Toward Health Information Technology that Supports Overweight and Obese Women in Addressing Emotion- and Stress-Related Eating (a Mixed Methods Approach)

by

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DEDICATION

To my ancestors; may my work bring honor to your sacrifices.

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"And He said unto me, 'My grace is sufficient for thee, for My strength is made perfect in weakness.' Most gladly therefore will I glory rather in my infirmities, that the power of Christ may rest upon me."

- 2 Corinthians 12:9

I am so very thankful for and to all the people who have supported me throughout my doctoral studies and the dissertation process. I am truly blessed to have had the right people by my side during the past five years to help me be my very best. There is no way I could have done this on my own.

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ABSTRACT

Extensive research has shown that negative emotions and stress can prompt eating behavior that is in excess of physiological nutritional needs. Additionally, research indicates that women are more likely than men to cope with negative emotions and stress by overeating. There is a dearth of Human-Computer Interaction (HCI) research related to Health Information Technology (HIT) interventions that address overeating in context of negative emotions and stress. As a result, there is little guidance for HCI design and evaluation in this area. The study uses a convergent mixed methods design to understand how HIT can support overweight/obese women curb emotion- and stressed-related eating (ESRE), with the ultimate goal of sustained weight management. In the interview study strand, cross sectional semi-structured interviews (N = 22) explore ESRE behavior in overweight/obese women (BMI ≥ 25). The survey study strand, consisting of a questionnaire (N = 430) administered to overweight/obese women, comprises data about user characteristics, stress, ESRE, and coping.

This dissertation thesis found that that overweight/obese women who engage in ESRE encountered stressors that spanned from daily hassles, persistent challenges, and life-changing losses; they also experience stressors related to serving as caretakers and social support providers. They used food as a coping response to the stress they encounter, and tend to associate food with social support. Furthermore, some have characteristics that make them particularly vulnerable to ESRE behavior. This thesis suggests that HIT should assist users before their coping eating response is triggered. Additionally, HIT should support women in becoming aware of their tendencies to associate food with social support.

This dissertation thesis also found that overweight/obese women who engage in ESRE need to be supported in both the acute and chronic dimensions of their ESRE behavior. Their acute needs include instrumental support for eating awareness in-the-moment as they are making food choices that could be ESRE, as well as in the form of a just-in-time distraction intervention to prevent them from engaging in ESRE. Their chronic needs include support for holistic goals and motivation to address their ESRE, emotional support for encouragement in weight loss efforts, and informational support for appraisal to understand ESRE and change thought patterns for lasting behavior change. This thesis suggests that HIT needs to allow for more self-experimentation and tailoring opportunities. Finally, this dissertation thesis found that stress and self-blame contribute to ESRE behavior, and that the relative influence stress and self-blame had on ESRE differs by racial groups. This thesis suggests that HIT avoid content and design choices that may incite feelings of self-blame.

This dissertation thesis' contribution is that it fills a gap in the literature by using an interpretivist approach to understand the ESRE experiences of overweight/obese women, including their support needs and perspectives on HIT currently available for weight management purposes. This permits insight into previously-undescribed aspects of the experiences including the anthropomorphizing of food, stress related to caregiving and social support providing, and the connection between depression and anxiety and ESRE. Additionally, the thesis relates the lived experience of ESRE to HIT design, and highlights ESRE behavior in context of socioeconomic factors. It also applies the concept of self-blame to a sample of overweight/obese women who are largely not diagnosed with an eating disorder. Finally, it explores how self-blame could be taken into account in the design of HIT for weight management.

CHAPTER 1. INTRODUCTION

"If Oprah with all of her wisdom and resources can't figure this [weight loss] out,
then I give myself a break for not figuring it out either."

                                                    - Overweight Woman Struggling with ESRE

1.1 Background

Overweight and obesity are pervasive in the United States. According to the
National Health and Nutrition Examination Survey (NHANES) administered by the National
Center for Health Statistics (NCHS), Centers for Disease Control and Prevention, more than
2 in 3 adults in the United States are overweight or obese, and more than 1 in 3 adults are
obese (Flegal, Carroll, Kit, & Ogden, 2012). Overweight and obesity are of particular
concern as they are risk factors for a number of health conditions and illnesses including
type 2 diabetes, heart disease, hypertension, fatty liver disease, osteoarthritis, stroke,
contraception and fertility complications, and various cancers (e.g., breast, cervical, colon,
endometrial, and kidney) (Kulie et al., 2011; NIH, 2012).

Additionally, as with a number of health measures, we find that racial and ethnic
disparities are evident in overweight and obesity: 78.8 percent of Hispanics and 76.7
percent of blacks are estimated to be overweight and obese whereas 66.7 percent of whites
are; about half (49.5 percent) of the black population is obese compared to 39.1 percent of
Hispanics and 34.3 percent whites (NIH, 2012). Overall trends indicate that while the rate
of increase in overweight/obesity is slowing down and perhaps overall prevalence is
stabilizing, slight but statistically significant increases continue to be seen in
overweight/obesity among African American and Mexican American women (Flegal et al.,
2012).

As a result, overweight and obesity reflect health disparities present in society, impact overall health and quality of life, and are linked to health conditions that require a great deal of resources to treat. In short, overweight and obesity are public health concerns that need to be addressed and minimized.

Weight Management Challenges

Overweight and obesity does not simply result from energy surplus (i.e., people intake more energy than they expend) (Kassirer & Angell, 1998). Indeed, susceptibility to weight gain is the result of a number of processes related to physiological, metabolic, behavioral, psychological, and genetic factors (Blundell et al., 2005). Additionally, all of these processes take place in our obesogenic environment that promotes obesity, in part, through ubiquitous strategic food marketing (Garber & Lustig, 2011), food products engineered to be highly palatable and addictive (Kessler, 2009), ever-expanding food portions (Swinburn & Egger, 2002), and easy availability of low priced, energy-dense, high fat foods (Kristeller & Epel, 2014).

Furthermore, successful weight management (i.e., the process of attaining and/or maintaining a healthy weight) tends to be fleeting for most people; it is estimated that most people who lose weight regain between 30% - 65% of it within one year, and regain most if not all of the weight within 5 years (Thomas, 1995, p. 1; Weiss, Galuska, Kettel Khan, Gillespie, & Serdula, 2007). Over time, people are less likely to maintain the diet and exercise regimens that may facilitate initial weight loss (Perri & Foreyt, 2004). Additionally, after periods of food restriction characteristic of diets, metabolism slows down and there is a greater sensitivity and draw to palatable foods, thereby making weight management even more difficult (Perri & Foreyt, 2004).

Some researchers argue that given the struggle people have with losing weight, resources are better allocated to preventing overweight and obesity rather than broadly promoting weight loss (see Lemmens, Oenema, Klepp, Henriksen, & Brug, 2008). Nonetheless, this thesis takes the position that effective tools should continue to be developed for overweight and obese people who would like to manage (i.e., lose or maintain) their weight—notwithstanding the great challenge that it presents.

Emotion- and Stress-Related Eating (ESRE) and Weight Management

Some people who do not have a clinical eating disorder diagnosis nonetheless engage in eating behavior that is driven, in part, by negative emotion and stress that is not effectively managed in other ways. Although the prevalence of nonclinical emotion- and stress-related eating (ESRE) has yet to be quantified with the same precision as clinical eating disorders, research studies show that a sizable minority of people engage in such eating behavior (see Gibson, 2012).

As illustrated in Figure 1, people who engage in ESRE tend to overeat when negative emotions are aroused and during times of stress rather than eat to meet nutritional needs. ESRE is not guided by physical sensations indicating hunger and satiety, increasing the likelihood of becoming overweight or obese. Effective and stable coping, which includes emotion regulation, however, disrupts the cycle whereby negative emotions and stress cause people to overeat; people are able to cope in such a manner that does not significantly impact their eating behavior.

Although weight management is based on caloric intake, caloric output, and how calories are metabolized, the widely accepted mantra of weight management, "calories-in-calories-out," is more complex than it appears at first glance (Kristeller & Epel, 2014). Both perceived and chronic stress set off a cascade of psychophysiological interactions that challenge earnest efforts in weight management to balance energy intake (Baum, 1990; Holmes & Rahe, 1967). As such, mere willpower to eat less calories or motivation to engage in exercise may not be enough to overcome ESRE behavior.
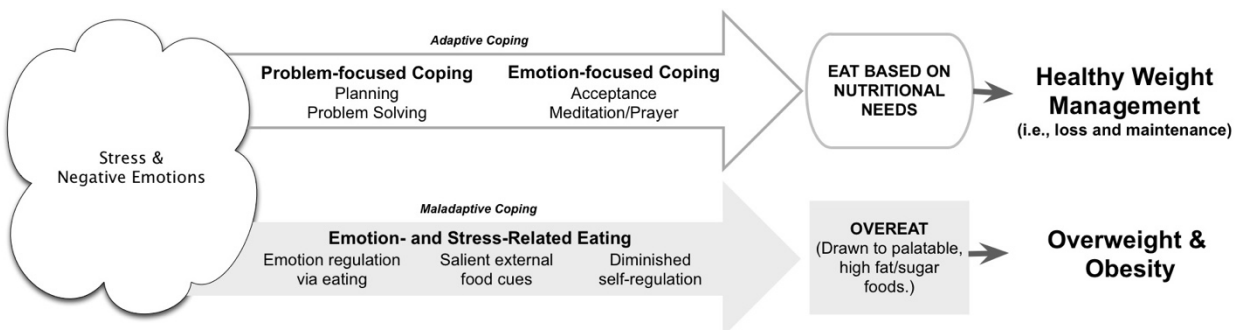
Figure 1. *How adaptive coping breaks the ESRE cycle.*

Research indicates a link between non-clinical ESRE and difficulty with weight management over time. Obese people who lost weight only to regain it over time have reported a tendency to cope with negative emotions by eating food (Bidgood & Buckroyd, 2005). Other studies have found that 1-2 years after a behavioral weight loss program overweight/obese ESRE behavior was significantly associated with weight change (i.e., higher levels of ESRE were associated with less sustained weight loss)(Lavery & Loewy, 1993; Teixeira et al., 2010). Furthermore, Niemeier, Phelan, Fava, and Wing (2007) found that eating as a response to internal thoughts and emotions as opposed to external environmental cues is associated with regaining weight after a period of weight loss. In related research, Butryn, Thomas, and Lowe (2009) found that reducing eating related to internal thoughts and emotions during the weight loss phase of a weight loss program significantly predicted maintenance of initial weight loss. As a result, supporting adaptive coping for people who are overweight/obese could possibly lead to greater success in their weight management efforts.

Guidelines for Weight Management

American Dietetic Association (ADA) guidelines, as well as guidance provided by the American Heart Association (AHA), recommend that weight management be addressed through the following three intervention areas: diet, physical activity, and behavior therapy (Academy of Nutrition and Dietetics, 2006; Klein et al., 2004). The practices of people on the National Weight Control Registry, all of whom have lost at least 30 pounds and kept it off for a minimum of one year, indicate that diet and physical activity are key. Generally, these people report that they eat a low-calorie diet, eat breakfast, maintain a diet of similar foods, eat in a consistent manner each day of the week and over the course of a year, avoid overeating during holidays and special occasions, self-monitor what they eat and how much they weigh, and engage in 35-75 minutes of moderate to vigorous activity each day (Moreno & Johnston, 2012).

Knowledge of healthy diet and exercise practices, however, are not sufficient for sustained weight loss over the long term. Obese people who have experienced weight loss failure (i.e., regained weight after losing it) have reported that they have information about diet and exercise, but ultimately abandon their weight loss efforts due to frustration with modest results, emerging life changes (e.g., new job, less disposable income to spend on weight loss), lack of willpower, and experiences of stress and negative emotions (Thomas, Hyde, Karunaratne, Kausman, & Komesaroff, 2008). A multi-pronged approach to weight management that includes behavior therapy may provide tools that would allow people to navigate setbacks and continue their weight management efforts as they implement sound diet and exercise practices.

Health Information Technology Design

As much as current health information technologies (HITs) designed for weight management have captured the attention of users, with some notable exceptions, research regarding weight management HITs to date has overlooked ESRE altogether. Given that, as described above, a portion of the population's overweight and obesity are related to negative emotions and stress, HIT design could potentially be extended to support behavior therapy that can contribute to sustained behavior change and successful weight management for a broader group of users.

Overweight/Obese Women as the Population of Interest

While there are a number of areas in which HIT could be designed to deliver behavior therapy that assists with weight management, the primary concern of this thesis is to consider how to support overweight/obese women's adaptive coping with the goal of obviating the overconsumption of food as a result of ESRE. Such a focus is important because, in the United States, the prevalence of obesity is higher for women (38.3%) than it is for men (34.3%)(Ogden, Carroll, Fryar, & Flegal, 2015). Moreover, the gender difference in obesity prevalence is particularly pronounced among Latinos (women = 45.7%, men = 39.0%) and African Americans (women = 56.9%, men = 37.5%)(Ogden et al., 2015). Additionally, research indicates that women have a greater tendency to engage in ESRE than men (see Gibson, 2012). Altogether this suggests the relationship between

overweight/obesity and ESRE in women could be of a quality and magnitude that is distinct from men, suggesting a need for interventions specifically targeted for this group. As a result, this thesis is scoped to the United States subpopulation of overweight/obese women.

1.2 Purpose Statement

The purpose of this mixed methods study is to develop guidance for design of HIT that supports adaptive coping to mitigate ESRE behavior. The study uses a convergent mixed methods design in which qualitative and quantitative data were collected in parallel, analyzed separately, and then merged (see Figure 2. *Convergent parallel mixed methods research design.*). In this study, cross sectional semi-structured interviews explored ESRE behavior in overweight/obese women who self-identify as engaging in ESRE behavior that they think has a negative effect on their health. At the same time a survey questionnaire was administered to determine the relationship between user characteristics, stress, ESRE, and coping in overweight/obese women. The reason for collecting both quantitative and qualitative data was to understand the phenomenon of ESRE in overweight and obese women with complementary data from different data sources, thereby allowing for a variety of analytical strategies (e.g., quantified associations).
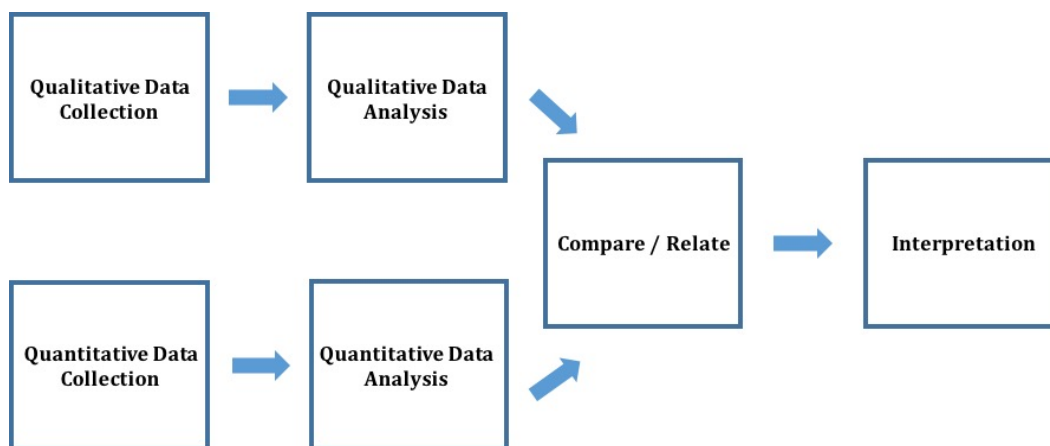
Figure 2. *Convergent parallel mixed methods research design.*

1.3 Research Questions

The study uses a sociotechnical design research approach to answer the following research questions:

RQ 1: What is the lived experience of women who engage in ESRE?

RQ 2: How can information technology for weight management be designed to address ESRE in overweight/obese women?

RQ 3: What do overweight/obese women perceive to be their support needs regarding their ESRE behavior?

RQ 4: What challenges do overweight/obese women who engage in ESRE experience in using existing information technology focused on weight management via eating behavior modification?

RQ 5: What is the relationship between self-blame as a coping response and eating behavior in overweight/obese women?

RQ 5.1: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, it at all, by racial group?

RQ 5.2: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, if at all, by educational attainment group?

RQ 6: Which information technology coping support features would be appropriate for particular subgroups of overweight/obese women?

1.4 Significance and Contribution

   The study seeks to provide guidance for ESRE HIT intervention development. As such, it broadens knowledge of how to incorporate behavioral weight management approaches into HIT interventions. More specifically, this research deepens our understanding of ESRE, an under-examined area in weight management HIT research. This study takes a multidisciplinary approach by considering validated psychological theories and measures along with HCI considerations. Further, by studying women's perspectives and needs, this research establishes a base for tailoring ESRE HIT interventions to the needs of particular user subgroups.

Thesis Document Overview

   To this end, **Chapter 2** is a literature review that presents theory and previous research on the overlapping concepts of emotion, stress, and coping; the connection between coping and self-regulation; and coping and eating behavior. Behavioral approaches to weight loss are then described along with HIT research related to weight management, coping (through emotion regulation), and ESRE. Then **Chapter 3** describes the research methods of the convergent parallel mixed methods study. **Chapters 4 – 6** present the results that respond to each research question, as well as discussion of those results and their implications for ESRE HIT intervention design. Finally, **Chapter 7** provides a concluding statement that highlights the principal findings and implications for the study as a whole.

CHAPTER 2. LITERATURE REVIEW

Notwithstanding the highly interconnected nature of emotions, stress, coping, and eating behavior, human-computer interaction (HCI) research has largely overlooked designing weight management tools for the specific context of ESRE. This literature review attempts to demonstrate why ESRE warrants carefully designed HIT tools. First, it provides working definitions for and explanations of the relationships between concepts related to emotions, stress, coping, and eating behavior, thereby providing a theoretical framework for the research study. It then describes behavioral weight loss programs to show the range of potential HIT weight management interventions. Next it provides a brief overview of the state of HCI research related to weight management, coping, and finally ESRE. It shows that there is a dearth of HCI research that comprehensively and effectively address ESRE. Altogether, this literature review demonstrates the need for developing guidance that will allow for appropriate design and evaluation of HIT that supports women challenged by ESRE.

2.1 Overlapping Concepts of Emotion, Stress, and Coping

2.1.1 Some Definitions and Conceptual Relationships

Affect can be conceptualized as a category of states that include emotions, moods (e.g., depression and happiness), stress, and motivational impulses (e.g., for eating) (Scherer, 1984). Theorists and researchers have conceptualized ***emotion*** in varying ways, though they generally accept that it comprises states that involve individual subjective experience, physical expression, and physiological reaction (Gross & Barrett, 2011). ***Mood*** is considered to be an affective state that is more "diffuse" and enduring than an emotion (Gross, 2013, p. 6). Psychological ***stress*** can be regarded as emotions related to harm/loss (i.e., previous harm/loss), threat (i.e., potential future harm/loss), and challenge (i.e., obstacles perceived to be surmountable)(Lazarus, 1966, 2006b).

The concepts of emotion and stress are highly interrelated. Both emotion and stress entail "whole-body responses to significant events" that play out in an individual's cognition, behavior, and physiology (Gross, 2013, p. 6). Furthermore, stressful situations can arouse particular negative emotions (e.g., anxiety, guilt, shame) that could be regarded as "stress emotions" (Lazarus, 2006b). Emotion and stress, however, differ in that emotion comprises positive (e.g., happiness, pride, relief, and love) and negative affect states (e.g., anger, fright, sadness, envy, jealousy, and disgust), whereas stress is generally regarded as a wholly negative affect state (Lazarus, 1993, 2006b).

Coping is the "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p. 141). ***Emotion regulation*** is regarded as "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275). Coping and emotion regulation are overlapping concepts that fall under the category of affect regulation. More specifically, coping can be viewed as a form of emotion regulation in the face of stressors (Glanz & Schwartz, 2008). A number of researchers have lamented the separate and disconnected treatment of coping and emotion regulation constructs in the psychology literature notwithstanding their similarities and interdependencies (Compas et al., 2014; Wang & Saudino, 2011). Integrating coping and emotion regulation constructs into a comprehensive model is beyond the scope of the thesis. As a result, this thesis regards emotion regulation as a form of coping, and refers to it as necessary to elucidate ESRE.

2.1.2 Transactional Model of Stress and Coping (TMSC)

While emotion and stress researchers take varying views on exactly how and to what extent emotion, stress, and coping are related, this thesis generally adopts the Transactional Model of Stress and Coping (TMSC)(see Figure 3: *Transactional Model of Stress and Coping.*) (Lazarus, 1966, 2006a; Lazarus & Folkman, 1984). The TMSC is particularly suitable for understanding ESRE because it incorporates a range of

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perspectives including social, cognitive, and physiological elements—all of which are commonly used in eating behavior theories and models
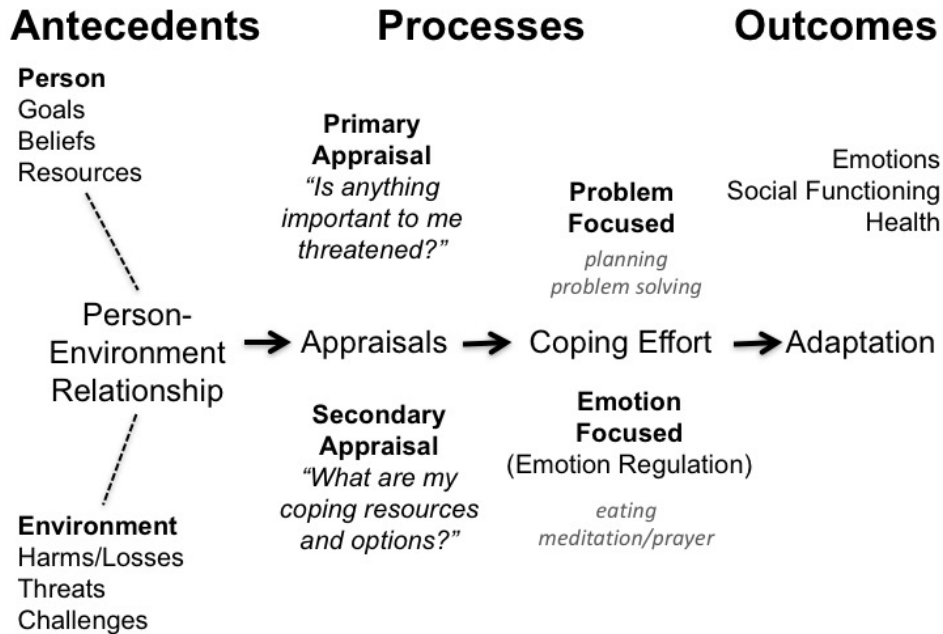
Figure 3. *Transactional model of stress and coping. (Adapted from "Transactional Model of Stress and Coping," Glanz & Schwartz, 2008, p. 216, and "A revised model of stress and coping," Lazarus, 2006, p. 198.)*

Under the broadly accepted TMSC (Lazarus, 1966, 2006b; Lazarus & Folkman, 1984) a *person*, who has unique characteristics (e.g., goals, beliefs about themselves/world, and available resources), *transacts* with an *environment* that comprises stressors (e.g., harms/losses, threats, challenges). When a person encounters a stressor he/she makes a *primary appraisal* to ascertain whether the stressor jeopardizes goals, values, etc., and if so, what might happen (Lazarus, 2006b). Additionally, the person engages in the cognitive-evaluative process of a *secondary appraisal* to determine his/her coping resources and options (Glanz & Schwartz, 2008). Based on these appraisals, the person uses *coping efforts* that have either a problem focus or emotion focus to mitigate the stressor's negative effects. Problem-focused coping (e.g., planning, problem solving) entails strategies that change the stressor, whereas emotion-focused coping (e.g., eating, meditation/prayer)

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involves changing how one understands, feels, or thinks about the stressor (i.e., emotional regulation) (Lazarus & Folkman, 1984, 1987).

Finally, the model holds that appraisals and coping efforts affect subsequent adaptational outcomes that include resulting emotions and their concomitant effects, social functioning, and health at the physiological level (e.g., hormone secretion) (Glanz & Schwartz, 2008; Lazarus, 2006b). As a result, coping is thought to be a dynamic process whereby an individual changes behavior and/or regulates emotion related to an encountered stressor to create an outcome related to his/her overall quality of life.

Some researchers evaluate coping strategies as either "good" or "bad" (Glanz & Schwartz, 2008), ignoring the costs and benefits each strategy may have in a particular situation. For instance, the traditionally conceived "maladaptive" coping form of *avoidance* may be preferable for circumstances in which the person has no control (e.g., Rayburn et al., 2005). It may also be generally beneficial in the short term as it immediately reduces stress (Suls & Fletcher, 1985) and allows a person to ease into dealing with the stressor, thereby providing the grounding for a person to use the more direct *approach* coping strategy (Roth & Cohen, 1986). This thesis follows the widely accepted view that coping strategies are not *a priori* good or bad, though their consequences may be depending on the context in which they are utilized (Lazarus & Folkman, 1987; Zeidner & Saklofske, 1996).

