *Negative Problem Orientation*	-0.02	0.03	[-0.08, 0.04]	-0.58	55	0.56

3.4.4 Interim Summary

NPO had a significant positive association with perceived helpfulness of emotion-focused content, insignificant negative association with helpfulness of problem-solving content, and significant negative association with helpfulness of avoidance content. NPO only significantly moderated the relations between selecting problem-solving content, not emotion-focused or avoidance. The moderation effect was such that participants with low NPO showed a positive relation between selecting problem-solving content and perceiving it as helpful, while those with high NPO showed a weaker positive association.

3.5 Coping, Physical Activity, and Stress

Regarding aim 6, a series of one-way repeated measures ANOVAs were used to examine whether different selected website content (representing types of coping) would differentially predict physical activity over time (7 days). Further, it was hypothesized that the frequency of selecting problem-solving content would be more strongly positively associated with physical activity behavior over time and have a greater effect size, compared to the frequency of selecting emotion-focused coping. Emotion-focused, problem-solving, and avoidance coping between-person summary scores were created by summing the frequency of selecting each type of content across 7 days.

3.5.1 Emotion-Focused Coping

Findings showed that selecting emotion-focused coping content was positively associated with steps per day across days (F[6, 162] = 2.19, p = 0.047, partial η^2 = 0.08; see Figure 20 & Table 14) However, selecting this content was not associated with active minutes per day (across days) (F[6, 162] = 0.94, p = 0.47, partial η^2 = 0.03; see Table 15). Interestingly, visual inspection of this graphs (Figure 21) suggested that women who selected emotion-focused content frequently (i.e., 9-10 times over 7 days) engaged in fewer active minutes than participants who viewed this content at lower frequencies (less than 9 times over the course of the study). Further, graphs suggested that individuals who viewed this content at the lowest frequency (1-2 times over 7 days) engaged in the highest amount of active minutes consistently across time (compared to those who viewed content at higher frequencies). This was consistent with a significant, positive correlation between average active minutes and emotion-focused coping (p = 0.04) and

an insignificant, negative correlation between average steps and emotion-focused coping (p = 0.24).

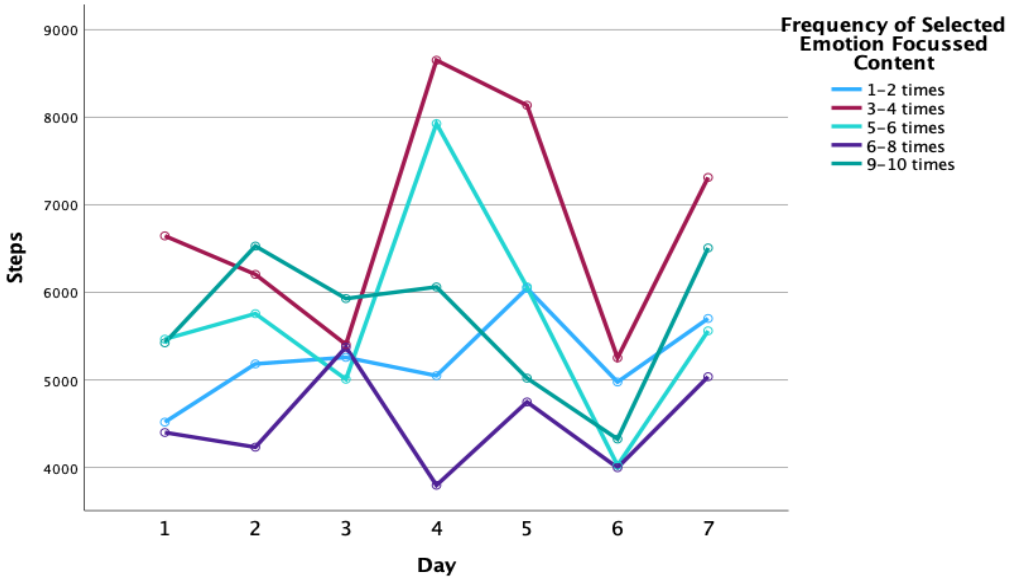

Figure 20. Repeated Measures ANOVA Examining Associations with Steps Across (7) Days by Frequency of Selected Emotion-Focused Content

Table 14

Means, Standard Deviations, and Repeated Measures Analyses of Variance in Frequencies of Selected Emotion-Focused Website Content and Steps Across Days

Day	1-2 times		3-4 times		5-6 times		7-8 times		9-10 times		$F(6, 162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	4517.3	1851.2	6645.0	2279.7	5465.0	3589.6	4399.1	2006.7	5423.3	1853.5	2.19	0.047	0.08
2	5182.7	2849.8	6205.4	2874.1	5756.6	1297.2	4231.1	2325.9	6528.7	1266.3			
3	5257.1	2190.3	5404.2	1969.8	5007.3	1251.3	5373.0	3731.2	5929.0	1470.3			
4	5047.7	1877.8	8651.8	1477.6	7927.3	3459.6	3796.0	2040.1	6061.7	6514.8			
5	6046.9	1577.2	8137.6	2030.9	6061.6	3826.7	4747.6	1864.5	5019.7	4418.0			
6	4975.9	1741.5	5251.0	3198.6	4023.9	1866.3	3996.9	1456.9	4324.0	751.2			
7	5701.1	1186.5	7313.0	1998.7	5560.3	2840.8	5036.3	2510.8	6507.3	2566.1			

Note: No participants selected this content 0 times or 11-12 times (highest and lowest frequencies).

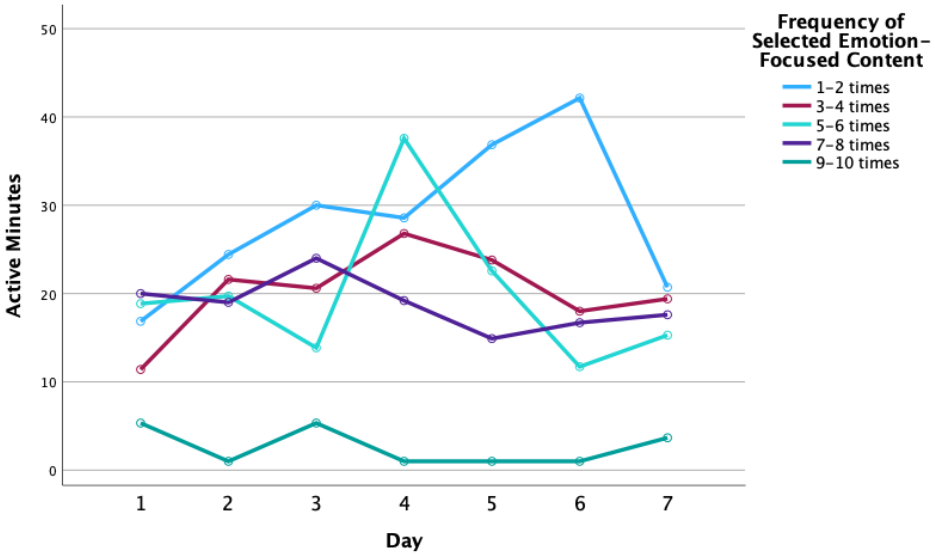

Figure 21. Repeated Measures ANOVA Examining Associations with Active Minutes Across (7) Days by Frequency of Selected Emotion-Focused Content

Table 15

Means, Standard Deviations, and Repeated Measures Analyses of Variance in Frequencies of Selected Emotion-Focused Website Content and Active Minutes Across Days

Day	1-2 times		3-4 times		5-6 times		7-8 times		9-10 times		$F(6, 162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	16.9	19.0	11.4	19.1	18.9	20.7	20.0	14.6	5.3	5.0	0.94	0.47	0.03
2	24.4	22.7	21.6	29.2	19.7	14.4	19.0	13.8	1.0	1.7			
3	30.0	30.2	20.6	22.6	13.9	13.0	24.0	20.9	5.3	5.0			
4	28.6	19.1	26.8	24.6	37.6	34.2	19.2	14.3	1.0	1.7			
5	36.9	23.2	36.9	31.7	23.8	29.5	22.6	15.2	22.6	15.2			
6	42.1	30.2	18.0	31.8	11.7	14.6	16.7	11.2	1.0	1.7			
7	20.7	19.4	28.5	15.3	19.4	28.5	17.6	12.5	3.7	6.4			

Note: No participants selected this content 0 times or 11-12 times (highest and lowest frequencies).

3.5.2 Problem-Solving Coping

Results revealed that selecting problem-solving coping content was not associated with steps per day across days (F[6, 162] = 1.99, p = 0.07, partial η^2 = 0.07; see Figure 22 & Table 16) nor associated with active minutes per day (across days) (F[6, 162] = 1.56, p = 0.16, partial η^2 = 0.06; see Figure 23 & 17). Furthermore, problem-solving coping was also not significantly associated with average steps or active minutes (ps = 0.86-0.87).

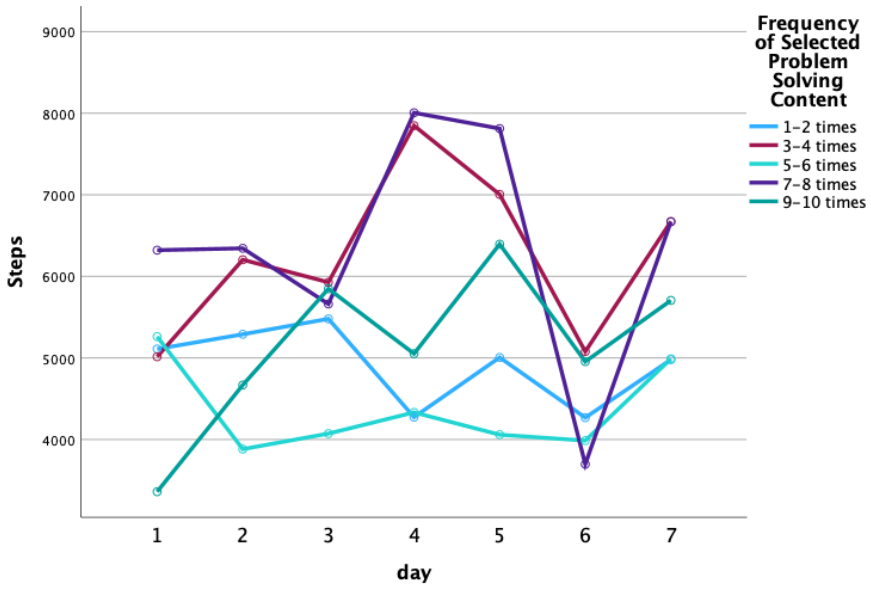

Figure 22. Repeated Measures ANOVA Examining Associations with Steps Across (7) Days by Frequency of Selected Problem-Solving Content

Table 16

Means, Standard Deviations, and Repeated Measures Analyses of Variance in Frequencies of Selected Problem-solving Website Content and Steps Across Days

Day	1-2 times		3-4 times		5-6 times		7-8 times		9-10 times		$F(6,162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	5109.4	2386.9	5014.4	2171.8	5261.3	3002.2	6321.0	3047.2	3359.7	2174.0	1.56	0.16	0.06
2	5289.6	2258.2	6203.9	1859.8	3881.9	1997.8	6343.5	3240.6	4668.0	2680.5			
3	5479.0	2906.8	5927.2	2370.5	4072.1	2381.6	5661.0	2225.2	5847.7	2424.6			
4	4274.3	2922.9	7847.6	3972.4	4332.1	2297.5	8005.5	1159.8	5051.7	2220.5			
5	5005.6	2776.5	7004.3	2989.6	4058.8	1884.1	7811.8	2375.7	6394.3	958.6			
6	4267.9	2142.4	5077.9	2240.8	3986.1	1063.9	3696.8	2066.4	4954.7	1791.6			
7	4979.4	2553.2	6672.5	2613.5	4988.6	1727.1	6668.8	2373.3	5705.0	2286.0			

Note: No participants selected this content 0 times or 11-12 times (highest and lowest frequencies).

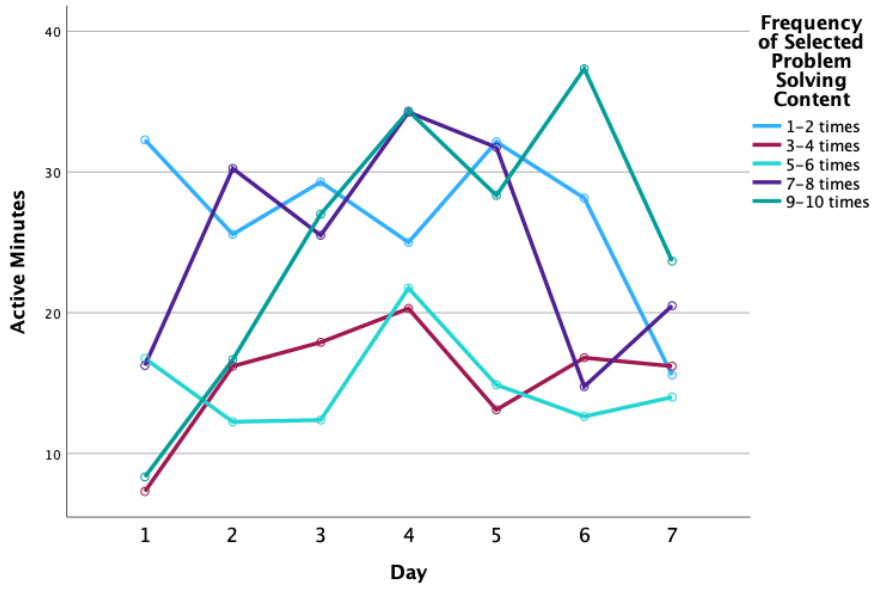

Figure 23. Repeated Measures ANOVA Examining Associations with Active Minutes Across (7) Days by Frequency of Selected Problem-Solving Content

Table 17

Means, Standard Deviations, and Repeated Measures Analyses of Variance in Frequencies of Selected Problem-Solving Website Content and Active Minutes Across Days

Day	1-2 times		3-4 times		5-6 times		7-8 times		9-10 times		$F(6, 162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	32.3	19.6	7.3	6.2	16.8	15.7	16.3	20.3	8.3	14.4	1.56	0.16	0.06
2	25.6	19.6	16.2	13.4	12.3	13.4	30.3	35.3	16.7	16.1			
3	29.3	31.7	17.9	17.8	12.4	16.8	25.5	24.6	27.0	10.6			
4	25.0	18.6	20.3	31.9	21.8	14.9	34.2	25.1	34.3	24.2			
5	32.1	34.9	13.1	8.4	14.9	12.3	31.8	33.6	28.3	10.4			
6	28.1	33.5	16.8	21.4	12.6	15.7	14.8	28.2	37.3	6.7			
7	15.6	13.2	16.2	16.9	14.0	14.7	20.5	31.5	23.7	22.6			

Note: No participants selected this content 0 times or 11-12 times (highest and lowest frequencies).