Coping strategies for dealing with stress and resulting negative affect may be manifested in some eating behaviors. For instance, research suggests that to a certain extent all people engage in "emotionally instrumental" (Booth, 1994, p. 91) eating, or eating food with the goal of improving how one feels emotionally. Macht and Simons (2000) found that when people from a non-clinical sample experienced negative emotions (e.g., anger, tension, fear), they were more likely to engage in eating to cope with the emotions. Over the course of the study, research participants reported their emotional state and motivations for eating five times a day for six days. Participants rated eating "to provide distraction," "to relax," and "to feel better" higher as reasons for eating when experiencing negative emotions than when they experienced positive or neutral emotions, thereby

suggesting that they used food intake as an emotion-focused coping strategy to alleviate their immediate negative emotional state (Macht & Simons, 2000, p. 70).

2.2 Coping and Self-Regulation

Coping, which addresses negative emotions and stress, can be a demanding process that makes self-regulation efforts even more challenging. The self-regulation process makes significant cognitive demands. In particular, self-regulation is thought to be connected to the brain's executive functions of updating (i.e., accessing information quickly and free from distraction), inhibition (i.e., resisting the urge to engage in tempting behavior in conflict with goal), and shifting (i.e., task-switching that allows for flexibility in the means used to achieve goals)(Hofmann, Schmeichel, & Baddeley, 2012). The heavy and at times overwhelming load of engaging in coping and self-regulation in tandem is an important conceptual relationship to consider when seeking to understand ESRE in context of weight management.

Generally, self-regulation is regarded as occurring when a person changes his/her response (e.g., action, thought, feeling, etc.) to a situation. Such a change is the "overriding" of a "natural response" by an alternative response, or none at all (Baumeister, Heatherton, & Tice, 1994, p. 7). Although self-regulation models differ, generally they all incorporate three elements: 1) a target or goal; 2) monitoring, which allows for comparison between a given behavior and goal; and 3) regulation, whereby strategies are implemented to manage thoughts, emotions, and behaviors that diverge from the goal (Wagner & Heatherton, 2013a). Failures in self-regulation are thought to occur in one of two forms: *underregulation*, the failure to apply enough self-control; and *misregulation*, the application of a self-regulation strategy that does not lead to the goal outcome (Baumeister et al., 1994, p. 14).

Negative affect, a construct that includes negative emotions and stress (see Section 2.1.1 Some Definitions and Conceptual Relationships) that are also found in the coping process, tends to influence self-regulation by undermining regulation and monitoring, as well as by increasing disinhibition. Negative affect seems to challenge regulation by making rewards and temptations more salient. This is thought to happen, in part, as a

result of an increase in glucocorticoid stress hormones that are released during times of distress; increases in these hormones result in the brain's reward system becoming particularly sensitive, thereby making stimuli (e.g., food, cigarettes, drugs) more tempting (Piazza & Le Moal, 1996).

Negative affect specifically impacts the monitoring phase of self-regulation by taxing cognitive processes to such an extent that it becomes more challenging to track behavior as it relates to a greater goal. Working memory load is increased as a person ruminates over negative emotions and the situation surrounding them, and as a person attempts to regulate such negative emotions (Wagner & Heatherton, 2013a). As a result, monitoring suffers as cognitive energy is focused on this negative affect. Additionally, "ironic process theory" suggests that when people experience stress or other demands on their cognitive load, they may end up thinking about and engaging in behavior that they actively work toward avoiding (Wegner, 1994). This is rooted in the fact that a person continually monitors his/her environment to seek out cues and signals of situations or actions that could potentially conflict with a goal. Under ordinary circumstances, upon monitoring a threat, a person has the capacity to take action to avoid the situation. At times of distress, however, a person may lack the cognitive resources to overcome the unwanted thoughts and behaviors that are made salient through their active monitoring.

Negative affect is also thought to deplete self-regulatory strength (i.e., willpower). The "strength model of self-regulation" suggests that people have a finite amount of self-control, and that it becomes depleted as it is used, thereby limiting a person's capacity for subsequent self-regulation (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Vohs, & Tice, 2007). This reduced self-regulation, or *ego depletion*, can occur as a result of efforts to regulate behavior or emotion, and may affect further attempts to regulate behavior or emotion (Schmeichel, 2007; Wagner & Heatherton, 2013b). As a result, the management of negative affect can deplete resources that could be used for behavior regulation, just as behavior regulation could deplete resources for emotion regulation, thereby appearing to initiate what is possibly a continuous cycle of ego depletion.

Additionally, according to "escape theory", some people who have negative and critical thoughts about themselves engage in emotional regulation strategies to distract or "escape" from experiencing negative affect (Heatherton & Baumeister, 1991). These people focus on their immediate environment to avoid self-awareness, and as a result lose track of their goals, become susceptible to temptations, and are more likely to act on impulses and urges that are in conflict with their goals.

At times, regulating and escaping from negative affect may take priority over goals, thereby leading to self-regulation failure. For instance, emotionally instrumental eating (i.e., eating food with the goal of improving how one feels emotionally) may trigger a person's indulgence in foods that are not on the eating plan that he/she is trying to follow. Such regulation of negative emotion by engaging in a behavior that will improve emotion—at least in the short term—is considered a "misregulation" (Tice & Bratslavsky, 2000). Rather than a failure of self-regulation *per se*, a misregulation reflects a shifting of priorities from long term goals to immediate emotional satisfaction (Tice, Bratslavsky, & Baumeister, 2001; Wagner & Heatherton, 2013a). Nonetheless, the end result is that previously avoided behavior is engaged in as a response to negative affect.

2.3 Coping and Eating Behavior

Research suggests that some eating behavior can be a form of coping and may reflect the ineffective regulation of stress and negative affect, which in turn impacts self-regulation efforts. Furthermore, research indicates that when women experience stress they are not only drawn to palatable food (i.e., food high in sugar and fat), but also have a greater drive to eat food (Chao, Grilo, White, & Sinha, 2015; Groesz et al., 2012; Torres & Nowson, 2007). As a result, women under stress have a tendency to crave high calorie foods, eat more, and potentially gain weight as a result. Although the connection between stress, coping, self-regulation, drive to eat palatable foods, and overweight/obesity it is not entirely understood, a range of eating behavior theories and studies of physiological processes start to provide potential answers.

2.3.1 Psychosomatic, Externality, and Restraint Theories

While a range of eating behaviors fall under ESRE, three overlapping and interconnected explanations of the general phenomenon are psychosomatic theory (emotional eating), externality theory (external eating), and restraint theory (restraint eating). These three theories suggest that the etiology of overeating is rooted in eating behavior that is shaped in some way by various states of affect. They posit that overeating occurs as a result of the ignoring, misperception, or general lack of awareness of internal signals of hunger and satiety, or what is considered "interoceptive awareness."

Psychosomatic Theory (Emotional Eaters)

Psychosomatic theory suggests that some individuals (over)eat in response to their emotional experience rather than physiological signals of hunger and satiety (Bruch, 1964, 1973; Kaplan & Kaplan, 1957). Emotional eaters eat in response to an emotional condition, whether positive or negative. The impact of positive emotion on eating, however, is not as widely researched as that of negative emotion. The limited studies seem to indicate that both men and women eat more in response to negative emotions. Men, however, report that they are inclined also to eat more in response to positive emotions (Macht, Roth, & Ellgring, 2002), and they do so more in comparison to women (Geliebter & Aversa, 2003; Nolan, Halperin, & Geliebter, 2010). As a result, women may largely demonstrate emotional eating in context of negative affect. Some explanations for the eating reaction to stress on the part of emotional eaters is that based on early childhood feeding experiences (e.g., not being fed when hungry, being fed to cope with distress or as a reward), adult individuals confuse certain types of emotional arousal, such as stress, anxiety, or joy, with hunger (Bruch, 1973; van Strien, Herman, & Verheijden, 2009). Therefore, emotional eating is largely viewed as learned behavior that is used as a strategy to reduce negative affect (see Canetti, Bachar, & Berry, 2002; Kaplan & Kaplan, 1957).

Externality Theory (External Eaters)

According to the externality theory of obesity, compared to normal weight individuals, obese individuals are sensitive to external food-related cues in the environment and have poor interoceptive awareness (e.g., hunger, satiety, etc.), which ultimately leads to overeating (Schachter, 1971; Schachter, Goldman, & Gordon, 1968; Schachter & Rodin, 1974). Some research, however, indicates that sensitivity to external food cues is not related to whether or to what extent a person is obese or not (Price & Grinker, 1973; Rodin, Slochower, & Fleming, 1977). It is argued that overeating in response to external food cues may be evolutionary desirable; given the scarcity of food over the course of world history, individuals who overate when the environment indicated food was available, may have had a better chance of survival over time (Rodin, 1981, p. 365). Nonetheless, the external eater is thought to be particularly vulnerable to overeating during periods of stress when external food cues may become even more salient than internal ones (Polivy, Herman, & McFarlane, 1994). For instance, some research indicates that individuals measuring high on external eating had a significant positive relationship between food intake (i.e., snacking) and the occurrence of self-identified life "hassles", such as arguments or falling behind in a daily schedule (Conner, Fitter, & Fletcher, 1999).

Restraint Theory (Restraint Eaters)

Restraint theory posits that highly restrained eaters tightly restrict their food intake (i.e., diet), but tend to counterregulate (i.e., overeat in excess) when they encounter disinhibitors (e.g., negative emotions, high calorie foods, etc.) (Herman & Polivy, 1980a). Under restraint theory, it is thought that each person has a homeostatically controlled weight range (Herman & Mack, 1975). Individuals who eat restrictively to attain a desired weight that may be lower than their body's natural "set point", such that they may experience regular hunger (Herman & Mack, 1975, p. 649; van Strien, Frijters, Bergers, & Defares, 1986, p. 296). When cognitive restraint is disrupted by disinhibitors including environmental food cues and emotional arousal (Wardle, 1990, p. 388), the restraint eater becomes aware of his/her underlying hunger (Herman & Polivy, 1980b, p. 137). Through a reliance on self-imposed eating "rules" rather than hunger and satiety signals, restraint eaters are believed to have developed poor interoceptive awareness (van Strien et al.,

1986, p. 296). As a result, and perhaps counterintuitively, restraint theory views diets as leading to overeating in restraint eaters (Herman & Polivy, 1980a).

2.3.2 Physiological Explanation

A closer look at the body's response to stressors suggests that ESRE comprises a complex set of interactions between physiological processes and behavior. When people experience stress, there is activity in the hypothalamic-pituitary-adrenal (HPA) axis including the release of glucocorticoid (e.g., cortisol) hormones, which if persistent over time increases abdominal fat (Daubenmier et al., 2011). Animal studies indicate that abdominal obesity has the effect of decreasing corticotropin-releasing factor (CRF) mRNA, thereby alleviating HPA activity (Dallman et al., 2003). As a result, researchers think that people experiencing stress may be drawn to eat large amounts of high density food to restrain their internal stress responses, though they are ultimately perpetuating overweight and obesity. This view is supported by research that found the higher level of stress-induced eating that an individual reported, the more likely they were overweight or obese (Ozier et al., 2008). Furthermore, the Reward-Based Stress Eating Model, which draws on addiction literature, describes how reward neurocircuitry may play a role in ESRE (Adam & Epel, 2007). This model posits that recurring stimulation of reward pathways via eating palatable food and/or stress-related HPA stimulation results in neurobiological adaptations that progressively entrench and increase compulsive overeating. Therefore, as immediately problematic ESRE behavior is, it can also have long-lasting effects on a person's ability to manage their weight.

Altogether, the psychosomatic, externality, and restraint theories along with the physiological explanation begin to show the complexity of ESRE. Moreover, it suggests that weight management efforts by people who engage in ESRE will likely need to address a number of considerations beyond "calories in" (diet) and "calories out" (exercise).

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2.4 Behavioral Approaches to Weight Management

As previously noted in **Chapter 1** (*Introduction*), both the American Dietetic Association and American Heart Association recommend that weight loss be addressed through diet, physical activity, and behavior therapy. Behavior therapy incorporates a broad array of strategies that support modifications in eating and activity behaviors that are related to weight. Such strategies include self-monitoring, goal setting, stimulus control, cognitive restructuring, and stress management among others (Klein et al., 2004; Wing, 2008). Numerous studies indicate goal-setting and self-monitoring are crucial parts of successful weight management(Khaylis, Yiaslas, Bergstrom, & Gore-Felton, 2010). Additionally, behavioral science research indicates that stress-reduction strategies, when added to diet and exercise interventions, lead to better weight loss management than individuals who address diet and exercise alone (Manzoni et al., 2008). Research also shows that behavioral interventions to mitigate stress are more effective for weight management when weight loss is identified as the central goal (Katterman, Kleinman, Hood, Nackers, & Corsica, 2014). Furthermore, research indicates that behavior therapy alone is an effective weight loss strategy, but produces greater weight reduction when used together with diet and physical activity interventions (Shaw, O'Rourke, Del Mar, & Kenardy, 2005).

2.4.1 Comprehensive Weight Loss Programs

People attempt and achieve weight loss *via* a number of methods with varying levels of support from health professionals and peers. The full range of strategies and techniques used in weight loss interventions can be well understood through an examination of comprehensive weight loss programs such as behavioral weight loss treatment offered by hospitals and universities (e.g., University of Michigan Investigational Weight Management Clinic, MHealthy Ready to Lose Weight Loss Program), as well as commercial weight loss ventures (e.g., Weight Watchers, Jenny Craig). While each weight loss program has its own unique characteristics, they all generally share a core set of practices.

These programs tend to view eating and exercise as learned behaviors that can be changed. Participants are guided to change what they eat, how much they eat, and/or their amount of physical activity. Additionally, such weight loss programs assume that for such behavior change to take hold over an extended time period, and hopefully in perpetuity, the environment that shapes eating and exercising must be changed as well.

Comprehensive behavioral weight loss programs use self-monitoring, feedback, and goal setting to achieve weight loss (Stroebe, 2008). Self-monitoring in the form of a daily food diary allows individuals to track to their food intake and pinpoint diet changes that need to be made or perhaps maintained. Such tracking usually entails not just food intake, but also converts them into the corresponding calories, grams of fat, or dietary food group servings to match goals. After food intake tracking is firmly in place, the type and amount of physical activity is then monitored. Again, such tracking allows the participant to see if changes in physical activity need to be made. Self-monitoring also serves as feedback. As weight loss is tracked over time, participants can compare food intake and physical activity to results on the scale, and determine whether and to what extent further modifications need to be made. Once a baseline of food intake and physical activity is established, goals regarding diet and exercise are made. Such goals may include daily calorie ranges or food group servings, minutes of walking or number of steps, or behaviors such as no eating past a certain time in the evening or limiting fast food to once per week. Self-monitoring assists with goal setting in that a participant can see whether they are meeting their goals and how goals may need to be modified to further experience weight loss success.

Comprehensive behavioral weight loss programs also provide nutrition education including familiarization with appropriate food serving sizes, how to read food nutrition labels, and alternative healthy cooking methods (e.g., baking instead of frying) (Wing, 2008). Additionally, participants are guided to eliminate environmental food cues as much as possible. This could include purging pantries and refrigerators of unhealthy food and not resupplying those food items. Participants are also encouraged to troubleshoot certain situations such as parties where a lot of tempting food will be served, to think about how to deal with the anticipated challenges in advance.

Additionally, comprehensive behavioral weight loss programs assist participants in correcting "faulty thought processes" (Stroebe, 2008, pp. 170-171). Such thought processes could include believing that one has failed and should subsequently give up if he/she departs from the prescribed eating or exercise plan, or perhaps using food as a mood regulator. Self-monitoring plays an important role in the weight loss process in that it serves as a record to which participants can return to recognize points at which they may have overeaten along with the situation that lead up to the overeating. In this way participants can better identify potentially challenging situations that may lead to overeating and provide opportunities to develop appropriate coping strategies.

2.5 Health Information Technology (HIT) Interventions

Notwithstanding the role that emotion and stress play in overweight/obesity, HIT design for ESRE and weight management has not been considered in depth. Most HIT research tends to look at weight management interventions without explicit support for adaptive coping. Nonetheless, some general findings related to HIT weight management interventions can provide guidance for developing a theoretical model for ESRE-focused weight management interventions. Additionally, there is a body of research developing around technological support for coping (in the form of emotion regulation), but it is not conducted in the context of weight management. Fortunately, although a nascent area of inquiry, some research is starting to look at ESRE.

2.5.1 HIT for Weight Management Generally

Research has been conducted on HIT weight management interventions across various devices (e.g., mobile phones, tablets, virtual reality headsets, etc.), applications (e.g., tailored short message service (SMS) messages, web apps, ecological momentary interventions (EMI), etc.), and strategies (self-monitoring, chat sessions, tailored feedback, etc.)(Ramalho, Silva, Pinto-Bastos, & Conceição, 2016). Although researchers are still trying to ascertain the best combination of devices, applications, and strategies, certain themes have emerged. First, research has shown that Internet-based weight management programs that include behavioral components tend to produce better weight loss results than education alone (e.g., Neve, Morgan, Jones, & Collins, 2010; Saperstein, Atkinson, &

Gold, 2007). This suggests that it would be beneficial to understand the most effective behavioral elements to incorporate into HIT for overweight/obese women who engage in ESRE. Second, studies have generally found that tailoring and social support are important features for HIT weight management interventions (Saperstein et al., 2007; Thomas & Bond, 2014). Perhaps somewhat related is that adherence and attrition to an HIT intervention is a great concern (Arem & Irwin, 2011). Additionally, more engagement is better. For instance, in a systematic review mobile phone weight loss interventions, Aguilar-Martinez et al. (2014) found that there is a positive association between weight loss and frequency of use of the mobile intervention. In all, this highlights the need to provide tools that attract and engage users. For users of potential ESRE weight management HIT interventions, further research is needed to better understand the range of individual user characteristics and the features (e.g., tailoring, social support) most likely to draw users into sustained use of a system.

2.5.2 HIT for Coping Via Emotion Regulation

Aside from weight management tools, HCI researchers have been studying HIT interventions that address coping via emotion regulation. For instance, Pollak, Adams, and Gay (2011) developed and studied PAM, a photographic affect meter with which a user selects an image that corresponds to his/her mood. PAM, which runs on mobile devices, proved to be a simple, quick, and effective measure of emotions. Although PAM was developed apart from a weight management program, one of its suggested applications is as a tool to be used by researchers studying emotional eating, though it also seems to have potential to be integrated into an application for users to self-monitor their emotions (Pollak, Adams, & Gay, 2011). Additionally, there is a line of research with unobtrusive biofeedback sensors and algorithms that promise to capture and interpret data about how one is feeling based on sensors that monitor physiological changes in the body, daily routines, and interaction behavior (Ayzenberg, Hernandez Rivera, & Picard, 2012, May; Leon, Montalban, Schlatter, & Dorronsoro, 2010, August; Pavel, Callaghan, & Dey, 2011; Stütz et al., 2015; Wang et al., 2014, September). Although this emotion-related research is not currently integrated into weight management solutions, it will be a promising area to draw upon in the future for ESRE weight management HIT interventions.

2.5.3 HIT for ESRE

Few HIT studies have looked at supporting emotion regulation in context of weight management. Bauer, de Niet, Timman, and Kordy (2010) found that following a cognitive behavioral group treatment program, text message reporting of eating behavior, physical activity behavior, and emotions (i.e., answer to "How often have you felt sad or unhappy last week?") with follow-up tailored feedback was marginally effective for overweight children attempting to lose weight (p. 317). Additionally, some HCI research on self-monitoring has attempted to comprise diet and emotional stress in context of weight loss for a nonclinical population, but explicit connections between diet and emotional stress were not deeply investigated (Mattila et al., 2008). Other research for a nonclinical population has looked at a wider range of behavioral interventions that are explicitly linked to weight management and that include stimulus control strategies for eating behavior that is based on a number of triggers including "emotion"(Luhanga, 2015, September); this line of research is encouraging, but still preliminary and in the process of being conducted.

There are a handful of studies that have explicitly addressed ESRE through HIT. Manzoni et al. (2009) provided relaxation training to a group of women with some using a traditional imagination condition and others using a virtual reality condition to support relaxation. While both groups ultimately lost about the same amount of weight, ESRE episodes were reduced more among women in the virtual reality condition. While a preliminary study, it highlights the potential for using newer technologies to address ESRE and weight management. Additionally, other exploratory research was conducted on HIT interventions that look specifically at eating binge-trigger connections in relation to clinical eating disorders (Juarascio, Goldstein, Manasse, Forman, & Butryn, 2015). It is unclear, however, the extent to which HIT interventions for clinical eating disorders is applicable to nonclinical populations, which is the focus of this research study.

Carroll et al. (2013) has carried out what is perhaps the most ambitious preliminary HCI research on ESRE. The research comprised three studies through which emotional eating was addressed through the just-in-time interventions of a smartphone app that supported food and emotion tracking, the provision of deep-breathing relaxation exercises via smartphone app, and testing of physiological sensors designed to detect emotions. Findings indicated that the nature of emotional eating presented differently in participants, thereby suggesting that tailoring interventions to individual users may be most effective. Additionally, the physiological sensor proved to be accurate at sensing emotions, which in turn opens the door to development of other just-in-time automated interventions that can be triggered by emotion detecting sensors. This initial work, however, also raises a number of questions. Even if these interventions minimize ESRE, would this necessarily translate into effective weight management? How would these interventions work with overweight/obese participants attempting to lose weight? (The study did not indicate whether participants were overweight/obese.) Additionally, if interventions should be tailored for users, are there any user traits that predict which kind of interventions are most likely to be accepted by and effective for the user? Notwithstanding the contributions of Carroll et al. (2013)'s preliminary work we still lack a comprehensive understanding from which to develop HIT interventions for overweight/obese women struggling with ESRE.

CHAPTER 3. RESEARCH METHODS

3.1 Research Problem

Little is known about the coping support needs of overweight/obese women who engage in ESRE. Furthermore, it is unclear whether current information technology is appropriately designed, and if not, how it could be improved. This research endeavors to explore and understand user needs so that future development of information technology interventions can better assist people in addressing ESRE behavior, thereby leading to potentially more effective weight management.

There is a need to consider the role that HIT interventions can play within the greater ESRE behavior process. As illustrated in Figure 4, women who experience stress have support needs. HIT is one of many intervention delivery systems that can support adaptive coping. Adaptive coping leads to women eating based on nutritional needs, thereby making it easier to engage in healthy weight management. Alternatively, if support needs are not met, women will engage in maladaptive coping. For instance, stress could cause women who engage in ESRE behavior to eat food to feel less stress, to pay greater attention to external rather than internal cues for eating, and to experience diminished self-regulation when eating (VanStrien & Frijters, JER, 1986). As a result, rather than eating to meet nutritional needs and guided by physical sensations indicating hunger and satiety, maladaptive copers will tend to overeat in times of stress and when negative emotions are aroused, subsequently leading to and further entrenching overweight/obesity. Adaptive coping, however, disrupts the cycle whereby stress causes people to overeat. By acknowledging the interplay between stress and eating behavior, HIT interventions can support adaptive coping that allows women to avoid making food choices and engaging in eating behaviors that are automatic, without thought, and exceed required caloric needs (Kristeller & Epel, 2014).
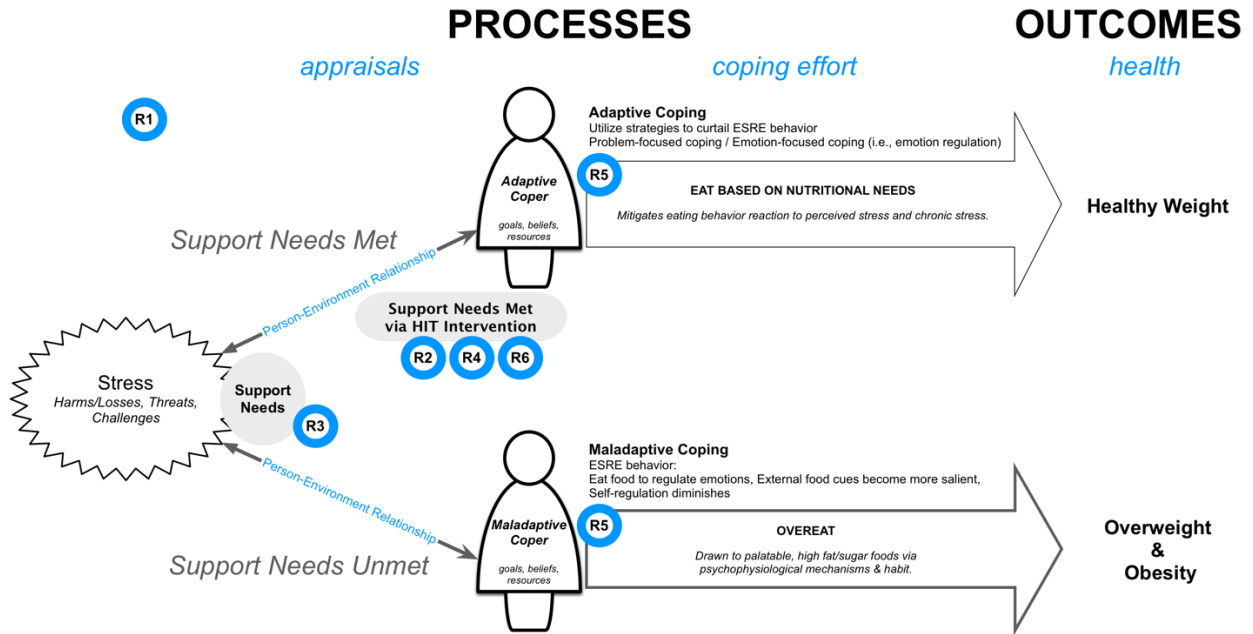
Figure 4. *Conceptual model and research questions.*

3.2 Research Questions

To develop actionable recommendations for how HITs should be designed to address ESRE, this study seeks to answer the following research questions (see Figure 4. *Conceptual Model and Research Questions.*):

RQ 1:   What is the lived experience of women who engage in ESRE?