3.5.3 Avoidance Coping

Finally, results showed that selecting avoidance coping was neither associated with steps per day across days (F[6, 162] = 1.06, p = 0.39, partial η^2 = 0.04; see Figure 24 & Table 18), nor active minutes per day across days (F[6, 162] = 0.75, p = 0.61, partial η^2 = 0.027; see Figure 25 & Table 19). However, avoidance coping was positively associated with average active minutes (r[32] = 0.42, p = 0.02).

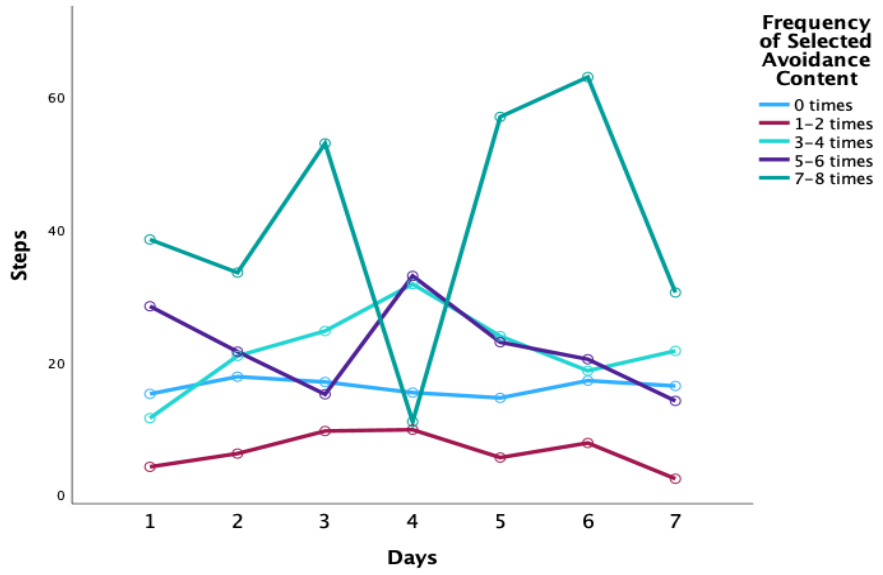

Figure 24. Repeated Measures ANOVA Examining Associations with Steps Across (7) Days by Frequency of Selected Avoidance Content

Table 18

Means, Standard Deviations, and Repeated Measures Analyses of Variance in Frequencies of Selected Avoidance Website Content and Steps Across Days

Day	1-2 times		3-4 times		5-6 times		7-8 times		9-10 times		$F(6, 162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	32.3	19.6	7.3	6.2	16.8	15.7	16.3	20.3	8.3	14.4	1.56	0.16	0.06
2	25.6	19.6	16.2	13.4	12.3	13.4	30.3	35.3	16.7	16.1			
3	29.3	31.7	17.9	17.8	12.4	16.8	25.5	24.6	27.0	10.6			
4	25.0	18.6	20.3	31.9	21.8	14.9	34.2	25.1	34.3	24.2			
5	32.1	34.9	13.1	8.4	14.9	12.3	31.8	33.6	28.3	10.4			
6	28.1	33.5	16.8	21.4	12.6	15.7	14.8	28.2	37.3	6.7			
7	15.6	13.2	16.2	16.9	14.0	14.7	20.5	31.5	23.7	22.6			

Note: No participants selected this content 9-10 times or 11-12 times (highest frequencies).

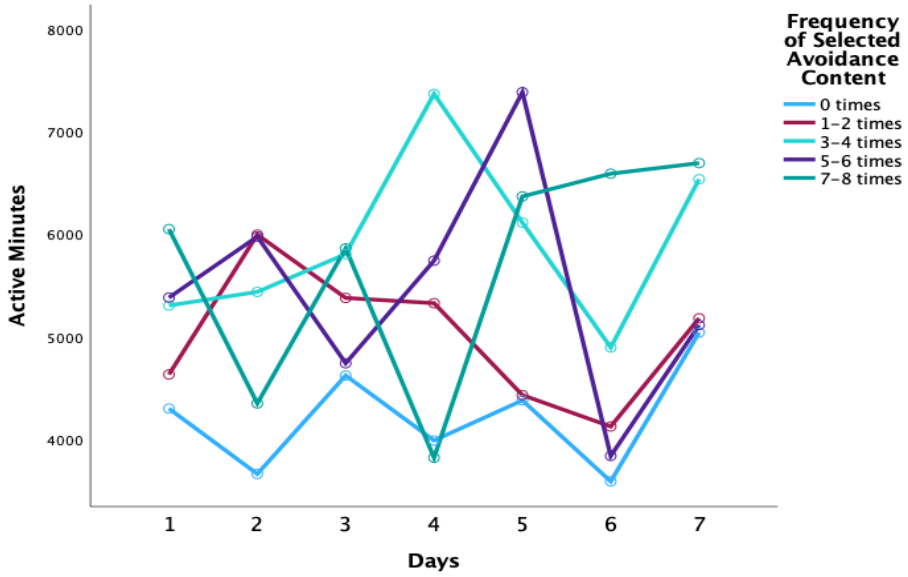

Figure 25. Repeated Measures ANOVA Examining Associations with Active Minutes Across (7) Days by Frequency of Selected Avoidance Content

Table 19

Means, Standard Deviations, and Repeated Measures Analyses of Variance Frequencies of Selected Avoidance Website Content and Active Minutes Across Days

Days	0 times		1-2 times		3-4 times		5-6 times		7-8 times		$F(6, 162)$	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
1	15.2	10.0	4.2	4.3	11.5	14.6	28.4	20.1	38.5	17.7	0.75	0.61	0.03
2	17.8	15.3	6.2	9.6	20.9	19.2	21.6	21.7	33.5	27.6			
3	17.0	19.9	9.6	12.6	24.7	18.8	15.1	15.3	53.0	56.6			
4	15.4	13.6	9.8	13.4	31.7	29.0	33.0	18.2	11.0	11.3			
5	14.6	12.7	5.6	10.9	23.9	19.5	23.0	11.5	57.0	66.5			
6	17.2	15.5	7.8	14.7	18.7	21.8	20.4	20.7	63.0	49.5			
7	16.4	15.0	2.4	4.8	21.7	22.0	14.1	11.8	30.5	2.1			

Note: No participants selected this content 9-10 times or 11-12 times (highest frequencies).

3.5.4 Interim Summary

Emotion-focused content was the only content associated with steps, across days and averaged at the person level. Further, women who showed frequent use of emotion-focused coping had the lowest active minute engagement over time. Although the correlation was insignificant, emotion-focused coping showed a negative association with active minutes.

Chapter 4

Discussion

The overarching goal of the present study was to conduct an initial examination of coping patterns among women in midlife with heightened CVD risk, as measured by physical activity-promoting content that they self-selected on a web application (website) tailored for this population. In line with this goal, participants were screened for CVD risk and other relevant health factors, completed a baseline survey, virtual orientation, 7 days of data collection using the website, and a virtual exit interview. The primary aims of this study were to explore (1) self-perceptions of stress and coping styles, and (2) associations between emotion-focused and problem-solving coping behaviors (as represented by website content selections) and (a) perceived helpfulness and (b) physical activity (steps, active minutes) over 7 days. Secondary aims included exploration of avoidance as a third coping type, negative problem orientation as a predictor/correlate of coping, and associations with self-efficacy for managing chronic medical concerns. Findings from this study provide preliminary but important insight into the ways that women use physical activity website content to fulfill their coping needs, which would help to inform improvements to digital physical activity interventions for this at-risk group.

4.1 Aim 1

Describe women's overall perceived stress (or appraisals) about their health and physical activity at baseline.

The PAHS score can be contextualized with reference to the PSS score or general stress, given the fact that these scores were significantly correlated. Scores for the present sample fell into the moderate range per the PSS cut-offs. This sample had slightly greater PSS scores compared to a normed sample of individuals in this age range with no heightened CVD risk; as such, women in midlife with $\geq$1 risk factor for CVD appeared to have slightly higher stress than the general population. This seems intuitive, given that evidence across prospective cohort, cross-sectional, and case control data showed a significant association between a variety of CVD markers and high levels of perceived stress alone (Stewart et al., 2018).

Further, it makes sense that midlife women with heightened CVD risk would report higher stress and/ or related physical activity and health stress compared to the general population, given the gender inequalities that have been more prevalent during and post- height of the COVID-19 pandemic, when data collection for the present study occurred (October 2022 – June 2023; Centers for Disease Control; 2022b). A recent systematic literature review points out that while gender inequities in work are not new, there is a growing recognition of the importance of invisible labor or unpaid work in areas such as caregiving or housekeeping and the mental/cognitive load placed on women, above and beyond the physical burden of actually completing additional tasks (Reich-Stiebert, Froehlich, & Voltmer, 2023). This cognitive load, involving organizing,

reminding, decision-making appeared to be exacerbated for women during the COVID-19 pandemic (Reich-Stiebert, Froehlich, & Voltmer, 2023). In turn, this has led to impact on health care for women in midlife (i.e., delaying medical visits during the COVID-19 pandemic and concurrent changes in caregiving (Brown & Arigo, 2022). It appears that the impact of invisible labor is now receiving more attention for direct detriment to the health and well-being of women, given the growing evidence of its association with increased stress and reduced bandwidth to exercise willpower around health decisions (Daminger, 2019).

Interestingly, however, the present sample also endorsed higher self-efficacy for managing chronic medical concerns compared to a normed sample with at least 1 chronic medical concern. Notably, greater PAHS was significantly negatively associated with health self-efficacy in the present study. It is possible that this self-efficacy buffered women in this sample against some of the additional stress seen in a variety of clinical samples (i.e., patients with diabetes, chronic pain; Walker et al., 2014; Puschmann et al., 2020).

4.2 Aim 2

Describe selections of website content that may reflect in-the-moment emotion-focused versus problem-solving coping processes, with respect to the frequencies of selections in each category across days.

Overall, findings suggest that women perceive themselves as engaging in problem-solving coping more so than emotion-focused or avoidance coping (per Brief-COPE scores). Yet, their behavioral demonstrations of coping showed a greater tendency

to select emotion-focused content, followed by problem-solving, then avoidance. This preference for emotion-focused coping is consistent with previous evidence among women in midlife, especially when coping with health concerns (vs daily hassles, work problems, family conflict; Simpson & Thompson, 2009). Although there have been several studies to support gender differences in coping such that women tend to prefer emotion-focused coping, while men prefer problem-solving coping (Colville et al., 2015; Gloria & Steinhardt, 2016; Simpson & Thompson, 2009), less research has provided insight around possible reasons for this preference.

However, a recent study explored gender differences in coping during the initial lockdown period of COVID-19 and found that women were more likely to engage in emotion-focused vs problem-solving coping (Cholankeril, Xiang, & Badr, 2023). The authors contended that although women experience higher rates of mental health distress including anxiety symptoms compared to men, there appears to be a preference for emotion-focused coping strategies that are associated with poorer *health* outcomes compared to problem-solving, potentially a function of the fact that emotion-focused coping has been associated with more positive *caregiving* outcomes (compared to problem-solving; Cooper, Katona, & Livingston, 2008; Morano, 2003; cf. Cholankeril, Xiang, & Badr, 2023). Further, authors asserted that given some lingering debate about effectiveness of specific types of coping, this is likely context-dependent and based on the desired outcome (Cholankeril, Xiang, & Badr, 2023). Thus, it is possible that supplemental efforts to assist midlife women in coping suited to their health goals would be useful.

The discrepancy between self-reports of coping and behavioral demonstrations of coping is an important observation, and to our knowledge, this is the first of its kind in the population of interest. It is possible that this is reflective of general contextual fluctuations between self-reported preference for social exchange (i.e., social support and social comparison) and behavioral response that can occur among women in midlife with heightened CVD risk (Arigo, Mogle, & Smyth, 2021). However, this also leaves the questions of how much insight women in midlife have about this preference-behavior discrepancy. As described prior, women may be primed for greater use of emotion-focused coping given lingering traditional sociocultural gender norms (managing more domestic and caregiving responsibilities), though benefit from problem-solving coping for physical activity and other health management. It is possible that this population is not aware of benefits of coping for particular outcomes, nor of their actual behavioral tendencies vs preferences, acting as a potential barrier to their ideal health behavior engagement.

4.3 Aim 3

Examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and the overall frequencies of selecting content that may reflect emotion- versus problem-solving coping processes.

Women who endorsed greater (vs. lesser) overall stress also endorsed greater stress about physical activity and health, though correlations did not suggest problematic overlap in these assessments. This suggests some convergent validity for our study-developed PAHS measure and that that physical activity/health stress may act as a

significant source of stress for this population. General perceived stress also predicted some behavioral demonstrations of coping. Specifically, PSS predicted both problem-solving and emotion-focused coping, with a slightly greater effect size for emotion-focused coping compared to problem-solving. Effect sizes were moderate, however, the PSS was only marginally more predictive of emotion-focused than problem-solving coping (10% and 9%, respectively). This is somewhat consistent with correlational research such that people who engage in more emotion-focused coping report greater levels of stress compared to problem-solving, likely due to the facilitation of personal growth and expanding personal resources for coping in the future (Kumanova & Karastoyanov, 2013).

In contrast, PAHS did not predict behavioral demonstrations of coping in any category. It is possible that PAHS had limited validity, as this was a study-developed measure that requires psychometric evaluation in future work. It is also possible that teasing apart different sources of stress (vs focusing on physical activity/health stress specifically) might remove necessary context of multiple sources of stress that women in midlife are facing simultaneously (fluctuations in family life, ongoing self-discovery, managing work/life balance, and stressors such as divorce, personal or family sickness; Sharts-Hopko, 2007; Thomas et al., 2018). In other words, to understand individual sources of stress for this population, it may be helpful to utilize specific and broad measures of stress alike to provide needed context into how multiple sources of stress may compound and pull from coping resources, thereby limiting resources for other sources of stress.