RQ 2:   How can information technology for weight management be designed to address ESRE in overweight/obese women?

RQ 3:   What do overweight/obese women perceive to be their support needs regarding their ESRE behavior?

RQ 4:   What challenges do overweight/obese women who engage in ESRE experience in using existing information technology focused on weight management via eating behavior modification?

RQ 5:   What is the relationship between self-blame as a coping response and eating behavior in overweight/obese women?

RQ 5.1: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, it at all, by racial group?

RQ 5.2: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, if at all, by educational attainment group?

RQ 6:   Which information technology coping support features would be appropriate for particular subgroups of overweight/obese women?

3.3 Research Approach

The foregoing research questions were addressed via a convergent mixed methods research design (Creswell, 2014) (see Figure 2. *Convergent Parallel Mixed Methods Research Design*).
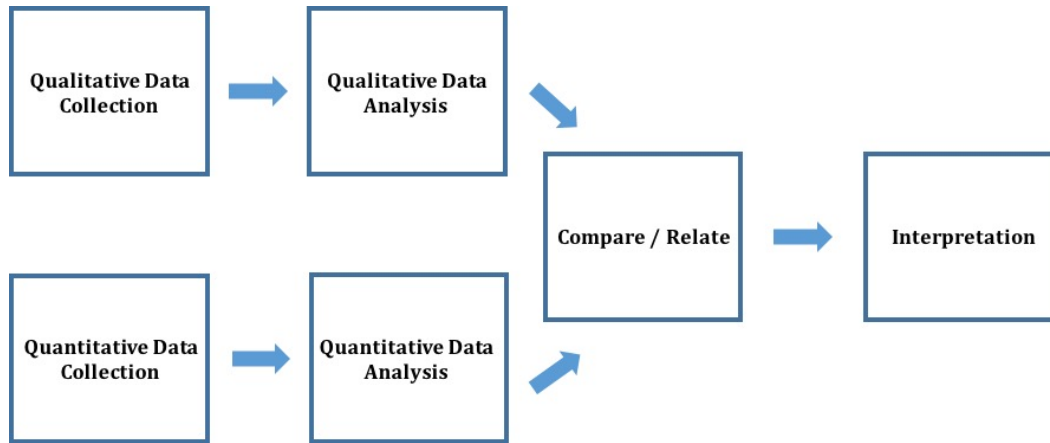
Figure 2. *Convergent parallel mixed methods research design.*

An interview study explored the experiences of overweight/obese adult women who engage in ESRE and their use of existing HIT interventions (N=22). A cross-sectional survey (N=430) was administered to interview participants, as well as to a larger sample of overweight/obese women to understand the social context of overweight/obese adult women who engage in ESRE. Data from both the interview and survey studies were compared and related, and then subsequently interpreted. Qualitative and quantitative data was collected in parallel and then analyzed together to understand the phenomenon of ESRE in overweight/obese women with complementary data from different data sources (Creswell, 2014). These research methods were approved by the University of Michigan IRB - Health Sciences and Behavioral Sciences (HUM00110332) on April 25, 2016.

3.4 Interview Study Strand

3.4.1 Interview Pilot Study

An initial pilot study comprising six semi-structured interviews was conducted to inform development of the initial thesis proposal. A convenience sample was used to select participants for the pilot study (Bernard, 2013). Running the pilot study highlighted the following needs:

- To recruit participants with lower levels of education for the interview study, and particularly for the survey study.

- To focus the study protocol to be more focused on *appraisals* and *coping* as constructs through the interview and survey questionnaires.

3.4.2 Interview Study Sampling and Recruitment

The interview study used a purposive sampling method (maximum variation) to achieve representation across race/ethnicity, age, educational attainment, and overweight/obesity severity (Patton, 2005). Interview study participants were recruited through word of mouth, email lists associated with a large Midwestern university and its hospital system, as well as through flyers distributed at conferences and businesses in a Midwestern metropolitan area. Interview study participants were all women age 25 or older with the following characteristics: overweight or obese (BMI ≥ 25), no eating disorder diagnosis, owned and used either an iPhone or Android smartphone, attempted to lose weight at some point in their lives, and concerned that their tendency to overeat food when feeling stress or other negative feelings was negatively affecting their health. The interview study sample size resulted from ending interviews once saturation was reached (Kuzel, 1992).

3.4.3 Interview Study Data Collection

The interview study started with a brief orientation meeting to be sure each participant understood what participation entailed, as well as to have the opportunity to ask questions. Participants then used the free version of the *Lose It!* smartphone app to track their dietary intake for 10 days. *Lose It!* is a smartphone app available on both iPhone

and Android platforms. At the time of data collection (September 2016 – April 2017), the free version of *Lose It!* supported daily food, physical activity, and weight tracking that could be accessed on mobile and desktop devices (see Figure 5. *Lose It! food and exercise log options.). Lose It!* allowed users to set their own weight goal and the rate at which they would like to lose weight on a weekly basis (e.g., 1 lb. per week, 1.5 lbs. per week, etc.). Based on these entries, lose it calculated a daily calorie budget that serves as the user's daily caloric goal. Users entered dietary intake (food and drink) by either manually entering the food item and calories, using prepopulated food item information from the *Lose It!* database, using food items from their own food list (i.e., previously entered food items), or scanning the food item barcode (see Figure 6. *Lose It! food search screen*.) When users entered food, the *Lose It!* food log screen gave a count of how many calories were consumed, and how many calories were still available (in green) for the day or how many calories the user had exceeded (in red) beyond the daily calorie budget (see Figure 7. *Lose It! food log screen.)* At the end of each day, *Lose It!* sent a message that stated the date by which they would make their goal weight if they continued to eat the same as they ate on that day. Additionally, *Lose It!* sent other positive messages encouraging users to engage with the smartphone app (see Figure 8. *Lose It! message encouraging user to log dietary intake.*).

Weight was entered in either manually by users or automatically uploaded from a wireless scale. Weight was entered at the user's discretion; this could be done on a daily basis or less frequently if the user desired. Weight changes were reflected on a weight loss graph. Physical activity was either manually entered by users or automatically updated from fitness trackers. Users could earn an upward adjustment in daily food calories by engaging in physical activity.

Lose It! tracked goals related to weight and physical activity (steps and exercise calories). *Lose It!* did not provide opportunities to track eating behavior (aside from dietary intake), emotions, or physiological sensations related to hunger. Additionally, while the free version of *Lose It!* included access to a forum for various challenges (weight

loss, physical activity), as well as connectivity to user Facebook and Twitter accounts, study participants did not report using *Lose It!* to engage with those communities.
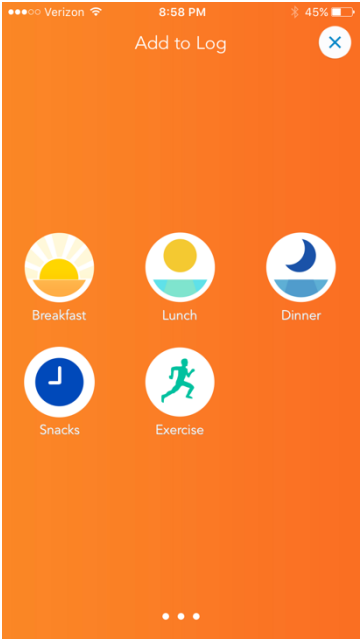
Figure 5. *Lose It! food and exercise log options.*
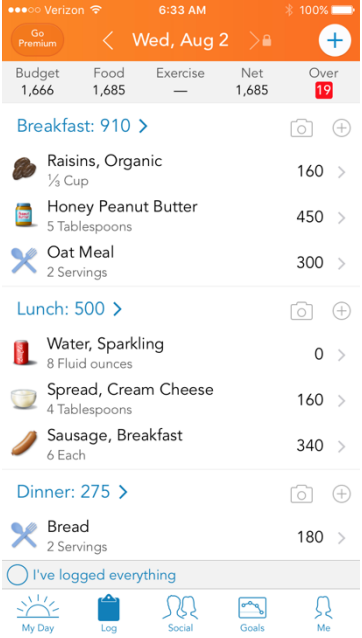
Figure 6. *Lose It! food search screen.*
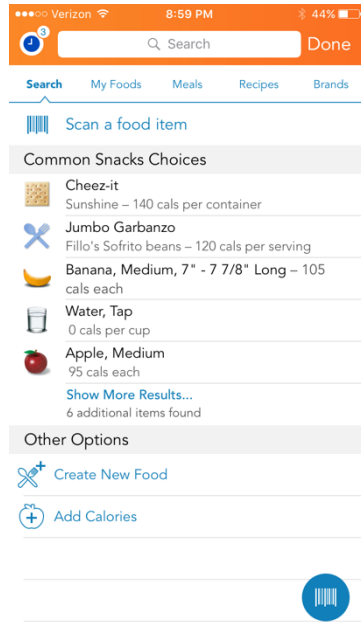
Figure 7. *Lose It! food log screen.*
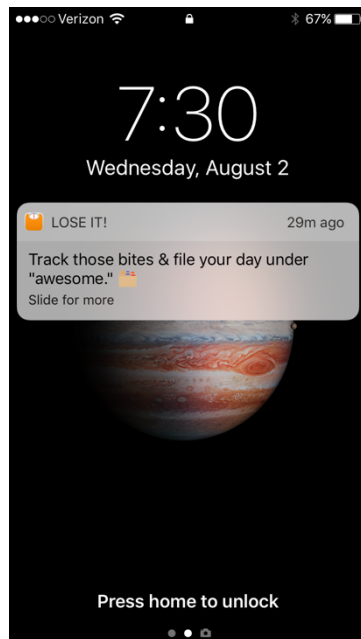
Figure 8. *Lose It! message encouraging user to log dietary intake.*

Lose It! was selected for the study because it is a popular smartphone app that supports the tracking of weight and dietary intake through its free version. Additionally, it supported a researcher account that could connect to user accounts (per their permission) to view food entries and communicate via in-app messaging.

Participants also shared photos on the theme of "My Relationship with Food," and had a 60-90 minute unstructured interview with the researcher that took place within 2-3 days of completing 10 consecutive days of *Lose It!* tracking.

After the brief orientation meeting and before the unstructured interview, participants completed the ESRE Context survey (see Appendix E: Survey Instrument) that was also administered to the larger sample. At the beginning of the unstructured interview, the System Usability Scale (Brooke, 1986) (see Appendix D: Interview Survey – System Usability Scale) was administered to gauge the extent to which participants' expressed attitudes and feelings about their tracking experience was based on *Lose It!* usability challenges. For the rest of the interview session a semi-structured interview guide was followed. The guide included general questions related to stress-induced eating, as well as questions tailored to participants' survey responses, photos, and *Lose It!* dietary intake log. At the end of study participation, participants received an incentive payment.

3.4.4 Interview Study Data Analysis

Audio recordings from interviews were transcribed by a third-party transcription service. Inaudibles noted in transcripts were checked and corrected as needed. Transcripts were analyzed with the aid of MAXQDA12 coding software. An initial codebook was developed and then added to throughout the coding process (see Appendix G: Codebook). Both deductive and inductive approaches were used to analyze qualitative interview data. Deductively, literature related to ESRE, as well as pilot study interview responses, served as the conceptual starting point of the codebook used for Provisional Coding; inductively, new codes will be added to the codebook as they emerge through line-by-line coding (Saldaña, 2016). Following first cycle coding, Pattern Coding was used in the second cycle to group codes into themes in preparation for merging this qualitative data with quantitative data from the survey study (Miles, Huberman, & Saldaña, 2014).

3.4.5 Interview Study Threats to Validity

Qualitative data collection and analysis in this study is susceptible to threats to credibility and neutrality (Schensul & LeCompte, 2013). To address the credibility issue of premature or false conclusions peer debriefing was used to ensure that data collection was accurate and complete (Spillett, 2003). To mitigate observer effects (i.e., participant deception or providing answer they thought were wanted), responses were triangulated with food logs, photos, surveys, interview questions, and follow up probes. To preserve neutrality, a reflexive journal was maintained and referred to by the researcher (Ortlipp, 2008).   In practical terms this meant recording and referring back to personal thoughts and reactions to the data as it was analyzed. This process allowed for feelings and opinions about the data to be acknowledged, thereby ensuring that data was analyzed in a neutral manner. Additionally, different explanations for data interpretation were explored, and data interpretations were discussed with a second researcher.

3.4.6 Interview Study Participant Descriptive Statistics

Participants in the interview study had the following characteristics:

Table 1. *Descriptive Statistics for Interview Participants (N = 22).*

	M (SD)	*N*
Age (years)	35.9 (9.46)	
BMI	35.4 (6.18)	
Race/Ethnicity	N/A	
White		10 (45.5%)
African American		6 (27.3%)
Latina		5 (22.7%)
Asian or Native American		1 (4.5%)
Education		
High School or less		4 (18.2%)
Associate Degree		1(4.5%)
College Degree		6 (27.3%)
Graduate School		11 (50%)

3.5 Survey Study Strand

3.5.1 Survey Pilot Administration

The survey was pre-tested both online (*n* = 3) and via paper (*n* = 2). Pilot participants were interviewed immediately after taking the survey to obtain feedback and determine if any questions were confusing or misinterpreted; the survey was amended as needed based on their feedback.

3.5.2 Survey Study Data Collection, Sampling, and Recruitment

The cross-sectional survey study was identical to the one given to interview study participants (see Appendix E: Survey Instrument). The survey was administered in the following three ways: as part of the interview study (*n* = 22); in-person via paper survey (*n* = 59), and online through a Qualtrics survey panel (*n* = 349). The survey was designed to be completed in approximately 12 – 15 minutes.

Interview study participants were all women age 25 or older who were overweight or obese (BMI ≥ 25). The overall survey study used the purposive sampling method (maximum variation) to achieve representation across race/ethnicity, age, educational attainment, and overweight/obesity severity (Etikan, Musa, & Alkassim, 2016). A special effort was made to recruit a socio-economically diverse sample. This included in–person recruitment at conferences targeting women of color, among cashiers at a Midwestern grocery chain, and at a Midwestern hospital cafeteria. Additionally, recruitment flyers were posted at restaurants and grocery stores with racially and ethnically diverse customers, as well as to a message board for patients of a Midwestern hospital system's bariatric surgery program.

Furthermore, the Qualtrics survey panel used the quota sampling method whereby responses from 350 participants were stratified by weight (overweight, obese, super obese), race/ethnicity (Black, Latina, Other), and education level (Bachelor's Degree, No Bachelor's Degree) (Bernard, 2013) (see Table 2. *Qualtrics Panel Quota Sampling Stratification.*).

Table 2. *Qualtrics Panel Quota Sampling Stratification.*

OVERWEIGHT - 48% (*n* = 168)					
African American - 25% (*n* = 42)		*Latina* - 25% (*n* = 42)		*Other* - 50% (*n* = 84)	
BA	No BA	BA	No BA	BA	No BA
50% (*n* = 21)	50% (*n* = 21)	50% (*n* = 21)	50% (*n* = 21)	50% (*n* = 42)	50% (*n* = 42)
OBESE - 43% (*n* = 151)					
African American - 25% (*n* = 38)		*Latina* - 25% (*n* = 38)		*Other* - 50% (*n* = 75)	
BA	No BA	BA	No BA	BA	No BA
50% (*n* = 19)	50% (*n* = 19)	50% (*n* = 19)	50% (*n* = 19)	50% (*n* = 37)	50% (*n* = 38)
SUPER OBESE - 9% (*n* = 31)					
African American - 25% (*n* = 8)		*Latina* - 25% (*n* = 8)		*Other* - 50% (*n* = 15)	
BA	No BA	BA	No BA	BA	No BA
50% (*n* = 4)	50% (*n* = 4)	50% (*n* = 4)	50% (*n* = 4)	50% (*n* = 7)	50% (*n* = 8)

Qualtrics survey participants were recruited from multiple third-party online market research panels. Participants have registered to be panel members and opted into receiving invitations to surveys. All panel participants have verified their physical address, demographic information, and email address. While participants are drawn from the general population, they have the skill, knowledge, and ability to use online resources to an extent that may not be reflected in the greater populace.

For the current study, potential participants who fit the screening criteria were randomly selected from the third-party panels to receive an invitation to complete the survey. The invitation included information about the length of the survey and the incentive payment they would receive for completion. Panel deduplication was used to ensure that the same potential participant does not receive multiple invitations to the same survey. Additionally, IP addresses were used to reduce the chance of participants completing more than one survey submission.

Survey responses were filtered for participants who took less than four minutes to complete the survey and for failure to correctly answer attention questions (e.g., "I am paying attention to this survey. (Select 'Agree' for your answer.)"). Upon inspection of the 350 responses, one additional response was filtered out due to nonsensical short answer responses that suggested the participant overcame the filtering measures in place despite providing answers contrived solely for an incentive payment.

3.5.3 Survey Instrument Measures

The survey comprised the following measures that were incorporated into this research:

Person

Anthropometric Measures

Body Mass Index (BMI) was based on self-reported height and weight, and calculated as follows: weight (kg) / [height (m)]2. Per United States Department of Health and Human Services guidelines, participants with a BMI between 25.0 – 29.9 were categorized as "overweight," and participants with a BMI >30.0 were categorized as "Obese" (U.S. Department of Health and Human Services. Centers for Disease Control and Prevention, 2015).

Sociodemographic Characteristics

Age, race/ethnicity, education level information.

Eating and Weight Management Background

Questions about experiences with weight management and related self-monitoring efforts. These were not incorporated into the thesis analysis.

Digital Access and Skills

Questions are related to access to and skill with digital technology. These were not incorporated into the thesis analysis.

Environment

Perceived Stress Scale (PSS)(Cohen, Kamarck, & Mermelstein (1983))

        The Perceived Stress Scale (PSS) measures stress appraisals in the previous month (Cohen, Kamarck, & Mermelstein, 1983). This study used the ten-item scale version. Survey respondents answered questions (e.g., How often have you been upset because something happened unexpectedly?, How often have you felt difficulties were piling up so high that you could not overcome them?) via a 5-point Likert scale that was scored as follows: 0 = Never, 1 = Almost Never, 2 = Sometimes, 3 = Fairly Often, 4 = Very Often. The scale was scored by summing responses to the ten items (reverse scoring positive item scores), resulting in a possible PSS score range of 0-40; higher scores indicate greater stress. Consistent with other studies, principal component analysis showed two factors aligning with negatively worded questions (Helplessness Subscale: 1, 2, 3, 6, 9, 10) and positively worded questions (Self-Efficacy Subscale: 4, 5, 7, 8) (Lee, 2012). The Cronbach's α for this study was .90.

Coping Effort

Brief Coping Orientations to Problems Experienced (COPE)(Carver (1997))

        Self-Blame is a two-item subscale in the Brief COPE Inventory (Brief COPE), which is designed to measure how people typically respond to stressful events (Carver, 1997). For this subscale survey respondents were asked to report how they respond to a stressful event (I criticize myself and I blame myself for things that happen) via a 4-point Likert scale that was scored as follows: 1 = I usually don't do this at all, 2 = I usually do this a little bit, 3 = I usually do this a medium amount, 4 = I usually do this a lot.   The subscale was scored by summing responses to the two items, resulting in a possible Self-Blame score range of 2-8; higher scores indicate higher levels of self-blame. The Self-Blame Spearman-Brown coefficient was .81 for this study (Eisinga, Grotenhuis, & Pelzer, 2013).

Palatable Eating Motives Scale (PEMS)(Burgess, Turan, Lokken, Morse, & Boggiano, (2014))

The Palatable Eating Motives Scale (PEMS) measures the frequency of coping with negative situations by eating tasty foods and drinks (e.g., chocolate, French fries chips, pizza, soda, sweet coffee drinks, etc.) (Burgess, Turan, Lokken, Morse, & Boggiano, 2014). This study used the 4-item version of the PEMS Coping subscale. The subscale asked respondents how often they ate or drank tasty foods/drinks for particular reasons (e.g., To forget your worries, To cheer you up when you are in a bad mood) via a 5-point Likert scale that was scored as follows: 1 = Almost never or never, 2 = Some of the time, 3 = Half of the time, 4 = Most of the time, 5 = Almost always or always. The subscale was scored by calculating the mean of the four subscale responses, resulting in a possible PEMS score range of 1-5; higher scores indicate higher frequency of coping through palatable eating. Principal component analysis showed that one factor was present. The PEMS Cronbach's α for this study was .92.

3.5.4 Survey Study Data Analysis

Collected data was analyzed with statistical techniques that included regression analysis. CSCAR was consulted to select the appropriate statistical techniques based on the sample size and research questions; they also reviewed the data analysis and interpretation.

3.5.5 Survey Study Threats to Validity

Quantitative data collection in this study could be subject to selection bias (Bernard, 2013). The bulk of survey respondents (n = 350) were recruited from an online Qualtrics panel, which suggests they had access to and some level of skill with digital technology. To mitigate this bias, survey participants were recruited in person to take a paper survey.

3.5.6 Survey Study Participant Descriptive Statistics

Table 3. *Descriptive Statistics for Survey Participants (N = 430) (includes n = 22 interview participants).*

	Mean (SD)	Number (%)
Age	45.88 (13.02)	
BMI	32.46 (6.29)	
Education (yrs)	14.86 (2.47)	
PSS	19.25 (7.56)	
Brief COPE Self-Blame	4.75 (2.03)	
PEMS Coping	2.70 (1.22)	
Diagnosed Eating Disorder		n = 16 (3.7%)
Chronic Health Condition		n = 291 (67.6%) Arthritis: n = 115 (26.7%) Hypertension: n = 146 (33.9%) Pre- or Type 2 Diabetes: n = 82 (19%)
Race/Ethnicity		African American: n = 135 (31.4%) Latina: n = 122 (28.4%) White: n = 162 (37.7%) Other: n = 11 (2.6%)
College Educated		Bachelor's Degree: n = 221 (51.4%) No Bachelor's Degree: n = 209 (48.6%)
Obese/Overweight		Obese: n = 242 (56.3%) Overweight: n = 188 (43.7%)

CHAPTER 4. THE LIVED EXPERIENCE OF ESRE

4.1 Introduction

To provide effective technological support for overweight and obese women concerning ESRE, it is critical to gain a nuanced understanding of the nature of the experience from their own perspectives. However, there is a dearth of published research that provides qualitative descriptions of ESRE behavior in adults. Kemp, Bui, and Grier (2013) interviewed 13 women about their eating behavior. The interview participants comprised 9 self-identified emotional eaters who were overweight or obese, and 4 healthy weight women who were not emotional eaters (Kemp, Bui, & Grier, 2013). They found that the emotional eaters used food to regulate their emotions, experienced weakened ability to avoid ESRE when in distress, thought about the food they were going to eat before they engaged in ESRE, and were tempted and persuaded by food marketing and packaging. Additionally, emotional eaters reported that they were accustomed to having large family meals and treated eating food as a kind of entertainment. Finally, emotional eaters in the study shared that their ESRE was the result of learned behavior over time. Although the overall sample of interview participants was relatively diverse, the entire sample of emotional eaters interviewed included only one Latina participant and had no White participants. Furthermore, findings did not indicate an explicit exploration of the relationship between socio-economic status and emotional eating behavior.

Research by Ford, Lee, and Jeon (2017) explored the emotional factors related to the development of emotional eating behavior through semi-structured interviews with 10 overweight/obese adult men and women who self-identified as emotional eaters and attribute their overweight/obesity to their emotional eating. They found that participants believed that their emotional eating was triggered by both positive and negative emotions. As for negative emotions, participants identified experiences when food "filled the space" of feelings of abandonment and rejection. Additionally, they found that these emotional

eaters stated that they were drawn to palatable foods such as ice cream, cake, chips, and pizza, and viewed such foods as a reliable source of comfort. Participants' accounts revealed persistence upon a continuous cycle of eating to feel better without addressing the root cause of their discontent. While this research starts to corroborate survey study results through the words of people who engage in ESRE themselves, many questions remain. The study does not distinguish whether there are differences in how various sociodemographic groups (e.g., race/ethnicity, education level, etc.) experience ESRE. Indeed, this work did not disclose the racial and ethnic identities of participants, so it is unclear how diverse the sample was along those dimensions. Additionally, the focus on the work was to provide guidance to therapists counseling clients who engage in ESRE; issues of HIT intervention design were not addressed.