4.4 Aim 4

Examine associations between women's baseline perceived stress (or appraisals) about health and physical activity and their in-the-moment perceptions of the helpfulness of content that may reflect emotion- versus problem-solving coping processes.

As hypothesized, PAHS was positively correlated with perceived helpfulness of emotion-focused and problem-solving content, with a small-to-medium effect size for emotion-focused content (r = 0.26), compared to a small effect for problem-solving coping (r = -0.19). Exploratory moderation analyses aligned somewhat with these findings such that PAHS significantly moderated relations between selection and perception of helpfulness of emotion-focused and problem-solving content. However, women with higher PAHS (compared to average and low PAHS) reported emotion-focused content as more helpful and problem-solving content as less helpful. In exploratory correlation analyses, PAHS was not significantly associated with avoidance coping, nor did it moderate relations between selecting and perceiving avoidance content as helpful.

Taken together, findings from the present study provide initial support for the notion that emotion-focused coping is perceived more positively (i.e., more helpful), as it may help to alleviate distress and *feel good* (relative to problem-solving and avoidance). Of note, participants in the present study were asked to reflect on the helpfulness of the content *in the moment* they received it. It is possible that future studies would benefit from assessment in the moment and after time has passed to better assess the supportive/helpful nature of the physical activity-promoting content such that it actually

led to more physical activity (vs. impacted their immediate emotional state). Further, this may be helpful psychoeducation for patients or research participants such that they have increased awareness and insight around *how* certain types of coping may be helpful and *when*. For example, this might help to increase the effectiveness of certain social support (or other resources to support physical activity) if individuals were cognizant of the potential impact on future outcomes. This parallels well with research describing emotion-focused coping as more *reactive* or focusing on responding to the occurrence of a stressful experience that already occurred/is presently occurring, while problem-solving coping involves goal setting, self-improvement and focuses on *proactive* coping for the future (Kumanova & Karastoyanov, 2013).

4.5 Aim 5

Determine whether baseline problem orientation was associated with website content selections or their perceived helpfulness.

Findings for aim 3 suggested some overlap, though notable discrepancy, between negative problem orientation (NPO) and PAHS. Similar to aim 4 findings, NPO was significantly, positively associated with emotion-focused coping and insignificantly, negatively associated with avoidance coping. While problem-solving coping had significant positive association with PAHS, it had insignificant negative association with NPO. Further, NPO showed a parallel pattern to PAHS in the moderation analyses with respect to problem-solving coping. NPO moderated the relations between selecting and perceiving problem-solving content as helpful such that participants with low NPO showed a significant positive relation, while those with high NPO showed a slightly

weaker positive relation. Unlike aim 4, NPO did not significantly moderate other forms of coping.

This discrepancy between PAHS and NPO findings is reasonable, as individuals with high NPO tend to have lower confidence in their ability to handle situations, especially via problem-solving (D'Zurilla & Chang; 2004). Thus, it makes sense that NPO was negatively associated with problem orientation and that with higher NPO, problem-solving content was rated as less helpful. However, stress is reflective of overall perception of internal and external resources while NPO primarily reflects internal resources (confidence in personal ability), and thus understandably, PAHS appeared to have an impact on multiple coping types directly, while NPO was only predictive of some coping tendencies.

With respect to the significant overlap between PAHS and NPO, it seems likely that threat perception is key. For those with a higher threat perception (either greater PAHS or NPO), there were more strong, positive associations between selecting and rating content as helpful if it was emotion-focused versus problem-solving or avoidance. It is possible that with greater threat perception, women in midlife with heightened CVD risk have a greater desire to focus on managing emotions versus desire for self-enhancement or openness to receive content at random. Further, this may represent desire for control when feeling more stressed/unable to manage treat.

Prior research shows a negative association between desire for control and emotion-focused and avoidance coping given their associations with external locus of control, while problem-solving coping is associated with internal locus of control (Stanislawksi,

2019). Thus, stress, problem orientation, or overall threat perception and related coping may be useful in understanding preferences and supportiveness/helpfulness ratings of physical activity promoting web content/intervention.

It is also possible that the desire to "feel good" in the moment when perceiving greater threat may impact perception of support in this context. Additionally, this information may prove useful for intervention tailoring. For example, building on skills to increase confidence in managing stress or threat broadly may be helpful to prime physical activity interventions for women in midlife at heightened CVD risk to engage in a broad variety of coping. Additionally, psychoeducation around benefits of certain kinds of coping (i.e., focusses on managing emotions associated with distress vs leads to self-enhancement) might also be helpful to encourage a variety of coping strategies. This might look like supplementing traditional physical activity-promoting content with introductory content on coping broadly to help individuals better understand their preferences for coping and connections to their long-term behavior.

4.6 Aim 6

Test for an association between the frequencies of viewing content that may reflect emotion- versus problem-solving coping processes and women's physical activity engagement over 7 days.

Across all types of coping, emotion-focused content was the only content (positively) associated with physical activity behavior (steps per day) over the 7 days of data collection. This was inconsistent with hypotheses that the frequency of selecting problem-solving content would be more strongly positively associated with physical

activity behavior over time and have a greater effect size, compared to the frequency of selecting emotion-focused coping.

However, the discrepancy between analyses for steps and active minutes was noteworthy. The correlation between selecting emotion-focused content and averaged steps across days suggested significant positive relations, while a correlation between selecting this content and averaged active minutes suggested insignificant negative relations. This discrepancy pairs well with visual patterns in the ANOVA graphs. In Figure 21, there is a distinctly lower trend for active minutes of physical activity for women who selected emotion-focused content frequently (i.e., 9-10 times over 7 days). However, women who viewed the content less frequently (i.e., 1-2 or 3-4 times over 7 days, had the highest trends for steps and active minutes (see Figures 20-21). Of note, this study was not advertised as an intervention, nor was change in physical activity encouraged. In fact, participants were explicitly informed that the primary purpose of the study was to get feedback on their preferences for the website content vs to increase their activity. A secondary purpose for the main author (KP) was to understand how natural physical activity (steps) might fluctuate with the introduction of different types of content. Participants were required to enter their step counts daily, though only participants who had access to physical personal activity trackers that provided moderate to vigorous exercise minutes (active minutes) or requested study-provided trackers were instructed to enter those into the website and surveys. Thus, active minutes were more exploratory in nature.

Although findings did not fully support hypotheses, there were overall patterns suggesting that engaging in some emotion-focused coping broadly might have been

helpful for lifestyle activity (step count), though engaging in too frequent emotion-focused coping was associated with significantly lower cardiovascular physical activity (active minutes). It is possible that this merely reflects pre-existing person-level differences, such that women who engage in more steps per day generally also gravitate toward emotion-focused coping or perceived less of a need to engage in problem-solving coping. However, this is an unlikely explanation as some prior research has suggested positive associations between increased physical activity, problem-solving coping, and coping-related decreases in stress, while emotion-focused and avoidance coping have been associated with the opposite (poorer mental health outcomes, increased stress, decreased physical activity; Popov, Sokić, & Stupar, 2021).