Bennett, Greene, and Schwartz-Barcott (2013) interviewed 16 male and female white undergraduate students who ranged from healthy weight to overweight who had high emotional eating scores on the Weight Related Eating Questionnaire (Schembre, Greene, & Melanson, 2009). Participants in the study kept a 3-day food diary and semi-structured interview. Researchers found that emotional eaters ate "unhealthful" foods when they engaged in ESRE. Additionally, female participants described their ESRE being triggered by stress, whereas male participants ate due to boredom and anxiety. Female participants also indicated that they tended to feel guilt after ESRE. Again, these results corroborate survey study findings.   Participants, however, were all white and college aged; none were obese. It is unclear whether and to what extent the described experiences of this sample is applicable to the population of focus in this thesis, overweight/obese adult women who are 25 year or older.

While these three studies are a start, there is still a need for qualitative descriptions of the ESRE experience from stressor appraisal to eating coping response so that HIT designers have a nuanced understanding of their users' eating behavior. Additionally, qualitative data from participants from a wider range of socio-economic status than what is currently represented in published research would provide greater insight into a broader range of ESRE experiences and help to ensure that HIT design was effective with diverse

women. Furthermore, none of the previous research cited here examines ESRE in context of HIT development. Given the myriad weight management HIT interventions that are used by consumers, it would be beneficial to understand the best ways that HIT could support overweight/obese women who engage in ESRE to manage their weight. As a result, this chapter addresses the following research questions:

RQ 1: What is the lived experience of women who engage in ESRE?

RQ 2: How can information technology for weight management be designed to address emotion- and stress-related eating in overweight/obese women?

4.2 Results

Study participants' accounts of their ESRE experience aligned with four main themes. 1) *Stressors*: Participants' ESRE was triggered by a range of stressors that spanned from daily hassles, persistent challenges, and life-changing losses. Additionally, participants engaged in ESRE when they experienced stress in the unique context of serving as caretakers and social support providers. 2) *Food as a Coping Tool*: Participants used food as a coping tool to deal with stress and negative affect, but acknowledged that it was ultimately ineffective in improving their overall situation. 3) *Personal Vulnerabilities*: Some participants believed that the psychological attributes of depression and anxiety made them vulnerable to ESRE; participants with limited access to material resources also thought it adversely affected their ability to mitigate ESRE. 4) *Relationship to Food*: Participants interacted with food by anthropomorphizing their relationship with it. Additionally, participants who were African American, Latina, and children and grandchildren of immigrants to the United States tended to associate food with social support.

4.2.1 Stressors

Daily Hassles

Participants described eating in response to daily hassles. Daily hassles dealt with short term events such as running late to meetings, driving in congested traffic, or experiencing a frustrating interaction with a coworker. One participant described a situation in which she ate a bag of caramel popcorn, which was stored in her office desk, due to work stress. She gave the following reason for why she ate the popcorn: *"Because I was stressed and I needed to eat something...It was the first thing I grabbed. I didn't really pay attention to what it was."* (P14) She was reacting to stress from running late to a meeting due to circumstances beyond her control, *"I don't like to be late when someone is waiting for me...I would prefer to be on time...I had scheduled things so that it should not happen."* (P14)

Persistent Challenges

Participants also ate in response to stress from persistent challenges. Persistent challenges were centered around life circumstances such as work demands, child caretaking duties, and chronic illness management. Persistent challenges tended to be ongoing, but dynamic in nature with ebbs and flows over time. One participant described how she and her husband were having marital problems. After a period of living apart, they decided to go to marriage counseling together. Notwithstanding their attempt to fix the relationship, they still had some intense exchanges. She explained why she was eating potato chips late one evening as follows: *"When I feel he's headed down a path where he could blow up, I get frustrated, I get anxious, I start feeling trapped, 'crunch, crunch, crunch, crunch, crunch'* [mimicking eating potato chips]*."* (P6) (See Figure 9. *Eating potato chips during the late evening as a coping response to marital challenges. (P6))* One set of consistent stressors for some participants was related to personal finance. One participant explained the origin of her desire to overeat chicken wings one day, *"I am $29 overdrawn on my [bank] account...the job that I'm working...sometimes [doesn't] have the money to get payroll. I'm two weeks behind, and I have two automatic payments come out every Monday, so*

now I'm overdrawn because there's no money in my account. I'm thinking, 'Oh, my God…I don't have the money.'" (P21)

Figure 9. *Eating potato chips during the late evening as a coping response to marital challenges. (P6)*

Life-Changing Losses

Life-changing losses generally dealt with the illness and subsequent death of family members. Witnessing the illness that lead up to death was a particularly heavy emotional weight to bear. One participant in her 30s related how difficult it was to handle her mother's early onset of dementia and recent move to an assisted living facility, *"She called me at 6AM…the nurse had helped her…she told the nurse that she was lonely and she wanted to talk to me. That's just heartbreaking."* (P3) ESRE behavior in reaction to life-changing losses was more difficult for participants to conceptualize than when in reaction to discrete events. One participant shared that she mentally processed her ESRE behavior as follows: *"it's easier to think of in terms of 'I had a stressful day at work and then I over ate'…than 'my [aunt] died and then I over ate'."* (P5) Life-changing losses were so devastating that even if healthy eating behaviors were in place, ESRE behavior could return during such an experience. P5 went on to describe how after adopting healthy behaviors for a period of time, she returned to ESRE in the face of a life-changing loss, *"My aunt got diagnosed with brain cancer…She had a surgery, relapsed, and…it became pretty clear that it was very serious…and then she passed away…so that whole year, I started stress eating again."* (P5)

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Caretaking and Providing Social Support

Participants reported providing a great deal of support to people with whom they interacted in their lives. Some participants fulfilled primary caretaking roles for family members. They also reported providing social support to partners, family, friends, and coworkers. Caretaking duties and social support activities included grocery shopping, planning and preparing meals, arranging medication, listening and responding to accounts of workplace tensions, encouraging others, providing information, and sharing financial resources.

Such caretaking and social support provision could be draining at times for participants. Some participants shared that when they provided social support, they took on the pains of the other person as though they were experiencing the crisis themselves. As one participant whose family members approach her when they lose a job or get ill described, *"That stresses me out to know that my family is suffering or going through something...sometimes it becomes overwhelming, and when it becomes overwhelming is when I'm stressed...Then, I'm going to eat and it's just going to be a bad situation after that, as far as gaining weight."* (P8) This participant's comment reflects how at times participants providing social support to others could connect to their ESRE behavior. Additionally, caretaking in particular could have cascading effects that spilled over into other social relationships, which in turn increased their stress levels. One participant described how getting custody of her mentally disabled adult nephew affected her life as follows: *"I got really heavy [when] I took over custody of my nephew who is mentally disabled...that responsibility and what it's done to my marriage have caused a lot of stress for me...[my nephew] always is going to need somebody [to care for him] and when...I start thinking about stuff like that, that's when I get stressed and upset."* (P12)

A number of participants were committed to caretaking and providing social support because they thought they were the only person or somehow unique in their ability to take on the related responsibilities for members of their social networks. As one participant related, *"I don't want to say 'no' because oftentimes they don't have another person to fall back on."* (P19) Another participant described how she viewed her role of

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listening to her husband vent about his stressful work environment at the end of each day, *"I'm a safe space for him to get all of that out."* (P10)

Participants also reported difficulty balancing their needs with the needs of others when caretaking and providing social support, which lead to greater stress in their lives and fewer resources for self-care. About one-third of participants reported that they regularly ultimately placed the needs of others before their own. One participant explained the reason why she often lacks energy to engage in her desired self-care activities such as exercising in the morning: *"The thing that I tend to forego on, many of the times, is myself. I let my own personal needs go last or many times forgotten in the wake of putting either others or responsibilities ahead of [myself]."* (P20)

While participants did not generally report prioritizing their own needs ahead of those of others, a few found success in balancing their needs along with others', which seemed to result from a shifting perspective developed over time. For instance, one participant related her internal thought process for deciding she could buy the food she thought was healthy and that she enjoyed, but that she previously viewed as off limits due to cost, *"'Why are you not buying the salmon? Because it's $10 a pound? But you make sure everyone else in the family gets what they want...Why am I not worth putting myself in the budget?'"* (P1)

4.2.2 Food As a Coping Tool
Calming and Soothing

Each participant reported using food to mitigate emotional discomfort stemming from stress and negative affect that were rooted in their responses to the aforementioned stressors. Eating food was used as a method for emotional comforting and soothing. As one participant described, *"Good food is a balm to the soul when everything else may not do."* (P9) For some participants, food filled the emotional emptiness they felt went along with their negative emotions: *"There's this feeling of a void, and [eating] is an immediate sense of instant gratification...feeling lost...feeling of despair...That deep hunger. It's not even sometimes that you're hungry. It's just that you want to feel safe. You want to feel like you're in control...having a sense of what to do, so that you don't have that feeling of despair."* (P20)

Some participants further acknowledged that they used food as a way to comfort themselves rather than directly address their stress and negative affect: *[I'm] feeding my feelings and emotions to make them better so that I don't have to deal with them myself."* (P14)

Some participants drew a close connection between eating and the resulting calming physical experience. One participant shared that the physical action of eating pulled her away from repeating certain stressful thoughts over and over: *"My mind is going so much, that motion of eating is what grounds me, in a way...if I can just eat something, it calms, it focuses."* (P3) Additionally, many participants reported eating food for the physically calming effect it had on their body. P13 described how eating ice cream made her feel: *"I have this like, 'ah, this is great now I just need a nap'...It really does trigger something in my brain...it's the same as...an orgasm. It's the same kind of physiological response, so it's like you're calmer. You're happy."* (P13) (See Figure 10. *Calming effect of eating ice cream. (P13)*)

Figure 10. *Calming effect of eating ice cream. (P13)*

Ineffective Coping Tool

Notwithstanding the emotional or physical relief of eating food provided in the moment, participants generally acknowledged that ESRE was not an effective coping tool. As part of this, some participants directly attributed their overweight/obesity to ESRE. One participant explained that her body weight suffered as a result of her ESRE: *"When I was dealing with emotional difficulties or challenges...food made me feel better. And in the grand*

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scheme of things, is that a crutch that's better than alcohol or drugs or running up credit card debt? Maybe. But it's not healthy." (P9) Another participant thought her greatest barrier to losing weight and keeping it off was her ESRE: *"Even if I'm working out and doing well, if I'm stressed I'm going to eat something terrible, and I'm going to eat a lot of it."* (P8)

Additionally, some participants reported having resulting negative feelings about their ESRE.   One participant described the *"cycle"* through which she experienced ESRE: *"You're going to eat it, it's going to feel good just a little bit. And then you're going to feel regret, and then you're going to feel guilt."* (P12) In addition to feeling guilty, some participants reported generally feeling bad about themselves. One participant described what she thinks and how she usually feels after ESRE: *"Why did I have to have that whole package of 32? That makes me feel sad, because I feel like I cannot control the way I eat."* (P16) As a result, the stress and negative affect that drove participants to engage in ESRE could be compounded by bad feelings about coping via ESRE.

Overall, most participants regarded ESRE as a scourge of sorts, the likes from which they wanted to be freed. But as one participant noted, her ESRE persisted, in part, because she would never be able to rid herself of food, a crucial component of the behavior. As she related, *"Sometimes I wish it was crack. No, not really, but it was something that can go away, that I really didn't need to live with, but you need food."* (P21)

4.2.3 Personal Vulnerabilities

Participants described personal characteristics that made them particularly susceptible to ESRE. Depression and anxiety overwhelmed participants and drained physical and cognitive energy to avoid ESRE. Additionally, access to material resources affected their ability to access healthy food, which in turn made it more difficult for them to mitigate ESRE behavior.

Psychological Attributes

Participants' personal vulnerabilities included their psychological attributes. The most salient attributes that participants related to their ESRE behaviors were depression and anxiety. Participants (*n*=9) who reported struggling with depression and anxiety disorders found that their mental health challenges made it difficult to avoid ESRE behaviors.

For some, depression and anxiety were so overwhelming that they surrendered to ESRE without trying to change their behavior. As described by one participant *"I was depressed. I was stressed about school, about my family, about relationships. I just didn't care about [my eating behavior] anymore."* (P16) Another participant reported her mindset when she slipped into depression during a very difficult period in her life: *"I lost my mom less than a year ago, I'm pregnant with my first son my mom will never know, now I'm on bedrest. It was an accumulation...so, I just ate. I watched TV and ate, watched TV and ate."* (P17)

Furthermore, depression and anxiety depleted energy, thereby making it challenging to engage in behavior that mitigated or prevented ESRE. One participant explained why she was not able to keep up with her coursework in school, chores around her home, and consistently track her food intake for weight loss, *"With the depression, you have to pick and choose things that you have the energy to do."* (P13). Another participant related how depression and anxiety affected her ability to do grocery shopping so that she could cook healthy meals at home, *"The stress is debilitating, the energy and the will to do those things* [i.e., grocery shop and cook]*...break down."* (P1)

Access to Material Resources

Some participants (*n*=4) reported lacking material resources for mitigating ESRE behavior through healthier food choices; those who did have material resources identified that financial resources could help them as they tried to change their behavior. One participant, who had sufficient material resources and access to the food she wanted, described how having healthy food on hand could be beneficial when she wanted to engage in ESRE: *"If I already have [healthy] food available at my desk that's more convenient [than*

chips or pizza], then I don't have to make the decision while I'm feeling…emotional or overwhelmed…those decisions to eat or not eat, or what to eat when I'm stressed, before I feel those emotions of being stressed, will really help me." (P11)

Participants with limited financial resources, however, reported a lack of access to what they considered to be healthy foods. It was particularly difficult to find fresh, affordable produce, which in turn meant that kind of food was less accessible when engaging in ESRE behavior. P21, who received public food benefits, reported on the poor condition of produce at her local supermarkets as follows: *"It's inexpensive but it's crap…the apples are dried up…everything is mushy…the green peppers are always shriveled…a lot of these [good produce] places don't take food benefits, so where are we supposed to shop for healthy stuff?"* (P21)   Another participant who had a *"decent paid job"* also found it difficult to buy the fresh produce she wanted with her grocery budget, *"I've noticed that if you want to eat fresh fruits and vegetables…it's pretty expensive…It's just frustrating because sometimes I can't buy the healthy things that I want to buy in order to stay on top of being healthy."* (P22)

4.2.4 Relationship with Food
Anthropomorphizing Food

A number of participants talked about their relationship with food as though it comprised interpersonal interactions experienced between human beings. Many participants described relationships with food that were fraught with contradictions. One participant described her contrasting views of food as follows: *"Sometimes it does feel like it can be the enemy, but at the same time it's my friend because it makes me feel better."* (P16) Another participant likened her relationship to a secret affair that she knew was bad for her, but was drawn to nonetheless: *"[It's] like my secret lover that I turn to for comfort and fulfillment…You don't tell anybody that you ate half a pizza. You don't tell anybody that you had two Top Ramen at once. It's an old bad relationship that you go back to. You're like, 'We're done. It's over. I don't ever want to see you again. I'm better than this now.' Then, some catastrophe happens, and you're like, 'Old friend, are you still there?'"* (P20) Additionally, for many participants, the contrary nature of their interactions with food were marked by

power struggles. As one participant commented on her food relationship: *"Difficult, one-sided, I feel like the food has the control...It's also delicious...So it's both horrible and wonderful at the same time."* (P5)

Furthermore, participants described food relationships in which they were drawn to and depended on food even though they knew it ultimately negatively affected their health in the form of excess weight. For example, one participant described her relationship with food as follows: *"I love it, and it loves me...but I can't stand it because when I'm down I turn to it, and then it doesn't like me so much because it's going to stick to me like glue."* (P8)

Food Associated with Social Support for Certain Subgroups

Participants who were African Americans, Latinas, and children and grandchildren of immigrants to the United States reported that social support from family and friends was often provided in context of eating food. Food was a centerpiece of gatherings related to the exchange of social support. Many participants reported that food was associated with joyous celebrations, but also difficult times including mourning at funerals. Notwithstanding the range of occasions for which food was present, one participant (the grandchild of immigrants) suggested that she positively associated food with "*being around everybody and the camaraderie of the family.*" (P21)

Furthermore, social support was communicated through eating food itself. African American and Latina participants in particular reported customs around the quality, range, and amount of food a host is expected to provide to a guest, and, in turn, the guest's responsibilities related to accepting and communicating satisfaction with the food. One African American participant described the host responsibilities as follows: "*Anytime someone opens up their home, you are supposed to make them feel welcome...you over indulge...there's not just one appetizer...there's not just one type of meat...there's not just one thing to drink...I want you to remember what type of time you had with me...it's a connection. Food is definitely a connection.*" (P9) As for the guest responsibilities, one Latina participant (P22) gave the following description of mealtime when visiting her mother: *"When my mom serves me, she serves me a lot."* Furthermore, P22 feels obligated to finish all the food on her

plate, in part, because she thinks her mother would be *"offended"* and would ask *"Did you not like it?."* (P22)

Additionally, general social support through spending time with friends was effected through dining experiences. As one African American participant related, *"I like to go out and eat and pick from the menu and get served and you talk to your friends and have a cocktail. I love that experience."* (P14) The idea of social support via non-food activity was less popular. One African American participant described how she turned to her sister for advice in dealing with an interpersonal issue with a friend, *"Where do two people go out when they want to have a talk? You don't just sit on a park bench... You go and get food."* (P2)

4.3 Discussion

This study describes stressors that trigger ESRE for overweight/obese women that include daily hassles, persistent challenges, life-changing losses, and caretaking and social support providing. Additionally, it relates how overweight/obese women feel when they engage in ESRE, and their acknowledgement that it is an ineffective tool for coping with stress. It shows that some overweight/obese women have the vulnerabilities of depression/anxiety and limited access to material resources, which may make them particularly prone to ESRE and challenged in mitigating their behavior. It also describes how overweight/obese women who engage in ESRE anthropomorphize food and conceptualize an interpersonal relationship with it. Finally, it relates how African Americans, Latinas, and children and grandchildren of immigrants to the United States strongly associate food with social support.

The results from this study suggest that one approach for addressing ESRE is to engage in self-care to preempt an ESRE coping response to stress. Furthermore, this study suggests that it is critical for some overweight/obese women who engage in ESRE to receive support for reconceptualizing their relationship with food in terms of how it is associated with social support. This and related HIT design implications are discussed further here.

4.3.1 Protective Action Through Self-Care

In this study, overweight/obese participants respond to stress by eating food. Participants report a barrage of stressors, ranging from short term daily hassles to life-changing losses, that can be overwhelming. Furthermore, many participants encounter significant stress when serving as caretakers and social supporters for family and friends. This finding is in line with previous research that shows women tend to take on more caretaking and social supporting for the people in their lives than men (e.g., Bott, Sheckter, & Milstein, 2017; Lachance-Grzela & Bouchard, 2010), and tend to report caregiving stress as they care for children, grandchildren, husbands, aging parents, etc. (e.g., Everett, Hall, & Hamilton-Mason, 2010; Musil et al., 2011). However, this work is unique in showing the link between these experiences and ESRE among overweight/obese women.

Notwithstanding their ESRE behavior, participants report they do not want to use ESRE as a coping response to stress they encounter in their lives. They recognize that ESRE does not directly address their stressors, can make them feel worse emotionally, and can have deleterious health effects such as weight gain. But when participants feel stress or negative affect, they want to feel better quickly. As a result, eating food becomes a convenient coping response that allows for immediate, though short-lived, relief. These experiences corroborate previous research that shows the strong pull toward food for relieving physiological experience of stress (Adam & Epel, 2007), and diminished self-regulation of eating behavior when mental resources are expended for other activities such as managing emotional responses (Baumeister et al., 2007; Kemp et al., 2013). As a result, by the time participants have reached a heightened state of stress or negative affect, it is very difficult for them to refrain from ESRE.

This study's findings suggest that greater self-care could help to prevent or at least mitigate responses to stressors and negative affect via ESRE. Self-care is generally regarded as a person taking responsibility for meeting their own physical and emotional health needs by preventing and responding to symptoms of health problems (Denyes, Orem, & Bekel, 2001). Such activities can include health status monitoring, adequate sleep, healthy diet, physical activity, cognitive and relaxation techniques, and getting social

support. For overweight/obese women like this study's participants, self-care activities could help prevent them from getting so stressed as to provoke an ESRE response in the first place.

Additionally, while self-care could be helpful for all overweight/obese women who engage in ESRE, it could be particularly critical for overweight/obese women who experience depression or anxiety. Participants with depression or anxiety describe becoming vulnerable to ESRE because they stop caring about what they eat and experience a depletion of the energy necessary to initiate and sustain behavior change. This finding is in accordance with research that shows depression and anxiety lower motivation and cause fatigue (Stahl, 2002; Tyrer & Baldwin, 2006). For these overweight/obese women, self-care related to their mental health challenges could keep it under control. Such self-care could take the form of monitoring symptoms to note oncoming relapses, engaging in consistent medication adherence, attending therapy or support groups as needed, or prioritizing or at least balancing their health needs with needs of others they caretake and support. Taking these actions to manage depression and anxiety, and in turn avoid the vulnerability to ESRE that they cause could be very protecting against ESRE.

4.3.2 Reconceptualizing Relationship with Food
This study also suggests that overweight/obese women who engage in ESRE behavior could benefit from rethinking their relationship with food. Some participants discuss food as though it is a person with whom they have an interpersonal conflict. They report having relationships with food that at times are contentious, in which they feel grateful for the good feelings food gives them, but frustrated by continuously being pulled back to food in times of stress and negative affect, fully aware such eating behavior it is not good for their health. This study extends previous findings that food can be viewed as a comforting friend (Ford et al., 2017) to the additional finding that some overweight/obese women experience a contradictory relationship with food (e.g., "love-hate," "friend-enemy"). Accordingly, participants have a great need to reforge their relationship with food in such a way that they can enjoy food without being dependent on it to feel better. Furthermore, overweight/obese women should be supported in having neutral

interactions with food in which considerations concerning its nutritional value and contribution to the person's health take primacy.

Additionally, African Americans, Latinas, and children and grandchildren of immigrants to the United States report strongly associating food with social support. Not only did participants link food with social gatherings of family and friends, but they also report exchanging emotional support food is shared between host and guest. This study's identification of the practice of connecting food with social support in context of sharing food and eating with others matches previous research in this area (Hamburg, Finkenauer, & Schuengel, 2014; Troisi & Gabriel, 2011). These participants could benefit from modifying or adapting the way they couple food with social support. They first need to become aware of the entrenched nature of the connection they make. Once there is that awareness, they can practice being more intentional about receiving social support separate and apart from food.

4.3.3 HIT Design Implications

This study's findings suggest that overweight/obese women who engage in ESRE could potentially benefit from HIT that supports 1) their awareness about their levels of stress and negative affect, and 2) thinking of food in a neutral manner and as nutritional sustenance rather than associate it so heavily with social support. Consequently, the following guiding design principles are recommended.

First, HIT should allow users to monitor their stress levels and negative affect, as well as help users predict when stress and negative affect may become so heightened as to induce an ESRE coping response. Practically speaking, current technology is able to monitor emotional state by either the user providing a self-report, through passive measurement via physiological sensors, or a combination of the two (Zenonos et al., 2016, March; Þórarinsdóttir, Kessing, & Faurholt-Jepsen, 2017).

To the author's knowledge, Carroll et al. (2013) is the only experimental technology study that contemplated monitoring user stress level or emotion state with ESRE as its primary consideration. Carroll et al. (2013) tested technology in which users tracked their own emotions and diet, and tested another technology in which stress levels were monitored and measured by wearable physiological sensors, though not considered along with dietary intake.

As similar technologies continue to be developed, it will be important to capture social context in addition to emotional state and dietary intake. For instance, in addition to emotional state and dietary intake, it would be useful for HIT to not only know the physical location and time of distress and resulting ESRE, but also the people that the user interacts with (e.g., supervisor, difficult coworker, family member, etc.), and the activities the person is engaging in (e.g., work, providing social support, doctor's appointment, etc.). Additionally, the HIT should go beyond monitoring and alert the user when a particular threshold of stress or negative affect is about to be breached. Furthermore the HIT should provide some recommendations for self-care activity (e.g., schedule more time for sleep, going for a walk, reminder to reach out for social support, etc.) to get the user into a more stable position.

Second, HIT should assist users in reshaping their relationship with food. HIT should present food in a neutral manner and emphasize its nutritional value to highlight its primary role of providing sustenance rather than social support. Many food tracking apps such as *Lose It!* (paid version) and *MyFitnessPal* display macronutrient (e.g., fat, protein, carbohydrate) information along with entered food items. This type of information could be further extended by currently available technology to provide macronutrient comparisons of healthier alternatives (e.g., baked potato versus French fries). This is unlikely to help a person when they are determined to engage in ESRE, but over time, nutrition information about healthier alternatives could potentially make a difference.

Additionally, HIT could support reframing the food relationship by helping users become aware of when they may be susceptible to using food in lieu of social support. Current technology, such as mindful eating smartphone apps, support awareness around the reasons for eating. The limitation of this kind of HIT is that it requires the user to have the time and desire to reflect on their eating behavior. As a result, while this may be helpful in the long term, it may not prove as useful in the moment of a desire to engage in ESRE. Nonetheless, HIT support for individuals to ascertain the different reasons why they are driven to eat—including for social support—may provide opportunities for users to interrogate long-held and established eating behavior assumptions. To minimize the burden of such reflection, this might helpfully be structured as short-term activities paired with "lightweight challenges," achievable through current technology, that could allow participants to experiment with new ways of thinking about food (Epstein, Cordeiro, Fogarty, Hsieh, & Munson, 2016).

4.4 Limitations

This chapter comprised the interviews of 22 individuals. As such, the trade-off for in-depth data regarding the lived experience of ESRE is a lack of generalizability to the greater population. To mitigate this concern, interviews were conducted until the same themes and patterns emerged from each new interview response; that is, saturation was reached. Another limitation to this study was that some selection bias was likely present. Women who wanted to discuss their ESRE behavior were drawn to the study. Such women may have other characteristics that affect their ESRE and that may not be immediately discernable to the author.

Some responses may have been skewed by participants taking an ESRE survey in advance of their interview. This experience could have exposed them to ESRE concepts in a particular manner that may have primed their responses. For instance, it is possible that survey questions about their coping behavior could have focused their attention on a limited set of stressor types, which they then reported in the interview. Participants who were not exposed to the survey before the interview may have reported a broader range of stressors. The alternative would have been to administer the survey after the interview.

The result of this could have been another problem entirely; survey responses would be primed by questions asked in the interview. As a result, it was prudent to give the interview study participants the survey before the interview so that they were at least more similarly situated to survey study participants who did not participate in the interview study.

Additionally, participants were recruited, in part, based on their gender identity, BMI, and self-assessed concern that their ESRE behavior negatively affected their health. Survey and experimental studies indicate that ESRE presents differently in men than in women. As a result, if men were included in the sample it is likely that the study would have found a broader range of ESRE behaviors. For instance, as noted earlier in this discussion section, women tend to have greater caretaking duties than men. Therefore, it is possible that men may have other stressors that are related to their traditional societal roles and expectations (e.g., providing income for their household, dominance in their work environment, etc.) that could potentially trigger ESRE behavior.

Finally, interviews conducted in this study were cross-sectional. At times participants were asked to recall feelings, experiences, and behaviors from their past and imagine what they might be in the future. A set of longitudinal interviews may have more effectively and accurately gathered data related to feelings, experiences, and behaviors as they unfolded over time. For instance, longitudinal interviews would have provided more in-depth information about how an individual person appraises and copes with stressors over time. While a general sense of this overall trajectory could be ascertained through the aggregate experiences of all participants, there could be value in understanding how particular stressors resulting in ESRE coping evolve for a single person. In this way each participant experience could be compared to one another, potentially leading to more nuanced findings and perhaps an understanding of ESRE trajectory types. Notwithstanding the benefits of a longitudinal interview study, this research project was time bound and required to be completed within strict time parameters that did not afford the option of a longitudinal study.

4.5 Conclusion

      Avoiding ESRE once in a heightened state can be very difficult to achieve. HIT should assist users in either identifying when they are approaching a point of no return, or in avoiding it altogether. Additionally, HIT for weight management should support women in renewing their relationship with food. While it may not be realistic to displace engrained attitudes and cultural practices around food, making users aware of their tendencies and offering alternate ways of approaching it could be useful for change over a longer period of time.

CHAPTER 5. PERCEIVED SUPPORT NEEDS

5.1 Introduction

Previous research indicates that social support is critical for weight loss maintenance (Jeffery et al., 2000; Wing & Jeffery, 1999), and that overweight and obese women perceive it as helpful (Thomas et al., 2009). Additionally, social support has been shown to motivate women to engage in "healthful eating" (Chang, Nitzke, Guilford, Adair, & Hazard, 2008). Little, however, is known about the support needs of overweight/obese women who engage in ESRE and want to manage their weight. Some limited research indicates that lack of emotional support is a predictor of ESRE in women (Laitinen, Ek, & Sovio, 2002). Nonetheless, there is a paucity of research on the relationship between ESRE and other forms of social support (see Wallwork & Tremblay, 2017), such as informational support and instrumental support, as well as other forms of support needs generally.

Furthermore, it is uncertain whether current HIT is appropriately designed to meet the support needs of overweight/obese women who engage in ESRE. Research indicates that HIT for weight management has a tendency to be abandoned before the user's health goal is achieved (Murnane, Huffaker, & Kossinets, 2015). For instance, users find it burdensome to enter dietary intake into food tracking apps (Epstein, Caraway, et al., 2016), and therefore stop engaging with the weight management tool. Additionally, some research has found that users stop logging over time because they experience life events that start to take precedence, or initial forgetfulness about entering data snowballs into complete abandonment because users take the view that missing data renders the log wholly inaccurate (Cordeiro et al., 2015).

ESRE, however, may require engagement over the long term to adequately address underlying reasons behind the behavior – this is likely particularly the case for ESRE, which is typically a long-term behavioral pattern (Canetti et al., 2002; Kemp et al., 2013). As a result, it is unclear how that potential need would be met by HIT that is generally used for limited time periods.

Additionally, overweight/obese women who engage in ESRE need to address and account for not only weight loss, but also the stress and negative affect they experience, and their subsequent eating as a coping response as described in Paper 1. Currently, with some exceptions (e.g., *Clue Period Tracker*), HIT tends to provide siloed solutions that separately address emotions, behaviors, and physiological measures, thereby failing to address the comprehensive nature of many health concerns. Therefore, it is open to question whether existing technology is well-designed to address the concomitant concerns of overweight/obese women who engage in ESRE.

As a result, this chapter addresses the following research questions:

RQ 3: What do overweight/obese women perceive to be their support needs regarding their ESRE behavior?

RQ 4: What challenges do overweight/obese women who engage in ESRE experience in using existing information technology focused on weight management via eating behavior modification?

5.2 Results

Study participants' descriptions of their support needs and challenges related to using HIT for weight management via eating behavior modification is organized by three primary themes. 1) *Health Goals*: Participants defined their health goals in holistic terms and desired HIT that supported their broad vision. 2) *Motivation to Achieve Eating Behavior Goals*: Participants experienced challenges in sparking motivation and inspiring initial steps to change their eating behavior; participants identified and, with some

exceptions, generally found emotional support provided by HIT to be helpful in sustaining existing motivation. 3) *Social Support Needs and Coping*: To reduce reliance on ESRE as a coping response to stress, participants needed informational support for appraisal to understand their ESRE behavior and adjust related thoughts patterns to sustain behavior change over time, emotional support to feel good about themselves and feel connected to other people, and instrumental support for just-in-time assistance with ESRE. Additionally, participants identified the need for HIT to provide opportunities to track both diet and emotional state; interact with users in a positive tone; and provide just-in-time support in the form of distractions to divert users away from ESRE behavior, or eating awareness to help the user ascertain the reasons driving their eating (i.e., to address hunger or for emotional regulation purposes).

5.2.1 Health Goals

Participants tended to view their health goals in holistic terms; they wanted HIT that was designed in alignment with how they wanted to measure progress with their weight management efforts. Additionally, participants were challenged in initiating and sustaining motivation to meet their health goals. They generally found emotional support from HIT to be a positive influence on their motivation, though some participants disliked such approaches.

Rethinking Goal-Setting: Health Defined in Holistic Terms

Overall, participants had the goal of achieving and maintaining good health, which was not wholly tied to weight loss, but more broadly conceptualized as *"mental, physical, and emotional health"* (P19). As one participant elaborated, *"Eating in proportion. Exercising on a fairly regular basis. Having a balanced emotional life, where you have time for your friends, time for yourself, time for your partner…that would be the ideal healthy life."* (P20)

Notably, not a single interview participant defined good health solely in terms of a specific weight. One participant noted, *"Skinnier is not necessarily better. Healthy is what is better."* (P18) Even when explicitly discussing weight loss, the physical body tended to be referenced in terms of ability (e.g., energy, stamina) instead of body weight or size. For

instance, one participant described the catalyst for her most recent weight loss effort as follows: *"It was me going, 'My joints hurt. And I know that I need to be in a better place…' without a real goal, just a, 'My knees need to not crunch as much.'"* (P7)

Many participants reported that their holistic view of health was developed over time as the result of bad weight loss experiences. Some participants used weight loss methods that were unsustainable and at times harmful to their health. After having those experiences, they realized that weight was not the only measure they should use to determine their health status. One participant related her experience losing weight with a low carbohydrate diet that she followed for about a year. The diet required avoiding carbohydrates including fruits and vegetables. She commented on the experience as follows: *"It wasn't actually healthy or good because I wasn't taking vitamins or supplements or getting other things that I needed…I eventually developed gout."* (P4) Another participant described her previous mentality while on a 1,000 calorie per day diet through which she lost weight but was in a bad mood most of the time: *"I had to be a certain weight to be happy…I didn't want to be healthy. I wanted to be thin."* (P16)

Despite a strong desire to focus on overall health, some participants reported struggling with de-emphasizing the importance of weight. One participant shared that as much as she wanted to have a broader view of health, it was difficult: *"I don't want to structure my desire to be healthy as a desire to lose weight…I want to love myself and better myself…[That's] hard to do."* (P5) Some participants took active measures to reduce the significance they placed on weight. As one participant reported, she had good reason for not owning a scale: *"I refuse to keep a scale at home…it would become an obsession every day. I could easily see that happening if I kept a scale…I don't want to do that to myself."* (P8)

HIT and Holistic Health Goals

Participants expressed the importance of holistic conceptualization of goals to be accounted for in HIT designed to support weight loss. To begin, this meant not necessarily emphasizing weight. In part, this was because weight-related goals in themselves could provoke negative feelings among participants. For example, a number of participants (*n* =

4) reported actively avoiding a scale as much as possible to protect themselves from the negative feelings associated with knowing their weight in quantified terms.

Instead of a sole focus on weight, participants advocated a wider range of options for goal identification in HIT that extended beyond weight tracking. Many participants wanted systems to emphasize process-oriented goals related to behavior change rather than the outcome of weight loss. For example, several liked it when HIT acknowledged via a message or badge that they were successful in implementing a healthy habit such as logging dietary intake for a particular number of days, drinking a certain amount of water in a day, or exercising consistently over a certain time period. One participant noted that an HIT emphasis on habit implementation rather than weight loss was important because she had control over her behavior but not the physiological process of weight loss: *"I don't determine my weight loss. I determine my habits and my habits determine my weight loss."* (P1)

Some participants wanted an emphasis on broader life goals that could be facilitated through weight loss. One participant suggested that HIT provide opportunities for users to post goal activities that would be possible after losing weight (e.g., meeting the weight limit to go horseback riding) rather than weight alone. As she noted, *"A goal like that is more something that I would like than a number."* (P13)

5.2.2 Motivation to Achieve Eating Behavior Goals

Participants reported varying levels of motivation related to changing and sustaining healthy eating behaviors. Despite their widespread acknowledgement that food was not an effective coping tool (see Chapter 4), many participants disclosed struggling with a lack of motivation. Moreover, they were unsure of how to get themselves to the preliminary step of wanting to make behavior changes. A number of participants suggested that they likely would make changes in eating behavior only if their health was in perceptibly immediate peril as a result of it. One participant stated that she would probably make a change, *"If I got diabetes or a heart attack or something like that."* (P8)

Other participants, however, who already had health challenges also reported having difficulty becoming motivated to change their eating behavior. One participant with Type II diabetes shared her reaction to getting the news from her doctor that she would need to get back on Metformin (a diabetes medication) because her illness had worsened: *"'Damn.' That's what I said instead of, 'All I got to do is...lose 10 pounds. That's a start and it will go down and I won't need [the medication].' The correlation is not there. It's almost like I don't care...I need the kick in the ass. What do I do? Where does that come from?"* (P18)

Several participants, however, felt consistent motivation. For them, motivation for making eating behavior changes came from their desire to maintain their health so they could continue to take care of other people in their life. As one participant, who was the sole guardian of her granddaughter and was concerned she may die if she did not change her health behavior, related her reasons for wanting to make a change in her eating behavior, *"I think that everything is motivated around [my granddaughter], not leaving her. If I didn't have her, I probably wouldn't care as much, honestly."* (P21)

HIT and Motivation

Participants provided examples and suggestions for how HIT could sustain preexisting user motivation through emotional support.[1] One participant described her experience with an online weight loss game through which she bet money that she would lose a certain amount of weight within a particular timeframe. But as it turned out the HIT-mediated emotional support she gave and received was a greater motivation for her than the financial incentive of meeting her weight loss goal. She discussed visiting the HIT community forum for motivational messages from other players, as well as to post motivational messages to the forum: *"It keeps me going. It keeps the fire lit for me to keep going."* (P12) She also described what happened when she stopped reading and contributing to the forums for a period of time: *"The weight crept on...So then I started back*

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[1] Participants did not report how current or potential HIT could initiate motivation for users to take the first initial steps to change; this will be further addressed in the Discussion section of this chapter.

up again and I'm back on it. I'm actually lower than when I first weighed in a year ago, so I'm doing good." (P12)

Many participants (*n* = 8) appreciated how some HIT supports users in maintaining motivation by providing "rewards" such as badges for reaching goals. As one participant suggested more HIT do, *"Reward [users] often for hitting certain walking goals, like a little thing that would pop up and (ringing sound), "Congratulations! You've reached your 10,000 step count!"'"* (P20)

A minority of participants (*n* = 2), however, did not particularly like such motivating messages. One participant explained her reaction to receiving messages from a mobile phone app that she had logged her food intake for a certain number of consecutive days, *"I don't like a cheerleader. There are a lot of fitness apps and stuff that are like 'Way to go.'…This stuff is not sincere."* (P3) The participant noted that this kind of "*fake encouragement*" was *"unnecessary"* and made her feel "*really uncomfortable.*" (P3) While she acknowledged that other users might like it, she emphasized that it was simply personal preference that lead her to dislike these types of motivational messages.

5.2.3 Social Support Needs and Coping

Participants reported needing three forms of social support to assist them in addressing their ESRE behavior. They had a need for informational support for appraisal to understand their ESRE behavior and reshape their thought patterns underlying their ESRE behavior for lasting behavior change. They had a need for emotional support to maintain a positive attitude about themselves and their weight management efforts. Finally, they had a need for instrumental support for just-in-time assistance with using ESRE as a coping response to stress.

Informational Support for Appraisal

Understanding Behavior

The first stage of understanding was recognizing they engaged in the behavior in the first place; this was a major step for some participants. One participant related how she had come to a recent realization about her behavior, *"I had no idea what the hell 'emotional eating' was…I had no idea what I was doing…I didn't know that was a thing."* (P21)

Participants were generally interested not just in changing their ESRE behavior, but also understanding it so that they could rely on it less as a coping method. One participant related how she was employing different behavioral strategies, such as surrounding herself with healthier food options and engaging in mindful eating practices, to mitigate her ESRE. Nonetheless, she wanted to know why she was drawn to ESRE. She stated, *"I haven't figured it out yet…maybe through counseling, eventually, I can peel back the onion and say, 'Why do I turn to food for comfort?'"* (P6)

HIT and Understanding Behavior

Participants were interested in using HIT to learn about themselves and getting help identifying behavior they could not see on their own. One participant shared that she liked to use HIT to track her dietary intake for short periods of time to get a snapshot of her eating behavior through answering the following questions: *"What are my current patterns? What needs attention? What is this chunk of data telling me about what's conscious or not? What needs more work?"* (P10)

Many participants noted that while calorie and physical activity tracking was helpful for weight management efforts, keeping record of their emotions would also be useful for gaining greater insight into their ESRE behavior. One participant related that HIT that supported emotion tracking would be beneficial because, as she stated, *"It would force me to do that self-reflection that I already know is good for me and sometimes I avoid or sometimes I don't get to as a first response to a feeling."* (P4)

A number of participants further suggested that HIT be designed to allow for tracking food/drink in tandem with emotions. Participants widely thought that such information would allow them to become aware of their ESRE behavior and to make behavior changes accordingly: *"It would be good to be able have just kind of a one-stop shopping, to have all that information [i.e., food and emotion]. I feel like I need to have as much information as I can to figure out what kind of changes would be best for me."* (P14)

In addition to food-emotion tracking, some participants were interested in tracking physical feelings in their body at the time they ate. They wanted to discern when they may have eaten certain foods for reasons aside from hunger or emotions. One participant explained that HIT would be most helpful if it were designed to be *"more inclusive of other life activities…like 'Did you have a headache?' Things like that."* (P2) She noted that kind of information would be helpful because, *"When I have headaches I eat more because I feel like maybe my blood sugar's low…so just seeing I had a headache that day, maybe that's why I had that second slice of pizza or that third slice of pizza."(2)*

Changing Thought Patterns

Many participants also reported the belief that they needed to make a fundamental shift in their thinking to stop using ESRE as a coping response. As one participant commented on her eating behavior: *"It needs to change within me…it's my mindset."* (P2) Furthermore, such change was viewed as a requirement for achieving lasting eating behavior change. One participant related, *"You have to change your way of thinking because if you go in and say, 'I'm going to change my lifestyle. I'm going to get rid of all of this and replace it with all of this,' but you still think the same way, what good is replacing anything?"* (P21)

More specifically, some participants identified the need to reset their thinking about food's purpose in their lives. Each participant acknowledged that food should not be used to make themselves feel better when experiencing negative emotions or stress. One participant related, *"Food is not love, food is food."* (P6) A number of participants reported success in changing the way they related to food when they thought about food primarily in terms of its nutritional characteristics. One participant who experienced some success in

adopting healthier eating behaviors, noted how she started evaluating food not as "good" or "bad" but rather in terms of whether it gave her what she needed: *"I'm not eating vegetables because they're good or not good, but because it gives me something,..[When] I eat pizza and ice cream…I don't think I've eaten that badly…I try to frame it in my mind like, 'Your body really didn't get anything that it needed.'"* (P1)

Participants also described challenges in changing their thinking as it related to their eating behavior. Participants who attempted to make a change in the way they thought about food reported that the process takes a long time. One participant who had gastric bypass surgery and lost 100 lbs. described her transition: *"[W]hen I'm sad I want to eat. I want to find comfort in something and it's always been food. Now I'm trying to change that into finding different comfort. The gym, I read a lot…it's like trying to re-train my brain, and that's the hardest part…I'm still not fully there with it mentally, it's going to take time."* (P17)

HIT and Changing Thought Patterns

Participants largely reported that HIT supported putting certain health behaviors in action, but did not shift the way they thought about their behavior. This was particularly salient for HIT with the ubiquitous and popular functionality of food tracking. Many participants reported that HIT food logging was very effective in encouraging them to plan meals so that they would stay within a certain daily calorie count. Some participants, however, shared how in certain situations they circumvented the logging and ate in excess of the daily calorie guidelines. One participant described such sidestepping in her approach to holiday meals and food tracking: *"I'm going to eat what I want…and count it [in the HIT tracking app] and I'll deal with the consequences later."* (P6) Another participant described her feelings about HIT food logging when it could be a *"hassle,"* such as on vacation, *"If I ate a lot of food, I just wouldn't put it [into the HIT tracking app], you just avoid the problem and then you'd move on to the next day."* (P3) As a result, participants went through the motions of using the HIT, but easily bypassed it and did not necessarily shift their thought patterns regarding eating behavior.

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Additionally, HIT food tracking was viewed as a temporary, unsustainable measure. One participant described why her use of HIT food logging was limited to relatively short time periods: *"I found it very...exhausting...I would...stop using it once I felt like I was in a healthier place. I think it's a really valuable tool, but I don't really want to live my life tracking food."* (P11) As a result, although HIT food tracking functionality had the potential to shape eating behavior in the short term, it was a feature that had a relatively narrow timespan to address participants' underlying thought patterns.

Emotional Support for Feeling Good and Connected to Others

Participants reported having a great need for emotional support to fortify themselves against using ESRE as a coping response to stress. One participant described the benefits of emotional support in context of weight loss efforts as follows: *"[It] really, really helps...being able to...celebrate successes and if somebody's having a bad day and they fell off the wagon...it's encouragement, not like, 'You failed,' but 'It's okay.'"* (P22) Additionally, some participants made a direct connection between getting emotional support and their eating behavior. One participant shared why emotional support is helpful for curbing ESRE: *"I quite like the fact that you have someone else with you...to see how you're doing...because when I eat the most, and I eat the worst, I am alone...when I'm not talking to people, I eat."* (P16)

Addressing stress and negative affect that could potentially lead to overeating was important for participants. Many participants reported how they depended on other people to work through negative emotions and stress by venting and processing their feelings. As one participant related, *"Normally, I either reflect on my own and then talk to my sisters or reflect through talking to my sisters."* (P4) Additionally, a number of participants developed relationships with coworkers that allowed them to discuss stressful events from both their work and personal lives. As one participant described her one-on-one time with a coworker during the workday, *"We get outside, we have a trail that goes around the building...We get away from everybody so we can talk out any issues that we're having with work...or our life things."* (P11)

A critical caveat for receiving emotional support was getting it from people with whom they had something in common. The most basic level of commonality was people who had similar struggles with overweight/obesity. As one participant commented about her best friend who provided emotional support: *"There's nothing quite like having someone who I know has been in my shoes in terms of the overweight experience and existing as an overweight person in the world, being kind of that voice of reason."* (P5)

Other participants further emphasized their desire to receive emotional support from people who were not only addressing overweight/obesity themselves, but who were also in the same phase of life. For instance, one participant reported supportive relationships where she and the other person understood both the professional and personal demands they faced along with weight management experiences: *"I really kind of relied on the friend of mine…because we're the same year in our programs…[we can] more openly talk about our goals…Our struggles. Our frustrations. Why things are working, why things aren't working."* (P2)

Yet other participants reported how they also appreciated emotional support exchange related to overweight/obesity with people who shared their social position. For instance, one participant described how she felt *"comradery"* with the other women in her Weight Watchers meeting group: *"[To] come together on a subject that is fraught, and has a lot of baggage associated with it. And we all have our own paths. And it was just nice to be in a room of all women and to have fellowship over all of that."* (P10)

Interacting with a trusted person or group of people was not only beneficial in terms of the comfort participants felt, but also because it motivated them to stay connected with others and continue to engage in the process of addressing their emotional health and eating behavior. One participant related how she started working out with a physical trainer who held exercise classes in small groups, which helped to sustain her motivation for health-enhancing behavior: *"I really liked the group and my trainer, and then after a while all of us became friends, and it became like we hung out on the weekends, so it had a really good family feel to it. So I think that's what kept me going is because I liked what I was doing and who I was doing it with."* (P8)

HIT and Emotional Support

Participants widely reported wanting HIT to provide opportunities for emotional support whether via other users or from the technology itself. Some participants strongly endorsed HIT providing a structure for the exchange of emotional support. One participant stated that if designing HIT for ESRE, she would be sure to include a forum for user communications with one other for the following reasons: *"People want to feel connected…Especially around food and relationships with food, there's this great sense of isolation or secrecy…there's power in community and knowing that you're in it with other people who are also striving for the same goals."* (P20)

In terms of emotional support from the technology itself, participants had the main desire for it to inspire positive attitude about themselves, their lives generally, and their weight loss process. One participant shared how she thought HIT could make her feel good: "*Send me a nice quote or [biblical] scripture…give me all the warm, fuzzy [feelings]— just something to prevent me going in to eating bad."* (P8) Other respondents suggested a more direct approach: *"I would want something that would tell me, 'You're awesome…you can do this.'"* (P12)

There were strong ideas as well about what technology should not do to ensure that actions were in fact perceived as supportive. One participant cautioned that HIT had to strike the delicate balance of persistence without annoyance: *"[It should] most closely mimic a really supportive person in my life. So something that is in my face, but in the least obnoxious way ever…it has to be keeping reminding me of its existence and…being engaging in a friendly way without going overboard on it."* (P5)

Instrumental Support for JIT Interventions
Need for Distractions

Participants reported that providing distractions to take away their attention from carrying out ESRE behavior to cope with stress and negative affect was a great area of need for instrumental support. One participant, who has experienced success in curbing her ESRE behavior, described how she depended on her fiancé to join her in an activity that would redirect her attention away from eating food when she felt stressed: *"'Let's go shoot*

pool, let's go bowling,'...I just distract myself. It's like a toddler. When they're mad about something you're like...,'Look over here!' That's exactly what I do to myself now." (P17)

None of the participants reported encountering prompts for distraction in the HIT they used, but described types of distractions that could potentially be provided by HIT. One participant suggested the following interventions that she could use: *"Having easily accessible methods of dealing with the anxiety/stress that don't involve calories would be great. Give me a mnemonic, or give me something to do with my hands, or a mental exercise or a breathing technique, just something so that I'm not always inclined to pick up calories."* (P9)

Eating with Awareness

Participants reported the value of being aware of what they ate in their efforts to curb ESRE as a coping method. Some participants shared that eating with awareness helped them control the amount of food they ate. One participant stated her need to have an *"active thought process"* through which she thought through the following: *"'I should stop now and save this for another meal,'...'I can just get a small snack, I'm not actually that hungry.'"* (P4) She further noted, *"If I just auto-pilot myself, I think I would eat too much."*(P4)

In support of greater awareness, many participants acknowledged that HIT with food tracking functionality encouraged them to consider the serving sizes of what they ate. As one participant described, although nutrition information was readily accessible on food packaging, logging it with HIT was beneficial for the following reasons: *"I could have just opened it and ignored the wrapper...[logging in the app] forced me to face things that I knew already."* (P11)

Additionally, many participants stated that sometimes they needed assistance with considering the reasons behind why they wanted to eat food at certain times, and with interrogating their underlying emotional state or stress levels. One participant related how when she is stressed and is walking to the vending machine to buy peanut M&Ms, she

would appreciate having someone say, *""Hey, I see you're going to get the peanut M&Ms. Are you feeling stressed?"* (P5)

Participants suggested combined food and emotion tracking functionalities in HIT slow themselves down to think about why they were eating and reevaluate if it was a good idea. As one participant suggested, tracking emojis that represented feelings at the time of eating could encourage mindful eating because usually, *"In the moment you're not thinking about, 'Hey, how are you feeling?' Or 'Is this a stress snack?.'"* (9)

5.3 Discussion

This study describes the support needs of overweight/obese women who engage in ESRE. Additionally, it sets out the challenges overweight/obese women who engage in ESRE encounter when using HIT designed for weight management via eating behavior modification. It relates how overweight/obese women who engage in ESRE define their health goals in holistic terms that extend beyond weight, and how such goals are not fully supported by HIT. It describes how some overweight/obese women struggle with motiving themselves to initiate change in their eating behavior. The study also shows how emotional support provided via HIT can help sustain existing motivation. The study describes how overweight/obese women who engage in ESRE need social support to reduce reliance on ESRE as a coping response to stress. More specifically, the study describes the need for HIT to provide informational support for appraisal to understand ESRE and change thought patterns for lasting behavior change, emotional support to induce positive feelings about self and connection to others, and just-in-time instrumental support to aid with distraction from ESRE and greater eating awareness.