Alternatively, it is plausible that emotion-focused coping helped women with flexibility during the study, such that it encouraged any increase in natural activity without having to stick to a higher intensity or frequency (e.g., 30 minutes of cardiovascular activity or exercise). A primary goal of emotion regulation is to *flexibly* cope with emotions (vs. removing them; Aldao et al., 2014). However, it is not clear whether emotion-focused coping facilitated emotion regulation in the present context, and relying on this type of coping too much might have been less helpful, specifically, for challenging women to engage in higher intensity or structured exercise. Of note, although this more intense/structured activity may be helpful in some contexts (i.e., midlife women with heightened CVD risk needing more immediate/robust intervention), it is important that *any* increase in physical activity is encouraged for this population, especially as small bursts of activity are being increasingly recognized as cardioprotective (i.e., short 2-minute bouts adding up to 15-20 minutes of vigorous activity per week can lower

mortality by 16-40%; Ahmadi et al., 2022). Further, rigidity around completely meeting physical activity guidelines can often lead to difficulty with sustainability of efforts. This is consistent with recent clinical guidelines for weight management and related cardiometabolic risk for women in midlife per recommendation 3.1.2: "Realistic and sustainable patient-centered weight loss goals should be established after a detailed discussion with the midlife woman (Ranjan et al., 2022)." Thus, it is preferred that this population engage in the most realistic intervention, instead of the ideal.

4.7 Summary

In sum, the present findings suggest a slightly greater stress perception in this sample of midlife women with heightened CVD risk compared to normed samples of the same age with no heightened CVD risk. Women showed a slight selection preference for emotion-focused content (followed by problem-solving, then avoidance coping). They were more likely to rate emotion-focused content as more helpful and problem-solving content as less helpful with higher ratings of stress. There seemed to be a significant overlap between perceived stress and negative problem orientation, which suggested that threat perception was key. For those with a higher threat perception (either greater perceived stress or negative problem orientation), there were more strong, positive associations between selecting and rating content as helpful if it was emotion-focused vs problem-solving or avoidance. It is possible that with greater threat perception, women in midlife with heightened CVD risk have a greater desire to focus on managing emotions vs desire for self-enhancement or openness to receive content at random. This might reflect a desire for control when feeling more stressed or unable to manage the stressor. Additionally, women in midlife may also be primed to select emotion-focused content

given its utility with domestic and caregiving responsibilities, despite the helpfulness of problem-solving coping for positive health outcomes.

Engaging predominately with both types of coping (selecting emotion-focused or problem-solving at least once most days or every other day) was associated with the highest physical activity over time. Choosing emotion-focused content was associated positively with steps over time, unlike problem-solving and avoidance coping. However, this did not hold for active minutes. In fact, choosing emotion-focused content the most frequently (9-10 times across 7 days) resulted in distinctively lower active minutes across days. It is possible that having variety of content, especially for a higher threat perceiving/lower pre-study activity sample could be helpful for increasing general activity due to assistance with flexibility in increasing *any* activity (especially natural activity like steps), though other strategies such as problem-solving may be more helpful for increasing structured activity (i.e., strategies to plan/fit in activity or challenge oneself.

Thus, physical activity interventions for the population of interest may be tailored based on desired level of physical activity increases. If the goal is to increase lifestyle activity (i.e., steps), using emotion-focused coping and related flexibility around small, sustainable increases in activity might be helpful. Problem-solving coping focused on self-enhancement may be more useful if the goal is to increase structured, more intense exercise. Further, flexibility may be an especially contextually relevant factor to consider in physical activity intervention tailoring for this population who tends to have a higher social burden in addition to managing other commitments and stressors such as career-building, caregiving, and menopause (i.e., helping women to identify *their* bare minimum

"realistic" daily/weekly goals vs the "ideal", encouraging focus on small, additive, physical activity that accumulates, encouraging flexible self-talk when facing barriers).

Chapter 5

Limitations, Strengths, and Future Directions

Primary limitations of this study were its sample size and reliance on between-person and ordinary least squares regression for statistical analyses. Aggregating day-level data with respect to behavioral demonstrations of coping results in some loss of information. Specifically, this aggerated data will demonstrate the average of experiences of participants over time, though will not have the ability to provide insight on temporal patterns or changes over time (i.e., in what type of website content is selected over time). However, aggregation with daily diary data is a commonly used method to understand the sum of participant experiences over time, while minimizing retrospective recall bias (i.e., asking participants to retrospect once over a period of time; Bolger, Davis & Rafaeli; 2003).

A second limitation of the present study is that a subset of the primary variables of interest were captured with study-developed measures (i.e., physical activity/health stress, content helpfulness scores). Given that a primary predictor variable was a study-developed PAHS measure, it is unclear the role that stress specific to physical activity and cardiovascular health is playing versus overall stress. Though we do have evidence of significant correlation between PSS-10 and the PAHS, this limits our ability to make statements about tailoring physical activity interventions for women in midlife with heightened CVD risk based on specific sources of threat or stress. However, using both measures in the present study provided insight into individual and collective sources of stress for this population. Additionally, the content helpfulness score was a study-

developed measure that involved summing of responses across two questions with the same scale: *not at all* (1) to *very much* (5), however, involved different question wording ("After reading the description of your peer: how much do you feel inspired, confident, or hopeful about your own physical activity?" vs. "how helpful was this message today?"). This question wording was a limitation of the pre-developed study website.

There were additional limitations with respect to physical activity assessment. First, not every participant used a physical activity tracker that provided moderate-to-vigorous exercise minutes, limiting the conclusions that can be drawn about this behavior. Additionally, both steps and active minutes summary scores had significant missingness (over 50%) due to SPSS deletion settings (if one out of seven days was missing for the physical activity data, all were dropped in the summary score), which significantly impacted the summary scores. However, these summary scores are for descriptive purposes, and future work should use statistical methods that are more robust to missingness (e.g., multilevel modeling).

A fourth limitation of this study is the relative homogeneity of the the present sample. Although efforts with made to widen eligibility criteria and recruit an ethnically diverse sample, the present sample is still mostly white, highly education, high socioeconomic status. Thus, more work must be done to verify the present findings among more diverse sample. Especially given this study's focus on the impact of stress on physical activity behavior, it is especially important to acknowledge that with a more heterogenous sample, there would likely be even more implications for sources of stress (i.e., finances, discrimination). Additionally, although our study was a potentially helpful initial step in understanding patterns of stress, coping, and physical activity among

women in midlife with heightened CVD risk, we recruited low-activity individuals with higher stress (compared to same-age populations). Thus, it would be helpful to have a larger, more heterogenous sample with women across a variety of starting activity levels and baseline stress.

The primary strength of the proposed study is its novel classification of social support and social comparison processes as problem-solving and emotion-focused coping. Social support and comparison processes are well-established as means of coping (Bandura, 1998; Halliwell, 2012; Helgeson et al., 2001; Kliewer et al., 1990; Lazarus &; Folkman, 1984; Pomery, Gibbons & Stock, 2012; Taylor & Lobel, 1989; Wills, 1981). Further, some initial support exists for upward and downward social comparison as means of problem-solving and emotion-focused coping, respectively. However, no studies thus far have used behavioral demonstrations of different types of social support or social comparison as fulfilling emotion-focused vs problem-solving needs. Additionally, no studies to date have examined how these different kinds of coping may be differentially perceived regarding perceived helpfulness or associated with physical activity over time. A second strength of this study is its examination of the association between perceived physical activity and health stress and coping preferences for a population at significant risk for cardiovascular concerns. Given that women in midlife tend to have greater CVD risk (compared to other populations) and many either greatly underperceive this risk, understanding descriptive patterns in perceived risk and how this is associated with coping.

With respect to study method, a major strength of the present study was multiple days of assessment. In addition to the baseline survey, women completed 7 days of data

collection, which allowed for both within- and between-person data. Although some data were collapsed (i.e., frequencies of selecting specific website content), averaged or summed summary scores allowed for more accurate measures of behavior (compared to global self-report alone). Another measurement-related strength of this study included some outcome measures. For example, physical activity was measured objectively with personal or study-provided physical activity trackers, with special care and attention placed on assisting participants in identifying correct activity metrics with their tracker and accurately entering in their data to study website/surveys. Relatedly, the present study did not require personal physical activity trackers, though did allow participants to use personal trackers if they had access/preferred. We believe that this increased access for study participation, also increased ecological validity for those who could use their own tracker and allowed for a more heterogenous sample with respect to starting physical activity level. Other recruitment efforts likely allowed for increased sample heterogeneity broadly, including advertisements maximize inclusiveness (e.g., using images of women from diverse backgrounds).

Additionally, significant effort was put into removing barriers and increasing ease for women including late-night after-hours baseline or exit interview availability, calendar reminders for morning website use/evening survey, email assistance to help with technology errors or other problem-shooting, brief 5-10 minute website/surveys completion time, low-burden study-provided physical activity tracker, virtual Zoom-facilitated appointments. This allowed for greater variety in the study sample (including participants across several US states) as well as likely contributed to excellent study retention given multiple study components (2/62 participants withdrew from study

activities; See Figure 3). Lastly, this study utilized web-based physical-activity promoting content, which has been emphasized as highly desirable for this population per recent clinical guidelines for weight management and related cardiometabolic risk for women in midlife (Ranjan et al., 2022).

5.1 Statement of Independent Contributions to the Proposed Study

The proposed study extends from the author's previous intellectual contributions to date. She has been involved in multiple study iterations with the population of interest (i.e., women in midlife at risk for cardiovascular concerns. Contributions have included participation in study management, recruitment via family medicine, participant interaction, website content creation, and manuscript development. Specifically, this author has contributed to: (1) pilot studies to establish feasibility and acceptability of intensive assessment approaches with women in midlife (Arigo et al., 2021), (2) a scoping review of physical activity interventions tailored for women in midlife (Arigo et al., 2022), (3) observational studies to examine influence of social comparisons on physical activity engagement (Arigo, Mogle, & Smyth, 2021), (4) mixed method study to examine preferences for physical activity programming and relevant lived experiences (data analysis in progress), and (5) physical activity promoting website development and testing (Arigo et al., 2022; 2023).

The present study utilized the previously developed website for a unique purpose. The original purpose of the study website was to examine general content selection tendencies (i.e., different types of social support and social comparison content) and temporal associations with physical activity behavior. In contrast, this author

independently conceptualized website content selections as a representation of how women in midlife with heightened CVD risk may cope with stress due to difficulty managing health and physical activity goals. Further, this author has expanded relevant coping theory (i.e., theory of stress and coping, emotion-focused vs. problem-solving coping) to better understand the contributions of social comparison to social support processes and implications on physical activity behavior. This author has therefore adapted study website and established procedures from earlier study iterations for an independent study purpose, to generate unique insights into women's coping efforts.

5.2 Future Directions

The present pilot study examined patterns of selecting web-based physical activity intervention content specific to social support and comparison processes among women in midlife with elevated risk for CVD, as well as psychological and behavioral correlates of these selections (perceived stress, problem orientation, and physical activity, respectively). This may provide initial but needed insight into the ways that women use physical activity website content to fulfill their coping needs, which would help to inform improvements to digital physical activity interventions for this at-risk group. One important next step would be to replicate findings or engage in a related study utilizing different methods for additional evidence to support emotion-focused content preference, particularly with a more heterogenous sample (racial/ethnic background, socioeconomic status, education, starting physical activity level). In this work, it may be useful to expand on various types of coping and translate this to web-based content. Additionally, it may be helpful in future studies to identify validated measures of PAHS, and web-content helpfulness, if available. Another key next step would be to engage in more

robust with-person analyses to better understand temporal patterns (i.e., stress in the moment vs baseline stress as a predictor of selected and positively perceived coping content). This information could inform future intervention to promote physical activity tailored based on threat perception, desired outcome, coping preferences, and encouragement of flexibility.

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Appendix A

Baseline Measures

Perceived Stress Scale

The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

	Never	**Almost Never**	**Sometimes**	**Fairly Often**	**Very Often**
In the last month, how often have you been upset because of something that happened unexpectedly?					
In the last month how often have you felt that you were unable to control important things in your life?					
In the last month, how often have often have you felt nervous or stressed?					
In the last month, how often have you felt confident about your ability to handle your personal problems?					
In the last month, how often have you felt that things were going your way?					

In the last month, how often have you found that you could not cope with all the things that you had to do?					
In the last month, how often have you been able to control irritations in your life?					
In the last month, how often have you felt that you were on top of things?					
In the last month, how often have you been angered because of things that happened that were outside of your control?					
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					

Physical Activity/Health Stress

In the last month, how often have you been stressed about the following?

1. Your physical activity engagement
    a. Never
    b. Almost Never
    c. Sometimes
    d. Fairly Often
    e. Very Often

2. Your physical health
    a. Never
    b. Almost Never
    c. Sometimes
    d. Fairly Often
    e. Very Often

Coping Orientation to Problems Experienced Inventory (Brief-COPE)

The following questions ask how you have sought to cope with a hardship in your life. Read the statements and indicate how much you have been using each coping style.

1. I've been turning to work or other activities to take my mind off things?

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

2. I've been concentrating my efforts on doing something about the situation I'm in.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

3. I've been saying to myself "this isn't real".

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

4. I've been using alcohol or other drugs to make myself feel better.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

5. I've been getting emotional support from others.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

6. I've been giving up trying to deal with it.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

7. I've been taking action to try to make the situation better.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

8. I've been refusing to believe that it has happened.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

9. I've been saying things to let my unpleasant feelings escape.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

10. I've been getting help and advice from other people.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

11. I've been using alcohol or other drugs to help me get through it.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

12. I've been trying to see it in a different light, to make it seem more positive.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

13. I've been criticizing myself.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

14. I've been trying to come up with a strategy about what to do.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

15. I've been getting comfort and understanding from someone.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

16. I've been giving up the attempt to cope.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

17. I've been looking for something good in what is happening.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

18. I've been making jokes about it.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

19. I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

20. I've been accepting the reality of the fact that it has happened.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

21. I've been expressing my negative feelings.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

22. I've been trying to find comfort in my religion or spiritual beliefs.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

23. I've been trying to get advice or help from other people about what to do.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

24. I've been learning to live with it.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

25. I've been thinking hard about what steps to take.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

26. I've been blaming myself for things that happened.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

27. I've been praying or meditating.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

28. I've been making fun of the situation.

I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1	2	3	4

Self-Efficacy for Managing Chronic Disease 6-item Scale

We would like to know how confident you are in doing certain activities. For each of the following questions, please choose the number that corresponds to your confidence that you can do the tasks regularly at the present time.

1. How confident do you feel that you can keep the fatigue caused by your disease from interfering with the things you want to do?

Not at all Totally

Confident

| | | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

2. How confident do you feel that you can keep the physical discomfort or pain of your disease from interfering with the things you want to do?