The results from this study suggest that overweight/obese women who engage in ESRE behavior could benefit from greater support of their holistic view of health so as to spur and sustain motivation for enacting eating behavior change. Additionally, the results point to the key roles emotional support serves in sustaining motivation, informational support for appraisal serves in supporting thoughtful analysis, and instrumental support serves in providing just-in-time interventions. These and related HIT design implications are discussed further here.

5.3.1 Need for Goal Articulation and Motivation

Goal Articulation

All study participants define health goals that extend beyond their weight. For some it was because they had negative feelings about their weight and did not want to set themselves up for disappointment. Some participants also had enough bad experiences with previous weight loss attempts in which they traded their health to be thin, only to regain the weight later. It should be noted, however, that some participants found that the focus on health rather than weight was an uphill battle; as much as they wanted to change their thinking, it was a difficult process. Previous research highlights the importance of focusing on the appropriate kinds of goals that underlie motivation to enact and sustain health behavior changes. Segar, Eccles, and Richardson (2011) found that midlife women (40-60 years old) with outcome goals focused on immediate benefits rather than long term benefits exercised more than those who had goals of overall health and disease prevention. This suggests the potential health benefits of translating holistic health goals into shorter term objectives for overweight/obese women who engage in ESRE.

Motivation

Overweight/obese women who engage in ESRE need to have their holistic view of health supported so that they can benefit from lasting motivation that will support their health behavior change efforts. Some participants report difficulty in finding motivation for enacting and sustaining eating behavior change. Some participants noted that only deathly illness would get them to change their eating behavior. But such motivation was even lacking in participants who had weight-related health issues. These findings are consistent with prior research that indicates that health behavior enacted with intrinsic motivation (i.e., action based on interest or values) is more effective and sustainable than health behavior enacted based on extrinsic motivation (i.e., action based on threat, reward, obligation, or guilt) (Ng et al., 2012; Segar, Eccles, & Richardson, 2008).

HIT Design Implications

HIT for weight management should support overweight/obese women focus on intrinsic, immediate goals that are ascertainable in the short term. HIT should leverage existing user desire to achieve goals beyond extrinsic motivations such as losing weight to look thin. As suggested by participants, HIT could reframe weight loss in terms of immediate quality of life improvements they would experience by losing smaller increments of weight (e.g., meeting weight requirement to participate in horseback riding with a family member), in terms of habit changes rather than outcomes, and in terms of broader holistic health goals that do not concern weight at all. Technology currently available would be able to provide such support to users.

5.3.2 Need for Acute and Chronic Support

Participants describe their needs as occurring on the two timescales of rapid and short in duration or extended over a longer period of time. These acute and chronic aspects of their needs are seen through the three forms of social support they report.

Chronic: Emotional Support for Encouragement

Participants report that emotional support benefits include receiving encouragement when they stray away from the weight management plan and celebrating goal achievements. Additionally, they like to receive emotional support from people whom they were like them in terms of similar experiences with overweight/obesity, and perhaps also the same phase of life, or social position (e.g., gender, race/ethnicity, age, etc.). Overall, emotional support makes them feel good about themselves, connected to other people, and more committed to remaining engaged in their weight management efforts. These findings are in line with other research that showed that emotional support is beneficial for weight management as it improves sustained weight loss over time (Karfopoulou, Anastasiou, Avgeraki, Kosmidis, & Yannakoulia, 2016; Seguin, Folta, Nelson, Hanson, & LaCroix, 2017).

Chronic: Informational Support for Appraisal to Reflect and Gain Insight

Participants report that informational support for appraisal benefits them by assisting with reflecting on behavior for greater insight and changing their thought patterns. This finding corroborates previous research that suggests discerning personal health-related patterns overtime can be challenging and requires support (Barbarin, Klasnja, & Veinot, 2016). In terms of ESRE behavior, participants want to know what they are doing and understand why they are doing it. They believe this knowledge will help them curb ESRE behavior. Additionally, some participants believe they need to make a fundamental change in the way they think about food. Namely, they want to focus on not using food as part of their coping response to stress.

Acute and Chronic: Just-in-Time Instrumental Support to Avoid ESRE

Participants report that instrumental support is particularly useful for providing just-in-time assistance with avoiding ESRE. Such just-in-time support utilized the following two contrary strategies: heightened awareness and distraction. At times, some participants are able to focus attention on what, why, and how much they want to eat. They determine how hungry they are, if at all; whether a smaller portion size is appropriate; and monitor satiety as they eat their meal. In this way, some participants are able to avoid ESRE in the moment. Although heightened awareness occurs just-in-time, thereby addressing the acute dimension of ESRE, it can also meet the chronic dimension of ESRE by providing insight when practiced repeatedly over time.

Other times the pull toward food can be so strong that slowing down to think about their eating will not be effective for abstaining from or mitigating ESRE. In these situations participants choose to remove themselves from the circumstances through distraction. Participants report that such distractions are usually engaged in with another person, though it could be done alone. While distraction does not provide the benefits of developing insight, it may be the best just-in-time option when no better alternatives are feasible (e.g., using willpower to not engage in ESRE) for addressing ESRE in its acute form.

HIT Design Implications

Overweight/obese women who engage in ESRE could benefit from HIT that supports the exchange of emotional support between users or to provide emotional support directly itself. Participants report enjoying giving and receiving emotional support to other users; it keeps them actively engaged in their weight management efforts. Additionally, they generally found encouraging communications from HIT to be motivating as well, though not all participants are highly enthusiastic about such messages. The varying reactions to automated encouragement messages from the HIT system itself was found in other research as well (Tang, Abraham, Stamp, & Greaves, 2015). Although most current HIT designed for weight management does not allow for personalization of the types of encouraging messages users receive, they could and should allow tailoring of these features. Such messaging could potentially annoy or otherwise frustrate a user, and thereby hastening abandonment.

HIT should also provide informational support for appraisal so that overweight/obese women who engage in ESRE can come to understand their behavior and change their thought patterns. In-the-moment eating awareness, when considered in aggregate could assist with understanding behavior. Many participants suggested HIT functionality that allowed them to track emotional state along with dietary intake. Carroll et al. (2013) developed and studied *EmoTree*, an experimental smartphone app. It allowed for tracking affect along with dietary intake. About 1/3 of study participants reported that they had greater awareness of when they were engaging in ESRE as a result of logging food and emotions at the same time. Additionally, the study found that while there were some patterns to how participants ate when they were feeling stressed, there was still notable variability between the participants. Taken altogether, these findings suggest that HIT should be designed to push insights to users without relying on them to figure it out on their own. Furthermore, HIT should be developed to provide such insights on a wide range of behaviors. For instance, HIT could push a message to the user that states what kinds of food or the times of day a user tends to eat when self-reporting stress. Current technology would allow HIT to support users in these ways.

Many HIT interventions available in the consumer market rely heavily on tracking features despite the prevalence of user abandonment. Notwithstanding the usefulness of tracking, participants concede that they tend to use tracking over relatively short periods of time. This corroborates previous research that indicates user abandonment of HIT tracking tools (Cordeiro et al., 2015; Epstein, Caraway, et al., 2016). Given the chronic nature of ESRE, short-lived interventions alone are unlikely to provide the level of reflection overweight/obese women need to enact and maintain behavior change. As a result, rather than insist that users will retain their tracking tools if only the right kinds and balance of features could be discovered and implemented, it may be best to focus on how tracking tools can be used effectively in the relatively short term. For instance, similar to how one participant uses food tracking tools, they could be used strategically to simply ascertain an overview of eating over a short period of time for the user to become cognizant, think about, and address undesirable behavioral patterns. Additionally, self-experimentation tools that extend beyond cookie cutter, one-size-fits-all tracking apps, though not widely available, could be further developed to support users interested in understanding their ESRE behavior, its triggers, and evaluate their responses to deliberately-isolated changes in their behavior (Karkar et al., 2017; Karkar et al., 2016).

Additionally, HIT should provide just-in-time interventions that assist with distracting users from engaging in ESRE. As one participant suggests, HIT distractions could take the form of brain puzzles or breathing exercises; additionally, they could be prompts to participate in physical activity such as walking or a bicycle ride. Similarly, Carroll et al. (2013)'s *EmoTree* also had a just-in-time intervention component that provided a guided breathing exercise when a user entered a self-report that indicated he or she was in a stressful or anxious state. While the breathing exercises were not as effective at stopping ESRE, they were at alleviating stress. Additionally, there was variability in how much the participants liked the breathing exercises, suggesting that tailoring options would be appropriate for ESRE distraction features. HIT could be designed to allow users to select from a range of system-supported distractions (e.g., puzzles, breathing exercises, other activity prompts, etc.) beforehand that could be pushed to them when they self-report stress. Additionally, as technology around physiological emotion sensing develops, future

HIT could be developed to push such interventions automatically to users without waiting for them to self-report their emotional state.

5.4 Limitations

This chapter is based on an interview study in which 22 individuals were interviewed. Although interviews were conducted until saturation was reached, the greater generalizability of its findings is limited. The strength of qualitative interviews as a method, however, is the ability to explore people's experiences in great depth, though be it with a limited sample size. Additionally, there could be selection bias among participants in that a certain type of person may have been drawn to a study focusing on ESRE. Participants were likely people who have considered their ESRE behavior and have pre-existing, established ideas about it.

Another limitation to the study is that some of the HIT recommendations from participants could be shaped by their use of the free version of the *Lose It!* smartphone app in advance of their interview. The *Lose It!* app's primary focus on food tracking could have limited participants to thinking about HIT in terms of self-monitoring of dietary intake. This in turn could lead to less variance in recommendations concerning other types of HIT (e.g., just-in-time-adaptive-interventions), or additional features available in the paid version of the app (e.g., meal planning support and social interactions via the app). Despite these limitations, participants also related their experiences with other HIT for weight management—though most of these were also food tracking smartphone apps. Nonetheless, food tracking smartphone apps are pervasive; participants feedback on the features of smartphone food tracking apps is helpful for guiding design of these ubiquitous weight management tools.

Furthermore, study findings may have been affected by the sampling method and the cross-sectional nature of the study. Maximum variation sampling was utilized to obtain a diverse sample of interview participants on a variety of measures including race/ethnicity with an emphasis on African Americans and Latinas. If the study had been focused on a single race, findings would likely reflect greater variance in that group. For instance, if the focus of the study were White women, differences in support needs and HIT

experiences based on geographic region, age, or socio-economic status may have been more salient. The benefit, however, of conducting the interviews with a relatively diverse sample was the ability to observe the commonalities and differences in support needs and HIT experiences between various groups. Finally, if this interview study were longitudinal rather than cross-sectional, findings may provide greater insight into the full cycle of HIT adoption and abandonment as it happens over time. While greater understanding of the adoption-abandonment cycle could be beneficial for designing HIT, this study had fixed time constraints.

5.5 Conclusion

Overweight/obese women who engage in ESRE have support needs to address both the acute and chronic dimensions of their ESRE behavior. Their acute support needs are for eating awareness in the moment as they are making food choices, as well as just-in-time interventions to distract from ESRE. Their chronic support needs are for assistance with monitoring holistic goals and sustaining motivation to address their ESRE behavior over the long term. Chronic support needs also extend to encouragement in weight loss efforts, understanding their ESRE and changing thought patterns for lasting behavior change. Finally, there is a particular need for HIT to allow more tailoring that accommodates the monitoring of holistic goals, choosing one's own rewards and suggested distractions, and helping users in understanding their behavior with interventions that extend beyond tracking tools, which usually are used for relatively short periods of time despite the enduring nature of ESRE.

CHAPTER 6. SELF-BLAME AND ESRE

6.1 Introduction

Although research has found that members of all racial/ethnic groups and educational attainment groups engage in ESRE, the finer nuances of that behavior in each group and how the groups compare to each other are unknown (e.g., Burgess et al., 2014; Sims et al., 2008). At the same time, BMI differences between racial and ethnic groups and educational attainment groups are better understood. For instance, African American women have greater overweight/obesity than their White counterparts (Jackson et al., 2013). Additionally, with the exception of African Americans, women with educational attainment levels above high school are significantly less likely to be obese (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016; Jackson et al., 2013). Groups differences in overweight/obesity suggest that contextual factors (e.g., group social norms, cultural practices, environment, etc.) or behavioral patterns that potentially affect weight, could affect groups differently.

One aspect of ESRE to consider across different race and educational attainment groups is self-blame as a coping response to stress. As described in Chapter 2 (Literature Review), the Transactional Model of Stress and Coping (TMSC) posits that a person transacts with their environment that comprises stressors. When a person encounters a stressor, he/she makes appraisals to determine whether the stressor is a threat and which resources are available for coping with the stressors. The person then makes a coping effort through their response to the stressors. There are different ways a person can respond to a stressor, but they are generally thought to comprise strategies that either change the stressor or change the way one understands, feels, or thinks about the stressor.

Self-blame is a coping response in which a person makes an interpretation about the stressor rather than tries to change the stressor itself. It is a phenomena in which a person is "prone to hold himself responsible for any difficulties or problems he encounters"(Beck, 1967, p. 21). Taking responsibility for failure to achieve some outcome can be either productive or inhibiting depending on where the blame is focused (Janoff-Bulman, 1979). Behavioral self-blame attributes failure to engaging in some action or lack of action; as a result, the person is empowered in the belief that they have control over the outcome. Characterological self-blame, however, attributes failure to some innate characteristic; as a result, the outcome and future ones like it are believed to be out of the person's control. When engaging in characterological self-blame, the person tends to assign their self-assessed failure to some inherent quality they lack, and then further blames themselves for their perceived flaw (Beck, 1967, p. 24).

The eating disorder population compared to non-eating disorder population report higher mean scores on self-blame coping (Ball & Lee, 2002). The binge eating disorder population compared to the non-binge eating disorder population has significantly higher self-blame scores, as well as higher self-blame scores on the days they binged (Wolff, Crosby, Roberts, & Wittrock, 2000). Although the population of interest for this thesis is subclinical ESRE, patterns of self-blame in individuals with clinical eating disorders may indicate differences present in the greater population. For instance, one study showed that obese individuals engage in self-blame when they cannot maintain their diet (Thomas et al., 2008).

Different racial and educational attainment level groups were chosen as the groups of comparison for this study because they have varying levels of overweight/obesity; there may also be differences in the way ESRE presents in each of those groups. Self-blame is selected as the coping response of interest for this study because it is a common coping response in people with eating disorders; ESRE, though not necessarily rising to the clinical level binge eating, is a related behavior. Additionally, one study showed that self-blame was detected in obese individuals, which suggests it could be pervasive throughout overweight/obese women generally (see Conradt et al., 2009). Furthermore, differences

between the groups may help to guide the design, targeting, and tailoring of HIT to address ESRE behavior.

As a result, this chapter addresses the following research questions:

RQ 5: What is the relationship between self-blame as a coping response and eating behavior in overweight/obese women?

RQ 5.1: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, it at all, by racial group?

RQ 5.2: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, if at all, by educational attainment group?

RQ 6: Which information technology coping support features would be appropriate for particular subgroups of overweight/obese women?

6.2 Results

The description of how self-blame and ESRE are interconnected is organized in three sections. 1) *Self-Blame as a Phenomena*: Interview participants (N = 22) reported that self-blame, which occurred in context of work, personal relationships, and weight management efforts, could lead to stress, which in turn, resulted in ESRE's use as a coping method. Additionally, they suggested that HIT-supported food tracking could intensify self-blame in users. 2) *Relationship between Self-Blame and ESRE*: Analysis of responses from survey study participants (N = 430) indicated that Self-Blame was a predictor of ESRE behavior for study participants as a whole and for all subgroups tested except for African Americans. 3) *Eliminating Self-Blame over Time*: Interview participants shared that minimizing self-blame improved success in weight management efforts.

6.2.1 Self-Blame as a Phenomena

Some participants reported engaging in self-blame — that is, they blamed themselves when problems arose, and attributed their difficulties to a personal failing. Participants expressed harsh assessments of themselves and quality of their work product in context of their employment. For instance, one participant related a work experience in which she felt stress about meeting a project deadline. The project scope changed unexpectedly, but she was not allotted additional time by her employer to make adjustments. She commented, *"Not getting my things done makes me feel like I failed...Even though one part of my brain knows circumstances and conditions were not in my favor, I still feel like I should be able to overcome that...I still feel the emotion of it, of feeling like I failed."* (P11) Additionally, when she wasn't able to meet the deadline she felt that she was valued less by her workplace and further reported feeling she, herself, brought less value to her position at work. In this particular instance, the participant coped with the stress by going for a *"lunch walk"* with a coworker. These walks, which tend to take place during the lunch break, allowed an opportunity for the participant and her coworker to get some physical activity, offer and receive informational and instrumental support, or simply vent negative emotions. As the participant described, *"We try to work it out. It doesn't always happen. Sometimes, it's just like 30 minutes of intense frustration...But it's really helpful. Because otherwise, we'd just sit at work being frustrated."* (P11)

Participants also reported engaging in self-blame as it related to their personal relationships. One participant referred to herself as a *"parent failure"* because she exceeded the weight limit required to go horseback riding with her granddaughter (P21). She remarked, *"my not taking care of my body is affecting an opportunity that [my granddaughter] could have, if I wasn't 277 pounds."* (P21) The participant went on to describe her reaction to the situation: *"That upset me, to the point where I had my face in the fridge for awhile... I don't how much I ate, but I ate a lot."* (P21)

Self-blame also occurred in context of weight loss efforts. One participant described how in the past she tried to follow restrictive diets that were challenging to adhere to over the long term. She shared how she criticized herself on days she did not comply with the diet, *"You're a failure. You couldn't do it. You couldn't even go a day without eating that."* (P12) Additionally, she reported blaming herself for lacking the *"willpower"* to follow the restrictive diet. Another participant suggested that she lacked the inherent ability to use a smartphone app to track her dietary intake over a long period of time. She described why she might discontinue use of the app in the future as follows: "*Laziness…no fault of the app. That's my own fault."* (P8)

6.2.2 Relationship Between Self-Blame and ESRE

The following analysis of survey data results provide further understanding of the role that self-blame plays in ESRE behavior. A cross-sectional survey ($N = 430$) was administered to determine the relationship between overweight/obesity, sociodemographic characteristics, stress and coping, and eating behavior.

Measures in this Study and Descriptive Statistics

The following measures collected via the survey were used in this statistical analysis:
- Age
- Perceived Stress Scale (PSS)
- Self-Blame subscale in the Brief COPE Inventory (Brief COPE)
- Coping subscale in the Palatable Eating Motives Scale (PEMS)
- Body Mass Index (BMI)

Further description of these measures (including scale reliability) is in Section 3.6.3 (Survey Instrument Measures).

Statistical Analyses

Group Comparisons

Race Groups

A one-way ANOVA was conducted to determine if there were differences in PEMS, PSS, and Self-Blame across select race groups (African American: $n = 135$, Latina: $n = 122$, White: $n = 162$). Outliers discovered by visual inspection of boxplots were examined and

ultimately retained. PEMS, PSS, and Self-Blame were normally distributed for each race group, as determined by a visual inspection of Q-Q plots. Additionally, Levene's test for equality of variances indicated there was homogeneity of variances for PEMS ($p = .374$), PSS ($p = .187$), and Self-Blame ($p = .935$).

There were statistically significant differences between race groups for PSS, $F(3, 426) = 4.664$, $p < .01$, $\eta^2 = .03$; and Self-Blame, $F(3, 426) = 3.051$, $p < .05$, $\eta^2 = .02$. Latinas ($M = 2.75$, $SD = 1.26$) had higher mean PSS scores than African Americans ($M = 2.64$, $SD = 1.25$), which Tukey-Kramer post hoc test showed to be a statistically significant difference ($p < .01$). Latinas ($M = 4.98$, $SD = 1.97$) also had higher mean Self-Blame scores than African Americans ($M = 4.32$, $SD = 2.00$), which Tukey-Kramer post hoc test showed to be a statistically significant difference ($p < .05$). No other statistically significant group differences were found.

Educational Attainment Groups

Independent-samples t-tests were run to determine if there were differences in PEMS, PSS, and Self-Blame across educational attainment groups (Bachelor's Degree: $n = 221$, No Bachelor's Degree: $n = 209$). Outliers found through visual inspection of boxplots were reviewed and ultimately retained. PEMS, PSS, and Self-Blame were normally distributed for each educational attainment group and BMI group, as determined by a visual inspection of Q-Q plots. Levene's test for equality of variances indicated there was homogeneity of variances for PEMS ($p = .07$) and PSS ($p = .22$); the assumption of homogeneity of variances was violated for and Self-Blame ($p = .001$). There were no statistically significant differences between educational attainment groups for PEMS, PSS, or Self-Blame.

Correlations

BMI was not normally distributed, as determined by visual inspection of Q-Q plots. BMI, however, had monotonic relationships with variables of interest, as assessed by visual inspection of scatterplots. As a result a Spearman's rank-order correlation was run to examine the relationship between BMI, Age, PSS, Self-Blame, and PEMS. Table 4 shows that

PEMS was weakly positively associated with BMI, r_s = .12, p < .05; weakly negatively

associated with Age, r_s = -.20, p < .001; and moderately positively associated with PSS, r_s =

.37, p < .001 and Self-Blame, r_s = .38, p < .001. Additionally, Self-Blame was weakly

negatively associated with Age, r_s = -.28, p < .001, and moderately positively associated

with PSS, r_s = .48, p < .001 (see Table 4. *Summary of Spearman's Rank-Order Correlation*

Analysis.). Finally, Age was weakly negatively associated with PSS, r_s = -.22, p < .001. These

were the only statistically significant correlations found.

Table 4. *Summary of Spearman's Rank-Order Correlation Analysis.*

	BMI	Age	PSS	Self-Blame	PEMS
BMI	---	.05	.04	.08	.12*
Age		---	-.22**	-.28**	-.20**
PSS			---	.48**	.37**
Self-Blame				---	.38**
PEMS					---

*Note. *p < .05, **p < .001*

Hierarchical Multiple Regression

A hierarchical multiple regression was conducted to determine if and to what extent

Self-Blame was a unique predictor of PEMS (i.e., a measure of ESRE) for the entire survey

sample, as well as select racial groups and educational attainment groups. Then an

additional set of hierarchical multiple regressions was conducted to apply the same two

previous models (i.e., Model 1: Age, PSS predicting PEMS; Model 2: Age, PSS, Self-Blame

predicting PEMS) to selected race groups separately (African American, Latina, and White)

and educational attainment groups separately (Bachelor's Degree, No Bachelor's degree).

All raw measures for variables were converted to Z scores and used in the regression

analysis so that the different scale measures could be compared more easily.

<u>Full Survey Sample</u>

The assumptions of hierarchical multiple regression were examined to determine if any were violated for the full survey sample. Independent and dependent variables had linear relationships, as assessed by visual inspection of scatterplots of studentized residuals and unstandardized predicted values, as well as partial regression plots of dependent and independent variables. Homoscedasticity of residuals was present, as determined by visual review of a plot of studentized residuals against unstandardized predicted values. Multicollinearity was absent (i.e., no tolerance values greater than 0.1), as there were no outliers (i.e., no standardized residuals greater than ±3 standard deviations), high leverage values (i.e., none > 0.2), or influential values (i.e., no Cook's distance values > 1). Additionally, visual inspection of the histogram and P-P plot of the standardized residuals indicated they were approximately normally distributed. Visual inspection of Q-Q plots showed that Age, PSS, Self-Blane, and PEMS were normally distributed.