Not at all Totally

Confident

| | | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

3. How confident do you feel that you can keep the emotional distress caused by your disease from interfering with the things you want to do?

Not at all Totally Confident

| | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

4. How confident do you feel that you can keep any other symptoms or health problems you have from interfering with the things you want to do?

Not at all Totally Confident

| | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

How confident do you feel that you can do the different tasks and activities needed to manage your health condition so as to reduce your need to see a doctor?

Not at all Totally Confident

| | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

5. How confident do you feel that you can do things other than just taking medication to reduce how much your illness affects your everyday life?

Not at all Totally Confident

| | | | | | | | | |

1 2 3 4 5 6 7 8 9 10

Negative Problem Orientation Questionnaire

People react in different ways when faced with problems in their daily lives (e.g., health problems, arguments, lack of time, etc.). Please use the scale below to indicate to what extent each of the following items corresponds to the way you react or think when confronted with a problem. Please circle the number that best corresponds to you for each item.

	Not at all true of me	Slightly true of me	Moderately true of me	Very true of me	Extremely true of me
1. I see problems as a threat to my well-being.	1	2	3	4	5
2. I often doubt my capacity to solve problems.	1	2	3	4	5
3. Often before even trying to find a solution, I tell myself that it is difficult to solve problems.	1	2	3	4	5
4. My problems often seem insurmountable.	1	2	3	4	5
5. When I attempt to solve a problem, I often question my abilities.	1	2	3	4	5
6. I often have the impression that my problems cannot be solved.	1	2	3	4	5

7. Even if I manage to find some solutions to my problems, I doubt that they will be easily resolved.	1	2	3	4	5
8. I have a tendency to see problems as a danger.	1	2	3	4	5
9. My first reaction when faced with a problem is to question my abilities.	1	2	3	4	5
10. I often see my problems as bigger than they really are.	1	2	3	4	5
11. Even if I have looked at a problem from all possible angles, I still wonder if the solution I decided on will be effective.	1	2	3	4	5
12. I consider problems to be obstacles that interfere with my functioning.	1	2	3	4	5

Blood Work

If available, please provide these bloodwork values from your most recent testing with your medical provider.

1. Hemoglobin A1C: _____ %
2. Fasting Blood Sugar: _____ mg/dL
3. High- Density Lipoprotein Cholesterol: _____ mg/dL
4. Low- Density Lipoprotein Cholesterol: _____ mg/dL
5. Triglycerides: _____ mg/dL
6. Systolic Blood Pressure: _____
7. Diastolic Blood Pressure: _____

Appendix B

Daily Website Prompts

My Physical Activity Today

Goal for the day: _____ steps and _____ minutes

Today steps so far: _____

Today active minutes so far: _____

Satisfaction with Yesterday's Activity

1. How satisfied were you with your steps yesterday?
    a. Very dissatisfied
    b. Mostly dissatisfied
    c. Somewhat satisfied
    d. Mostly satisfied
    e. Very satisfied
2. How satisfied are you with your active minutes yesterday?
    a. Very dissatisfied
    b. Mostly dissatisfied
    c. Somewhat satisfied
    d. Mostly satisfied
    e. Very satisfied

Choose a Peer

1. You have the opportunity to learn more about one of your peers and their progress toward their physical activity goals. Who would you like to learn about today?
    a. Peer #1: very active
    b. Peer #2: somewhat active
    c. Peer #3: not very active
    d. No preference: choose for me

Please tell us a bit about your response to the peer you selected or were given just now.

2. How was this person doing with their activity compared to you?
    a. Seemed to be doing much worse than I am
    b. Seemed to be doing a little worse than I am
    c. Seemed to be doing about the same as I am
    d. Seemed to be doing a little better than I am
    e. Seemed to be doing much better than I am
    f. Not sure or none of these
3. While you read the description of the peer, how much did you focus on the similarities between yourself and this person?
    a. Not at all

b. A little bit
c. Somewhat
d. Quite a bit
e. Very much

4. While you read the description of the peer, how much did you focus on differences between yourself and this person?
    a. Not at all
    b. A little bit
    c. Somewhat
    d. Quite a bit
    e. Very much
5. After reading the description of your peer, how much do you feel inspired, confident, or hopeful about your own physical activity?
    a. Not at all
    b. A little bit
    c. Somewhat
    d. Quite a bit
    e. Very much
6. After reading the description of your peer, how much do you feel disappointed, anxious or upset about your own physical activity?
    a. Not at all
    b. A little bit
    c. Somewhat
    d. Quite a bit
    e. Very much

Choose a Message

7. Which type of physical activity message would you like to see today?
    a. Encouragement to help me stay on track
    b. Tips for being more active
    c. Holding myself accountable
    d. No preference- choose for me
8. How helpful was this message today?
    a. Not at all
    b. A little bit
    c. Somewhat
    d. Quite a bit
    e. Very much
9. Do you want to see another message today?
    a. No
    b. Yes

Appendix C

End of Day Prompts

Steps

1. How many steps do you have so far today (please read from your pedometer)?
   _____

2. How many active minutes do you have so far today (please read from your pedometer)?
   _____

Appendix D

Supplemental Sensitivity Analyses

Given potential overlap between self-efficacy for managing health concerns and physical activity/ health stress, sensitivity analyses were considered. Analyses were ultimately performed given the significant correlations with dependent variables for study aim 3 (negative correlation with emotion-focused coping, significant positive correlation with problem-solving coping; see Table 3). When controlling for self-efficacy for managing chronic medical concerns, *p* value did decrease closer to significance and β increased, however, statistical significance of the correlation between PAHS and problem-solving coping did not ultimately change (with covariate: $F[2, 53] = 2.82$, $p = 0.07$, $\beta = 0.14$; without covariate: $F[1, 56] = 0.002$, $p = 0.97$, $\beta = -0.01$). When controlling for self-efficacy for managing chronic medical concerns, the *p* value did decrease closer to significance and β decreased statistical significance did not change, however statistical significance of the correlation between PAHS and emotion-focused coping did not ultimately change, however (with covariate: $F[2, 53] = 2.82$, $p = 0.069$, $\beta = 0.01$; without covariate: $F[1, 56] = 1.55$, $p = 0.22$, $\beta = 0.16$). Taken together, these results suggest that self-efficacy for managing medical concerns may be contributing at least partially to these relations, which makes sense given the overlap between perceived internal resources and stress perception. Thus, our aim 3 results should be taken with some caution given this context and continued work to parse out contributions of stress appraisal and perception.

Given potential overlap between negative problem orientation and physical activity/ health stress, sensitivity analyses were considered. Analyses were ultimately performed given the significant correlations with dependent variables for study aim 5 (positive correlation with emotion-focused coping, significant negative correlation with avoidance coping helpfulness; see Table 3). When controlling for negative problem orientation, the association between PAHS and frequency of selecting emotion-focused coping content does not notably change in significance (with covariate: $r[55] = 0.03$, $p = 0.82$; without covariate: ($r[56] = 0.16$, $p = 0.22$). When controlling for negative problem orientation, the association between PAHS and frequency of selecting avoidance coping content does not change notably in significance (with covariate: $r[55] = -0.17$, $p = 0.22$; without covariate: ($r[56] = -0.23$, $p = 0.08$). In sum, negative problem orientation does not appear to have a significant impact on the selection of emotion-focused or avoidance content.