A two-stage hierarchical multiple regression was then conducted with PEMS as the dependent variable. Step 1 entered Age and PSS together (Model 1); Step 2 added Self-Blame (Model 2). Previous correlation analysis demonstrated that Age and all the other regression variables were weakly correlated, and that Self-Blame and PSS were moderately correlated. As a result, the independent variables were entered in as they were to isolate the unique effect of Self-Blame on PEMS separate and apart from Age and PSS.

The full model of Age, PSS, and Self-Blame to predict PEMS (Model 2) was statistically significant, $R^2 = .189$, $F(3, 426) = 33.177$, $p < .001$, adjusted $R^2 = .184$. The addition of Self-Blame to the prediction of PEMS (Model 2) led to a statistically significant increase in R^2 of .045, $F(1, 426) = 23.411$, $p < .001$.

Correlations between multiple regression variables are reported in Table 5 and regression statistics are reported in Table 6.

Table 5. *Summary of Pearson's Correlation Analysis for Full Survey.*

	Age	PSS	Self-Blame	PEMS
Age	---	-.216***	-.277***	-.213***
PSS		---	.494***	.354***
Self-Blame			----	.379***
PEMS				---

Note. Analysis conducted with standardized measures (z-scores); *p < .05, **p < .01, ***p < .001.

Table 6. *Summary for Hierarchical Multiple Regression Analysis for Variables Predicting PEMS (N = 430).*

	PEMS					
	Model 1			Model 2		
Variable	B	SE_B	β	B	SE_B	β
Age	-.143**	.046	-.143	-.099*	.046	-.099
PSS	.323***	.046	.323	.210***	.050	.210
Self-Blame				.248***	.051	.248
R^2	.145			.189		
F	36.162***			33.177***		
ΔR^2	.145			.045		
ΔF	36.162***			23.411***		

Note. Analysis conducted with standardized measures (z-scores); *p < .05, **p < .01, ***p < .001.

Race Groups

Linearity, homoscedasticity, multicollinearity, extreme values, and normality were assessed for each race group separately via the same methods used for the original hierarchical multiple regression with the full survey sample. All assumptions of hierarchical multiple regression were met.

The full model (Model 2) of Age, PSS, and Self-Blame to predict PEMS for African Americans was statistically significant, $R^2 = .108$, $F(3, 131) = 5.268$, $p < .01$, adjusted $R^2 = .087$, though none of the predictors alone made a statistically significant contribution to the model.

Additionally, Age, PSS, and Self-Blame statistically significantly predicted PEMS (Model 2) for Latinas, R^2 of .223, F(3, 118) = 11.300, $p < .001$, adjusted $R^2 = .203$; and Whites, R^2 of .273, F(3, 158) = 19.733, $p < .001$, adjusted $R^2 = .259$. The addition of Self-Blame to the prediction of PEMS (Model 2) led to a statistically significant increase in R^2 of .034, $F(1, 118) = 5.109$, $p < .05$, for Latinas; and R^2 of .063, $F(1, 158) = 13.679$, $p < .001$, for Whites.

Regression coefficients indicate that Self-Blame ($B=.284$) was more of an influence than PSS ($B=.227$) on PEMS for White overweight/obese women. Self-Blame ($B=.247$) was less of an influence than PSS ($B=.316$) on PEMS for Latina overweight/obese women.

A final hierarchical multiple regression that included interaction terms comprising dummy-coded race group variables and the Self-Blame predictor variable was conducted to determine whether Self-Blame coefficients for each race group were statistically significantly different from one another. None of the differences in the Self-Blame coefficients were statistically significantly different when compared across race groups.

Correlations between multiple regression variables are reported in Table 7 and regression statistics are reported in Table 8.

Table 7. *Summary of Pearson's Correlation Analysis by Race Groups.*

	Age	PSS	Self-Blame	PEMS
African American				
Age	---	-.265**	-.155	-.187*
PSS		---	.409***	.269**
Self-Blame			---	.248***
PEMS				---
Latina				
Age	---	-.052	-.258**	-.163
PSS		---	566***	.412***
Self-Blame			---	.411***
PEMS				---
White				
Age	---	-.229**	-.346***	-.275***
PSS		---	.519***	.419***
Self-Blame			---	.467***
PEMS				---

Note. Analysis conducted with standardized measures (z-scores); *p* < .05, **p* < .01, ***p* < .001.

Table 8. *Summary for Hierarchical Multiple Regression Analysis for Variables Predicting PEMS by Race Groups.*

Variable (*Mean, SD*)	Model 1			Model 2		
	B	*SE$_B$*	*β*	*B*	*SE$_B$*	*β*
African American						
Age	-.134	.093	-.125	-.125	.092	-.117
PSS	.221**	.081	.236	.162	.087	.173
Self-Blame				.164	.094	.159
R^2	.087			.108		
F	6.262**			5.268**		
ΔR^2	.087			.021		
ΔF	6.262**			3.083		
Latina						
Age	-.148	.087	-.142	-.093	.089	-.089
PSS	.463***	.095	.404	.316**	.114	.276
Self-Blame				.247*	.109	.232
R^2	.190			.223		
F	13.914***			11.300***		
ΔR^2	.190			.034		
ΔF	13.914***			5.109*		
White						
Age	-.178*	.068	-.189	-.109	.068	-.116
PSS	.364***	.070	.376	.227**	.077	.234
Self-Blame				.284***	.077	.305
R^2	.210			.273		
F	21.079***			19.733***		
ΔR^2	.210			.063		
ΔF	21.079***			13.679***		

Note. Analysis conducted with standardized measures (z-scores); *p* < .05, ***p* < .01, ****p* < .001.

Linearity, homoscedasticity, multicollinearity, extreme values, and normality were assessed for each educational attainment group separately via the same methods used for the original hierarchical multiple regression with the full survey sample. All assumptions were met except for three outliers in the Bachelor's Degree group. Each outlier was inspected and ultimately retained.

For educational attainment groups Age, PSS, and Self-Blame to predict PEMS (Model 2) was statistically significant for Bachelor's Degree, R^2 = .263, $F(3, 217)$ = 25.799, $p < .001$, adjusted R^2 = .253; and No Bachelor's Degree, R^2 of .135, $F(3, 205)$ = 10.624, $p < .001$, adjusted R^2 = .122. The addition of Self-Blame to the prediction of PEMS (Model 2) led to a statistically significant increase for both Bachelor's Degree, R^2 of .065, $F(1, 217)$ = 19.103, $p < .001$; and No Bachelor's Degree, R^2 of .030, $F(1, 205)$ = 7.154, $p < .01$.

Regression coefficients indicate that the effect of Self-Blame on PEMS is greater for overweight/obese women in the Bachelor's Degree group (B=.299) than for overweight/obese women in the No Bachelor's Degree group (B=.204). A follow-up hierarchical multiple regression that included an interaction term comprising a dummy-coded Bachelor's Degree variable and the Self-Blame predictor variable was conducted to determine whether Self-Blame coefficients for each educational attainment group were statistically significantly different from one another. None of the differences in the Self-Blame coefficients were statistically significantly different when compared across educational attainment groups.

Correlations between multiple regression variables are reported in Table 9 and regression statistics are reported in Table 10.

Table 9. *Summary of Pearson's Correlation Analysis by Educational Attainment Groups.*

	Age	PSS	Self-Blame	PEMS
Bachelor's Degree				
Age	---	-.162*	-.224**	-.220**
PSS		---	.458***	.417***
Self-Blame			---	.438***
PEMS				---
No Bachelor's Degree				
Age	---	-.278***	-.324***	-.192**
PSS		---	.528***	.303***
Self-Blame			---	.325***
PEMS				---

Note. Analysis conducted with standardized measures (z-scores); *p* < .05, **p* < .01, ***p* < .001.

Table 10. *Summary for Hierarchical Multiple Regression Analysis for Variables Predicting PEMS by Educational Attainment Groups.*

Variable (*Mean*, *SD*)	B	SE_B	β	B	SE_B	β
		PEMS				
		Model 1			Model 2	
Bachelor's Degree						
Age	-.147*	.057	-.157	-.105	.056	-.113
PSS	.388***	.061	.392	.263***	.065	.266
Self-Blame				.299***	.068	.291
R^2	.198			.263		
F	26.912***			25.799***		
ΔR^2	.198			.065		
ΔF	26.912***			19.103***		
No Bachelor's Degree						
Age	-.125	.074	-.117	-.082	.074	-.077
PSS	.270***	.069	.270	.171*	.077	.171
Self-Blame				.204**	.076	.210
R^2	.104			.135		
F	12.001***			10.624***		
ΔR^2	.104			.030		
ΔF	12.001***			7.154**		

Note. Analysis conducted with standardized measures (z-scores); *p* < .05, **p* < .01, ***p* < .001.

6.2.3 Eliminating Self-Blame Over Time

Four interview participants who were in the midst of experiencing reduced ESRE behavior—and in some cases weight loss—ascribed some of their success to "being kinder" to themselves, and thus reducing self-blame. One participant who was engaging in healthier eating behaviors and steadily losing weight described how she shifted from being *"down on [her]self"* to being more positive: *"I'm not being negative because that's not something…that's going to work."* (P7)

For some participants, being more positive toward themselves was effected through setting realistic expectations in all areas of their lives. As one participant described, an important part of her weight loss process was letting go of perfectionist tendencies: *"Learning to forgive that I'm not perfect and I'm not going to be perfect."* (P12) Another participant who experienced gradual weight loss over time kept a reminder to be "*kinder to [her]self*" in the form of a tattoo. (P4) The participant explained the meaning of her tattoo that incorporated the words *"Let yourself be human:"* *"I'm not big into self-punishment for ways that I'm failing…we don't need to beat ourselves up…so I stopped doing that."* (P4)

Participants widely acknowledge that realizing the connection between treating themselves well and improved eating behavior and weight loss was learned over time, through life experiences. One participant compared herself in her 20s to her current self in her 40s: *"I was so hard on myself, really hard on myself…I've got battle scars and everything now. But I wouldn't trade the knowledge…being so hard on yourself, you're just not going to get anywhere."* (P1) She went on to share advice to anyone who struggles with ESRE: *"There's not a diet…there's not an exercise program, there is absolutely nothing that will be longstanding and long lasting until you start being kind to yourself and love yourself."* (P1) (See Figure 11. *"Be kind to yourself you're doing the best you can." Displaying placard in office as a reminder that it is important to be kind to yourself. (P1)*))

Figure 11. *"Be kind to yourself you're doing the best you can." Displaying placard in office as a reminder that it is important to be kind to yourself. (P1)*

6.2.4 HIT and Feelings of Failure

Participants cautioned that HIT could exacerbate feelings of failure. One participant commented that HIT, particularly that which utilizes food tracking, may be problematic for users prone toward self-blame: *"It opens up the ability to feel like you've failed or done something wrong when you don't stick to the regimen, you don't stick to the plan."* (P14) For some participants, this sense of failure then leads them to abandon using HIT to track their food intake, at least in the short term. One participant explained why she will stop using HIT food tracking for a day when she knows she has exceeded her daily calorie goal, *"I already know that I went over. Why even bother?...I feel a sense of I've already messed up, I've already failed."* (P2)

Additionally, participants suggested that HIT designed for weight management should be careful in how it indicates the need for behavioral modification. For instance, participants thought HIT should provide social support to users without inducing guilt. As one participant explained, *"Everything else in the world guilts you for being who you are...there's some form of guilt associated with you existing in the world, sadly, and [the HIT] definitely can't have that sort of association with what you're doing, and particularly with*

food. You got to eat to live, you can't be guilty about it."(P7) Additionally participants warned against the potentially negative tone in which HIT might communicate with them. As one participant shared, if HIT were to message that she should be mindful in her eating, she would respond, *"Yeah, fuck off,"* because as she noted, *"guilt in the moment doesn't really completely work on me."* (P3)

6.3 Discussion

This research, which comprises an interview study (*N* = 22) and survey study (*N* = 430), describes and shows how overweight/obese women's self-blame is connected to stress and sometimes leads to use of ESRE as a coping method. Self-Blame arises through a variety of interactions that occur through work, personal relationships, and weight management activities. Analysis of survey data (*N* = 430) shows that self-blame is not a statistically significant predictor of ESRE behavior for African American women, but is for overweight/obese women generally, Latina and White overweight/obese women, and across educational attainment groups of overweight/obese women. Overweight/obese women in the interview study find greater success in weight management when they engage in less self-blame and practice being kinder to themselves in the form of more positive self-talk. Participants warn that food tracking features in HIT can contribute to self-blame and subsequent disengagement with the tool because it is a salient reminder when they have not followed their eating plan. Additionally, participants desire HIT that does not induce guilt when it indicates or suggests the need for behavioral modification.

The results from this study suggest that overweight/obese women who engage in ESRE behavior could benefit from addressing self-blame for an improved weight management health outcomes. Additionally, while there are some differences in the way self-blame plays a role in ESRE for different subgroups of overweight/obese women, the distinctions are generally slight. This and related HIT design implications are discussed further here.

6.3.1 Self-blame, Stress, and ESRE are Connected

Interview study participants report a connection between self-blame, stress, and ESRE. Self-blame affects the way participants appraise stressful situations whether in context of work, personal relationships, or weight loss efforts. At times, when they encounter stressors, their coping response is to blame themselves and explain the problem, in part, as resulting from a personal failing. In some cases, this self-blame consequently leads participants to ESRE.

The foregoing description elicited from interviews was corroborated by a statistical analysis of the survey data. First, correlation analysis of the survey data shows a moderately positive correlation between Self-Blame and PEMS (i.e., the ESRE measure in the study) scores.

Regression analysis for the full survey sample shows that PSS and Self-Blame are statistically significant predictors of PEMS. The addition of Self-Blame to the prediction of PEMS (Model 2) has a statistically significant increase in R^2, though the increase is small as is the R^2 relatively low at .189. Furthermore, regression analysis shows Self-Blame contributes slightly more to PEMS prediction than PSS (i.e., the stress measure in the study). These results suggest that Self-Blame is one of many variables that predicts PEMS, and that PSS is almost as good a predictor of PEMS as Self-Blame is. To the author's knowledge, there are no published studies that test whether PSS, Self-Blame, or any other Brief COPE measures predict PEMS. Tangentially related to the current study, Boggiano et al. (2017) found that PEMS had a statistically significant correlation with stress measures vis-à-vis subscales in the Perceived Stress Reactivity Scale. Results from the current study, however, further suggest that PEMS is affected just about as much by the stress a person experiences as by the self-blame coping response a person has to that stress.

6.3.2 Self-Blame, PSS, and PEMS in Group Analysis
Race Groups

Survey data indicates that the connection between self-blame, stress, and ESRE differs by race group. There is insufficient evidence from the regression analysis to indicate there is a statistically significant difference between Whites and Latinas in terms of

the extent to which either PSS or Self-Blame is a predictor of PEMS. Based on the magnitude and direction of the association, there is evidence, however, that Self-Blame is a greater influence on PEMS than PSS for White overweight/obese women. Additionally, there is evidence based on the magnitude and direction of the association that PSS is a greater influence on PEMS than Self-Blame for Latina overweight/obese women. This suggests that for Latinas, unlike the full survey sample, PEMS is affected more by the stress they experience than by the self-blame coping response they have.

Additionally, survey data analysis shows that African American overweight/obese women may experience self-blame differently than their White and Latina counterparts. Latinas and Whites had a higher correlation between Self-Blame and PEMS than African Americans. ANOVA and T-Test analysis also show that Latinas had statistically significantly higher PSS and Self-Blame scores than African Americans. Furthermore, while the full model (Model 2) of Age, PSS, and Self-Blame predicting PEMS for African Americans was statistically significant, none of the predictors alone made a statistically significant contribution to the model. This is in contrast to the results for White and Latina women for whom both PSS and Self-Blame made a statistically significant contributions to the model.

This result for overweight/obese African American women could be due to collinearity between PSS and Self-Blame in African American women. Collinearity could have resulted from the way Self-Blame and PSS were measured. It is unclear which kind of self-blame (i.e., behavioral or characterological) or the context in which the blame is being made (e.g., weight management-related or other context) that respondents had in mind when they were completing the survey. Consequently, each group could engage in self-blame, but the blame focus and context could differ, thereby leading to these results. Additionally it is possible that the distinctions between PSS and Self-Blame as predictors of PEMS in overweight/obese African American women could be detected by analysis of these variables in a larger sample.

Educational Attainment Groups

Bachelor's Degree had higher correlations between Self-Blame and PEMS and PSS and PEMS than No Bachelor's Degree. ANOVA and T-Test analysis, however, found no statistically significant educational attainment group differences between Self-Blame or PSS. Additionally, results from regression analysis were in line with those for the full survey sample; PSS and Self-Blame are statistically significant predictors of PEMS. To the author's knowledge, there are no published studies that examine the predictors of PEMS in light of educational attainment differences. While previous research indicates obesity prevalence varies by education level (Flegal et al., 2016), the current study's findings suggest there are no differences in the overall relationship between stress, self-blame coping, and ESRE by education level among overweight/obese women.

Self-Blame and BMI

While the correlational analysis did not find a direct association between BMI and Self-Blame in this sample, it is possible that Self-Blame may play some role in overweight/obese women's BMI. The survey study sampled overweight and obese women. It possible that a wider range of BMIs in a different study sample may detect relationships between BMI and other measures. As such, the spread of BMIs may not have been large enough to detect fine grain relationships between BMI and other measures. A statistically significant correlation between BMI and Self-Blame may be found if a wider span of BMIs is studied.

6.3.3 Implications for HIT Design
Tailoring and Targeting

Although PSS and Self-Blame were generally found to make a statistically significant contribution to predicting PEMS in the various regression analyses, there were some group differences. Such differences could be important when designing HIT for weight management that will be used by overweight/obese women who engage in ESRE. For instance, just-in-time-adaptive interventions (JITAIs), which deliver interventions that adapt to the user's "internal state and context, " provide each user with a highly tailored experience to best meet their needs (Nahum-Shani et al., 2016). JITAIs push interventions

to users based on a range of tailoring variables that tend to be dynamic and changing over time (e.g., emotional state, physical location, number of snacks eaten in a certain time period). Baseline variables such as race, age, and affective traits may also be useful, however, for interpreting tailoring variable measures and determining which interventions to deploy. As a result, understanding the nature of ESRE and how it may differ between different groups is potentially beneficial for tailoring HIT to individual users.

Additionally, understanding group differences would help helpful for targeting HIT interventions to particular populations. The current findings suggest that there are differences in how African American overweight/obese women engage self-blame as it relates to ESRE. While this relationship needs to be studied further before any definitive conclusions can be drawn, it indicates that there are group differences that may be useful to take into account when attempting to design effective HIT systems for users.

Feelings of Failure and HIT Design and Content

Participants recommend that HIT designed to address ESRE behavior in overweight/obese women take care to not make users feel like they have failed. Doing so could provoke feelings of self-blame where users ascribe their shortcomings to some fundamental characteristic they lack. Additionally, participants recommend that HIT not induce guilt when supporting or promoting behavior modifications with users. Guilt, which results from a person's negative self-evaluation when they have done something wrong, is often used interchangeably with the separate and distinct concept of shame, which results from a person's negative self-evaluation of their "entire self" (Tangney, 1990). While it is unclear whether participants were interchangeably using the psychological construct of "guilt" and "shame" as often happens in colloquial use of the terms, they make the broader point that they do not want to have feelings of failure or to otherwise feel bad about themselves when interacting with HIT for weight management. Participants' concerns support suggestions by previous researchers that food tracking tools be designed in such a way to lessen or altogether avoid making users feel excessively bad about exceeding daily calorie limits (Cordeiro et al., 2015; Eikey & Reddy, 2017). As participants in this current study suggest, self-blame (attribution of failure to an innate characteristic), guilt (negative

self-evaluation of behavior), and shame (negative self-evaluation of self) all lead to the same result; they make the HIT tool less desirable to use, which in turn makes it more difficult to retain any given user over a longer period of time. These considerations should be taken into account by current HIT and technology yet to be developed.

Finally, four interview participants report that their weight management efforts became more successful once they minimized self-blame and took on a more positive and nurturing attitude toward themselves. As they noted, they learned this over time. This seemed to be supported by survey data analysis that shows Self-Blame is negatively associated with Age. This suggests that HIT for weight management could support users by encouraging reflection on what users have learned over time through their own weight management journey. Most users have multiple experiences trying to lose weight. Encouraging them to learn from what has worked and what has not worked in the past could be valuable. Such insights may come more naturally to some people than others; HIT could play a role in spurring on this kind of insight for all users. Prompts could ask users to create a timeline of their weight management experience over the course of their lifetimes. Additionally, users could be asked to match or collect images that describe their weight management experiences; such an activity could allow for users to relate their experiences in an abstract manner that may feel less threatening than a more direct approach. Users could be pushed positive, affirming messages that help them feel good about themselves and how far they have come in their journey, which in turn may inspire greater kindness toward themselves. Finally, a peer-based information exchange could be set up to support the sharing of personal stories and practical tips from overweight/obese women who have learned to minimize self-blame in their own lives (Veinot, 2010). In this way users could potentially learn from others about the need for and how to be kinder to themselves. Current technology would be able to support the design recommendations enumerated here.

6.4 Limitations

This chapter comprises data and analysis from a mixed-methods research approach. The interview study, which included 22 interviews, provides in-depth descriptions of the relationship between self-blame and ESRE. The survey study, which corroborated participant descriptions of the relationship between self-blame and ESRE, extended the interview findings to a larger sample. It is noted, however, that although the survey study (N = 430) findings were generalizable to a sample larger than the interview study sample, the survey study did not have a representative sample of overweight/obese women in the United States. More specifically, a quota sampling method was used for a large bulk of the survey participants (n = 349) through which BMI, race/ethnicity, and education level were stratified; the quotas were used to gather responses from a relatively diverse sample rather than to gather responses from a sample that was representative of the United States population.

Selection bias was a concern for both the interview and survey study in that certain types of people may have been more inclined to participate than others. The interview study likely attracted participants who were interested in discussion their ESRE experiences; women who experienced greater self-blame, guilt, or shame with their ESRE may have not opted to participate. Additionally, the bulk of survey participants came from a Qualtrics panel that was administered online. Even though respondents were sampled in such a way to obtain racial/ethnic and educational level diversity, they all had access to digital tools and knew how to use them. As a result, these participants may have greater resources than other similarly-situated women who are not part of an online survey panel. There was an attempt to mitigate these concerns by also administering the survey in-person via a paper format.

Another limitation to this study was that participant descriptions of their experiences with HIT may have been primed by their use of the *Lose It!* smartphone app for 10 days before their interview. This experience may have skewed their sense of how self-blame and guilt (or shame) could occur through use of HIT. For instance, if their primary point of reference was that of a food tracking tool such as *Lose It!*, they may not have been

able to fully articulate concerns that could arise from using other types of technologies focused on food, eating, and stress reduction.

Additionally, the scope and nature of the study findings are at least partly result of the research methodology used for the study. Using a cross-sectional research design for both the interviews and surveys limited the ability to understand causation. While the study overall provides observations, it is unclear whether certain behaviors have causal relationships with one another. For instance, a longitudinal survey would allow for the tracking of BMI, stress, and ESRE over time to identify whether participants with greater prevalence of ESRE also experienced increased BMI over an extended time span. While the results of such a study would not absolutely prove existence of a causal relationship, it would begin to inform a general understanding of it. Notwithstanding this limitation, the current study provides a foundation for points of departure for future research efforts (see Section 7.3 Further Research).

6.5 Conclusion

This study found that PEMS is predicted by PSS and Self-Blame in overweight/obese women. While this relationship held up in regression analysis by educational attainment group, there were some differences found between race groups. Understanding such differences could be beneficial for tailoring and targeting HIT. Additionally, HIT should support users reflecting on their past weight management experiences so they can learn from it, and support them in "being kinder" to themselves. Finally, HIT should take care to not to guilt (or shame) or make users feel as though they have failed lest it promote self-blame or negative emotions, which is counterproductive for weight management efforts.

CHAPTER 7. CONCLUSION

Previous chapters described a convergent parallel mixed methods research study that aimed to provide guidance for the development of HIT designed for overweight/obese women who engage in ESRE. The overarching framework of the Transactional Model of Stress and Coping, which describes stress and coping as a dynamic process (i.e., person-environment-appraisal-coping effort-adaptational outcome), organized this research.

This chapter summarizes the three papers (i.e., Chapters 4- 6) that comprise this dissertation thesis, highlights contributions, and comments on limitations and areas for future research.

7.1 Findings and Contributions

This dissertation research explored the lived experience of ESRE in overweight/obese women, the perceived support needs of overweight/obese women who engage in ESRE, and the relationship between the coping responses of self-blame and ESRE. This was accomplished through three chapters further summarized here.

7.1.1 Chapter 4 – The Lived Experience of ESRE

This chapter asked the following research questions:

RQ 1: What is the lived experience of women who engage in ESRE?

RQ 2: How can information technology for weight management be designed to address ESRE in overweight/obese women?

Findings

       This paper found that overweight/obese women encounter stressors that vary in time duration and severity; notably this includes stressors related to serving as caretakers and social support providers. Additionally, they used food as a coping response to the stress they encounter. Furthermore, some have characteristics that make them particularly vulnerable to ESRE behavior. Finally, they tend to associate food with social support.

       These findings suggest that directly addressing the stressors that lead to a coping eating response could potentially be an effective way to address ESRE behavior. Preventing ESRE once a person is in the midst of a coping response proves very difficult to overcome. As a result, overweight/obese women who engage in ESRE should actively engage in self-care as preemptive protective action against the onset of ESRE behavior. Such self-care is particularly important for individuals with the personal vulnerability of depression or anxiety. This paper also found that it is critical for overweight/obese women who engage in ESRE to reconceptualize their relationship with food, particularly in ways that address their conflicted, love-hate relationships with food, which they thought about as if it were a person. It should also seek to address the deep association between food and social support experienced particularly among African American, Latina women, and those whose families were recent immigrants. Although deep-rooted attitudes about food may be difficult to overcome, greater emphasis on food for nutrition's sake could be helpful.

HIT Design Implications

Current and future HIT should be designed to increase awareness of stress levels and negative affect. Additionally, it should assist users in transitioning their attitude of food to one that emphasizes the nutritional sustenance over strong associations with social support.

Contributions

This paper's contribution is that it filled a gap in the literature by using an interpretivist approach to understand the ESRE experiences of overweight/obese women. This permitted insight into previously-undescribed aspects of the experience including the anthropomorphizing of food and stress related to caregiving and social support providing. Additionally, this paper provided a first-hand description of the connection between depression and anxiety and ESRE, which is found in literature that analyzes survey data. Furthermore, the paper related this lived experience to HIT design, and highlighted ESRE behavior in context of socioeconomic factors.

7.1.2 Chapter 5 – Perceived Support Needs

This chapter asked the following research questions:

RQ 3: What do overweight/obese women perceive to be their support needs regarding their ESRE behavior?

RQ 4: What challenges do overweight/obese women who engage in ESRE experience in using existing information technology focused on weight management via eating behavior modification?

Findings

This paper found that overweight/obese women who engage in ESRE need to be supported in both the acute and chronic dimensions of their ESRE behavior. In terms of the acute aspects of ESRE, they need instrumental support for eating awareness in the moment as they are making food choices that could be ESRE. The second acute need they have is instrumental support in the form of a just-in-time distraction intervention to prevent them from engaging in ESRE. As for the chronic dimension of ESRE, they need support with holistic goals and motivation to address their ESRE behavior over the long term. The chronic form of ESRE also creates a need for emotional support for encouragement in weight loss efforts. Informational support for appraisal is needed to understand ESRE and change thought patterns for lasting behavior change.

HIT Design Implications

Current HIT is particularly lacking in allowing for overweight/obese women who engage in ESRE to identify and monitor holistic goals that extend beyond physiological measures such as weight. It can better meet the needs of overweight/obese women who engage in ESRE by allowing for more self-experimentation opportunities, particularly as an alternative to understanding behavior outside of food tracking, which is likely only to be used in the short term (Karkar et al., 2016). Finally, HIT can meet the needs of overweight/obese women who engage in ESRE by allowing for more tailoring, especially to allow inclusion of holistic goals, that are intrinsically motivated and have immediate benefits, and that may differ widely from user-to-user. Current technology is capable of providing this support to users.

Contributions

This paper's contribution is that it filled a gap in the literature by using an interpretivist approach to understand how overweight/obese women who engage in ESRE articulate their support needs, and react to commonly features available in HIT applications focused on weight loss. Additionally, it elicited feedback from overweight/obese women on the design of current HIT. This feedback highlighted the shortcomings of the current self-tracking paradigm used in many HIT applications, suggesting a need for many features extending beyond self-monitoring and feedback.

This research suggests new ways of framing goals to make them more salient for overweight/obese women, a finding that has not previously been identified in the literature focused on ESRE. Additionally, the role of pleasant distractions of diverse origins highlighted a potential form of intervention beyond those available in current applications. The importance of additionally tailoring according to the type of motivational messages provided was also a novel contribution. The use of HIT to address ingrained thought patterns is also a potentially new approach that could be offered in HIT specifically geared towards ESRE.

7.1.3 Chapter 6 – Self-Blame and ESRE

This chapter asked the following research questions:

RQ 5:   What is the relationship between self-blame as a coping response and eating behavior in overweight/obese women?

RQ 5.1: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, it at all, by race group?

RQ 5.2: How does the relationship between self-blame as a coping response and eating behavior in overweight/obese women differ, if at all, by educational attainment group?

RQ 6:   Which information technology coping support features would be appropriate for particular subgroups of overweight/obese women?

Findings

This paper found that stress and self-blame contribute to ESRE behavior. Differences were found between racial groups in terms of the relative influence stress and self-blame had on ESRE. More specifically, White women's ESRE is more influenced by feelings of self-blame than stress. Latinas' ESRE is more influenced by their stress than it is by their self-blame. There is insufficient evidence from the regression analysis to indicate a statistically significant difference in how stress and self-blame predict ESRE in Whites and Latinas. The regression analysis, however, suggests that Self-Blame is a greater influence on PEMS than PSS for White overweight/obese women. It also shows that PSS may be a greater influence on PEMS than Self-Blame for Latina overweight/obese women. This suggests that for Latinas, unlike the full survey sample, PEMS is affected more by the stress they experience than by the self-blame coping response they have. Additionally, predictors of African American women's ESRE was challenging to measure; these difficulties could suggest that stress and self-blame for African Americans is highly correlated.

HIT Design Implications

        Findings suggest that HIT for weight management should consider the user's potential tendency to engage in self-blame. These concerns should be reflected in the content and design of HIT interfaces, as well as in messages to users that should avoid evoking feelings of guilt and related self-blame. Additionally, HIT should support users in reflecting on their past weight management efforts to learn from their own experiences. Finally, knowledge of group differences in terms of how stress and self-blame affect ESRE could help inform HIT that seeks to either tailor experiences to individuals or target interventions to particular socioeconomic groups. These considerations should be accounted for in HIT currently available and that developed in the future.

Contributions

        This paper's contribution is that it applied the concept of self-blame, which is often discussed in relation to clinical eating disorders, to a sample of overweight/obese women of whom 96.3% are not diagnosed with an eating disorder. Additionally, this paper explored the differences between select race groups and educational attainment groups on the dimensions of stress, self-blame, and ESRE. To the author's knowledge, this was also the first study to specifically examine how issues of self-blame could be taken into account in design, by avoiding messages that could be perceived as guilt (or shame)- or blame-inducing, and by supporting users in developing an attitude of care towards themselves. Building on the framework of peer-based information exchange, personal stories from overweight/obese who have learned to care for themselves, along with practical tips, might be an effective approach for addressing these issues. This holds particular promise given interview participants' enthusiasm for sharing of support with people who have shared their struggles.

7.2 Limitations

        The interview study comprises ethnographic interviews with 22 individuals. As a result, the generalizability of its findings is limited. Nonetheless, interviews were stopped only once saturation was reached, suggesting that similar patterns of responses may be found with a larger sample. Additionally, the study required interviews in which personal

questions were asked about stress, eating behaviors, and weight. There may have been selection bias according to which individuals were willing to share such intimate details with a researcher; such individuals may have already been motivated to reflect upon their eating behavior and to take steps to change it.

Additionally, participant descriptions of their experiences with HIT may have been affected by using the free version of *Lose It!* smartphone app prior to their interview. More specifically, as the free version of the *Lose It!* app had less robust meal planning tools and social features, it may have skewed participant reporting of support needs and HIT experiences. Furthermore, the *Lose It!* app's emphasis on food tracking may have primed responses that did not fully consider the way in which other forms of HIT (e.g., intelligent personal assistants) may induce self-blame or guilt (or shame). Notwithstanding these limitations, the *Lose It!* app was selected because it is a popular weight management app in the consumer market that was accessible to study participants. Furthermore, it provided features that are commonly found in weight management apps that are widely available in the consumer market.

The survey study was administered in-person as well as through an online Qualtrics survey panel. While this allowed for a larger amount of responses to be collected in a relatively short period of time, there may have been selection bias in terms of the type of person who is interested in and able to serve on a survey panel. Of particular concern, Qualtrics respondents were individuals who had access to and the ability to use electronic devices connected to the Internet. The research design, however, attempted to mitigate this potential bias by recruiting in-person survey respondents for a paper administration of the survey. The in-person sample was particularly strong in recruiting African American women and women without a college education. As such, this work represents a more racially and educationally diverse sample than in much previous research, allowing for particular insights regarding the differential importance of family gatherings and social expectations in ESRE, as well as roles of self-blame in ESRE.

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Finally, the nature of the study findings was likely affected by the research methodology used. Both the interview and survey studies attempted to obtain relatively diverse samples, with particular attention to race/ethnicity and education attainment level. Although this ultimately allowed for the comparison between groups, it did not allow for in-depth understanding of each group alone. The cross-sectional research design used for both the interviews and surveys prohibited the ability to observe how participants cycled through various stages of ESRE over time. Additionally, it limited findings to observations and inhibited the ability to make findings related to causal relationships between stressors, coping, and ESRE. Notwithstanding the additional findings that would have likely resulted from a longitudinal study, this dissertation thesis research was time bound and had to be conducted within a timeframe best suited to a cross sectional research design.

7.3 Further Research

Further research in the following areas could be useful for a greater understanding of how to design HIT for overweight/obese women who engage in ESRE. Studies that interview women with a wider range of BMIs (i.e., healthy up through super obese) who engage in ESRE behavior could provide insight into the relationship between BMI and ESRE. Additionally, further research among a larger sample size and perhaps other or additional measures of stress, self-blame, and ESRE in African American would assist with a better understanding of how this group compares to Whites and Latinas on the same measures.

Furthermore, this study has highlighted potential new approaches to HIT design focused on eating, including novel intervention strategies and interaction designs. There is a need to specifically develop new technologies and to evaluate participants' responses to them through HCI methods including participatory design, technology probes, field deployments, and interventional studies.

7.4 Concluding Remarks

This dissertation thesis provides guidance for how to better design weight management HIT for overweight/obese women who engage in ESRE. HIT should be designed in such a way as to address the stress that triggers ESRE, before the eating coping

response is engaged. Additionally, it should address both the acute and chronic aspects of ESRE eating behavior. Finally, HIT should consider the user's potential coping response of self-blame in both the content presented to users and interface design features. There is significant promise for HIT design to address ESRE, if only we can listen clearly to the voices of women who engage in ESRE. This dissertation is an important step in helping these voices be heard.

Appendix A: Interview Screening Questionnaire

Block 1 - Study Information

PART 1: GENERAL RESEARCH STUDY INFORMATION (mHealth Support to Address Stress-Induced Eating in Women – University of Michigan IRB-HSBS eResearch ID HUM00110332)

What is the purpose of this study?

To understand how mobile technology can be designed to support women who engage in emotion- and stress-related eating.

What is involved for a participant in your study?

Participants will 1) use a popular smartphone app to track their eating for 10 days, 2) take 2-3 photos that express their relationship with food, 3) respond to 2 surveys (topics include stress, coping, eating behaviors, and technology use), and 4) participate in an interview that should take about 1.5 hours total.

Keep in mind that this study is best suited for women who have experience and are comfortable with using apps on their smartphone.

What location would a participant need to visit for your study?

The study can be completed either in-person in Ann Arbor, MI or via videoconference.

Does your study offer compensation to participants?

Yes, this study offers a $50 Amazon Gift Card (e-mail delivery) at the time of the interview.

Who can a potential participant contact about this study?
Name: Andrea Barbarin (PhD Candidate, University of Michigan-School of Information)
Email: andbar@umich.edu

Block 2 - Participant Information

PART 2: SCREENING QUESTIONNAIRE

If you are still interested in participating in the study, please answer the following

questions to determine your eligibility.

Email Address (to contact you about this study):

First Name

Last Name

What is your gender identity? (Select all that apply.)
Woman - Man - Prefer to self-describe:

Age:

What is your racial/ethnic identity? (Select all that apply)
American Indian or Alaska Native
Asian
Black or African American (non-Hispanic)
Latino or Hispanic
Pacific Islander
White or Caucasian (Non-Hispanic)
Other Identity Not Listed:

Are you fluent in English?
Yes No

Block 5 - Participation Behavior

Have you ever attempted to lose weight?
Yes No

Have you ever been diagnosed with an eating disorder?
Yes No

Are you concerned that you have a tendency to overeat food when feeling stress or

other negative feelings and that such eating is negatively impacting your health?
Yes No

Block 6 - Participation Ability

Do you own and use either an iPhone or Android smartphone?
Yes No

Are you able to track your food intake for 10 days with an app on your iPhone or

Android smartphone?
Yes No

Are you able to take two surveys (one ~15 minute survey before the interview, one ~5

minute survey at the interview)?
Yes No

Are you able to take 2-3 photos related to your relationship with food and email them?
Yes No

Where are you able to meet for an interview? (Check all that apply)

Site located at the University of Michigan School of Information in North Quad at 105
S. State St. in Ann Arbor, MI

Videoconference (you will be given a link that you can access via computer, tablet, or
smartphone)

Neither

What is your level of education? (Select highest level attained.)
Less than High School
High School Diploma or GED
Associate Degree
Bachelor's Degree
Master's Degree
Professional Degree
Doctorate Degree (PhD)

What is your occupation?

[   ]

Thank you for completing the screening questionnaire.

You will receive a response within 3-5 business days to confirm whether you can be enrolled in the study. If you qualify and we are able to enroll you as a study participant, you will receive an email with further instructions including links to electronic informed consent forms and surveys.

If you have questions in the meantime, please contact Andrea Barbarin (andbar@umich.edu).

Thank You,

Andrea Barbarin

Appendix B: Informed Consent to Participate in Interview Study

Study ID: HUM00110332IRB: Health Sciences and Behavioral Sciences Date Approved: 4/25/2016

Consent to Participate in a Research StudyPrincipal Investigator: Andrea Barbarin, Ph.D. Student,

School of Information, University of Michigan

Faculty Advisor: Tiffany Veinot, Associate Professor School of Information, University of Michigan

You are invited to be a part of a research study that will explore how adult women engage in stress-induced eating. The purpose of the study is to understand how mobile technology can be designed to support women who want to stop engaging in stress- induced eating and emotional eating. We are asking you to participate because you recently responded to a call for participation and indicated an interest in participating.

This study is being funded by the Rackham Graduate School, University of Michigan.

This study uses the Lose It! app, which was not developed by the study team.

The Lose It! app requires users to agree to their terms and conditions, which are available here; the study team did not develop those terms and conditions, and cannot change them.

You should review those terms and conditions before deciding whether to participate in this study. You should not take part in this study unless you feel comfortable with the terms and conditions that Lose It! has established.

PARTICIPATION

If you agree to be part of the research study, you will be required to do the following:

Complete two surveys.Take and email the Principal Investigator 2-3 photos that express your relationship with food.Download and use the Lose It! smartphone app to track your eating for at least 10 consecutive days. (You can view the Lose It! privacy policy here.)Make your Lose It! tracking logs and notes available to the Principal Investigator through her researcher account on the Ascend system.Allow the Principal Investigator to make copies of your Lose It! tracking logs and notes.Participate in one face-to-face interview (~1.5 hours) either via videoconference or at a public location of mutual convenience in Ann Arbor, MI to discuss your experiences with stress, eating, and weight management.Audiorecord your interview.

END OF PARTICIPATION:

When setting up your Lose It! account, you may choose whether you want to create a permanent account that you can continue to use after your participation in the study has ended, or a temporary (i.e., "throwaway") account that you can close at the end of your participation in the study.

At the end of the interview, the Principal Investigator will remove your Lose It! account as an account that is linked to her Ascend account.

Even if you close or delete data from your Lose It! account, LoseIt! may retain your data as described in their privacy and security policies. Additionally, even if the

Principal Investigator closes or deletes data from her Ascend account, Ascend may retain the data as described in their privacy and security policies.

BENEFITS AND RISKS OF PARTICIPATION:

While you may not receive a direct benefit from participating in this research, some people find tracking their food/drink intake and sharing their stories to be a valuable experience. We hope that this study will contribute to you becoming aware of and understanding how your eating behavior is shaped by the stress you may experience.

Answering questions or talking with others about stress triggers, weight loss, and eating behaviors can be difficult. You may choose not to answer any interview question and youcan stop your participation in the research at any time.

PARTICIPATION INCENTIVE:

You will be given a $50 Amazon Gift Card (delivered via email) upon completion of the interview. If you withdraw from either the pre-interview phase or interview phase of the study, you will not receive the $50 Amazon Gift Card incentive payment.

CONFIDENTIALITY & SECURITY (1 of 3):

We plan to publish the results of this study, but will not include any information that would identify you. This includes blurring or otherwise obscuring identifiable portions of photos that you take and email to the Principal Investigator. There is a risk that information you share during the study could be linked to your name. To protect your confidentiality, your name and any identifying information will be obscured or removed from any photos you email and your Lose It! tracking logs and notes. To protect your confidentiality, your name will not be used during the interview.

There are some reasons why people other than the researchers may need to see information you provided as part of the study. This includes organizations responsible for making sure the research is done safely and properly, including the University of Michigan.

CONFIDENTIALITY & SECURITY (2 of 3):

This study uses the following third-party applications: LoseIt!, and Ascend. Please review the privacy and security policies for each of those applications via the provided links:

LoseIt! Privacy Policy Ascend Privacy Policy

CONFIDENTIALITY & SECURITY (3 of 3):

To protect your information, any copies that the Principal Investigator makes of your Lose It! tracking logs and notes, as well as the digital recording of your interview, will be stored on secure servers approved by the University of Michigan to store sensitive data.

A written word-for-word digital copy of the interview discussion will be created by a professional transcriber. Transcribers will not have access to your name. Digital copies of the transcription will also be stored on secure servers approved by the University of Michigan to store sensitive data. The researchers will enter study data on a computer that is password-protected.

The researchers plan to keep this study data, including audio recordings and written transcripts, up to 2 years after the end of the study.

If you have questions about this research, including questions about the scheduling of your interview, your payment for participating, or data confidentiality and security, you

can contact:

Andrea Barbarin, Ph.D. CandidateUniversity of Michigan - School of Information 105 S. State Street, Ann Arbor, MI 48109 andbar@umich.edu

- Or -

Dr. Tiffany Veinot, Associate Professor University of Michigan - School of Information 105 S. State Street, Ann Arbor, MI 48109 tveinot@umich.edu

If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, University of Michigan, 2800 Plymouth Rd. Building 520, Ann Arbor, MI 48109, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu.

By signing this electronic form, you are agreeing to be part of the study. Participating in this research is completely voluntary. Please print a copy of this document for your records. Even if you decide to participate now, you may change your mind and stop at any time. Be sure that questions you have about the study have been answered and that you understand what you are being asked to do. You may contact the researcher if you think of a question later.

I read the privacy and security policies for the following third-party applications used in this research study: Lose It! and Ascend.

Name (text only) Date (mm/dd/yyyy)

I agree to participate in the study.

Name (text only) Date (mm/dd/yyyy)

I agree to allow the research team to use data from the Lose It! account I share with the researchers.

Name (text only) Date (mm/dd/yyyy)

I agree to have my interview with the researchers audiorecorded.

Name (text only) Date (mm/dd/yyyy)

Appendix C: Interview Protocol

PART 1: WEIGHT MANAGEMENT HISTORY/EXPERIENCES

1.) Tell me about your weight loss [management?] story.

- Think about the last time you tried to lose weight.
  - o How did you decide that you needed to try to lose weight?
  - o What did you do to try to lose the weight?
    - ▪ Did you use any tools or programs? (E.g., mobile apps, Weight Watchers, etc.) If so, which ones?
    - ▪ What did you like the most about it? What did you dislike the most about it?
    - ▪ [If not still trying to lose weight]: Why did you stop what you were doing?
    - ▪ Did you end up regaining any of the weight you lost?
    - ▪ Overall, did you have a good experience with trying to lose weight?
- What is a particularly **GOOD / BAD** experience you have had trying to lose weight? (cycle through good and bad separately)
  - o Did you use any tools or programs? (E.g., mobile apps, Weight Watchers, etc.) If so, which ones?
    - ▪ What did you like the most about it? What did you dislike the most about it?
  - o How many times over your life have you tried to lose weight?
    - ▪ Have you ever regained the weight you loss?
    - ▪ Did you do anything different at those other times in which you lost weight?
  - o Would you currently like to lose weight?

2.) If regained weight: Why do you think you regained the weight?

- If response related to exercise: What has happened for you that you don't you [do that activity (e.g., exercise more, do a different kind of exercise, etc.)]? If response related to eating: What has happened for you that you don't you [do that activity (e.g., eat less, eat healthier food, eat more often, etc.)]?

- What gets in the way of meeting your weight loss goals?

3) We've talked a fair bit about your experiences with weight loss already.

- Now thinking about weight loss more generally, what comes to your mind when you hear the term "weight loss"?

- How would you describe your relationship with food? Let's take a look at the photos you emailed me. (Review photos together.)

PART 2: STRESS
4.) Tell me about the last time you felt stressed.

- What was the situation?
  - How did you handle the situation?
    - What did you do? Did you try to make yourself feel better?
  - How typical is that situation for you?
- Are there situations that you experience on a regular basis that you find stressful? (Draw examples from *Perceived Stress Scale* Responses)
- Are there any stressful experiences that have been going on for a long time? Tell me about that--what's an example of one?
- Are there any people in your life who tend to make you feel stressed?
- How do you know that you are stressed? What did the stress feel like in our body?
- Can you think of ways to manage the stress you feel? (Draw examples from *Brief COPE* Responses)
  - Do you try to do these things? Why/Why not?

5.) Does your eating behavior change at all when you feel stress? (Draw examples from *PEMS* Responses)

- Do you eat more/less? Do you tend to eat certain foods?

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- o Is there anything you could do to stop [the eating behavior (e.g., over-eating, eating high-density foods)] when you feel stressed?
  - ▪ Do you try to do these things? Why/Why not?
- On your ***PEMS*** you answered [xxxx] to the question about [xxxxx]. Do you have an example of how this happens in your life? When was the last time you remember this happening?
- Continue to ask for examples from the ***PEMS*** depending on survey results.

6.) Do you think the ways that you eat when you are stressed is a problem?
- Are you interested in changing this eating behavior?
  - o Is it behavior that you think you are capable of changing? Why or why not?
  - o Is anything standing in your way to making a change with your stress-related eating?
- Is there any information that you think could be helpful in changing how you eat when you are stressed?
- What advice would you give to someone who struggles with eating differently while stressed?

7.) Were you able to use **Lose It!** over the past two weeks?
- Could you give me a tour of **Lose It!** and show me the different features?
- How did you feel about using it? [Discuss the different features with the participant, ask questions: did you like this? was this confusing?]
  - o What did you like the most?
  - o What did you dislike the most?
  - o Did you ever get bored using it?
- Did you notice if **Lose It!** made you change any of your behavior?
  - o In what way?
- Did you think **Lose It!** is useful?
- What kind of person do you think would find **Lose It!** most helpful?
- Is there anything you would change about **Lose It!**? What?
- Do you think you will keep using **Lose It!**?
  - o How long do you think you would have used **Lose It!** if you were not in the study?

8.) If you were to design a mobile app to help women with eating related to stress, what features do you think would be the most helpful?

Appendix D: Interview Survey – System Usability Scale (10 items)

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

1. I think that I would like to use LoseIt! frequently
2. I found LoseIt! unnecessarily complex
3. I thought LoseIt! was easy to use
4. I think that I would need the support of a technical person to be able to use LoseIt!
5. I found the various functions in LoseIt! were well integrated
6. I thought there was too much inconsistency in LoseIt!
7. I would imagine that most people would learn to use LoseIt! very quickly
8. I found LoseIt! very cumbersome to use
9. I felt very confident using LoseIt!
10. I needed to learn a lot of things before I could get going with LoseIt!

Q_X CONSENT TO PARTICIPATE IN RESEARCH

Thank you for your interest in our study (mHealth Support to Address Stress-Induced Eating in Women – University of Michigan IRB-HSBS eResearch ID HUM00110332). Below you will find information about the study and what to expect if you decide to participate. Please read the following information to make an informed decision.

ELIGIBILTY

You are eligible for this study if you 1) identify as a woman, 2) you are 25 years or older, and 3) your BMI is 25 or higher (we will calculate this for you in the survey).

NON-PARTICIPATION STATEMENT

Your participation is voluntary. You may refuse to participate or withdraw at any time. You may also refuse to answer any question.

PURPOSE OF THE STUDY

The purpose of this study is to understand eating behavior, stress, coping behavior, and digital access and skills of adult women with a BMI of 25 or higher.

PROCEDURES

If you decide to participate, you will be answering a series of questions about yourself. This will take between 12 and 15 minutes of your time.

ANONYMITY

Participation is completely anonymous. No identifiers will be used as part of the data collection.

RISK/DISCOMFORTS
Although unlikely, it is possible that certain survey questions could cause emotional discomfort for some participants. If you experience any discomfort after your participation, you may contact the SAMHSA National Helpline at 1-800-662-HELP (4357) or < http://www.samhsa.gov/find-help/national-helpline>.

BENEFITS
While you will not directly benefit from participation, your participation may help investigators understand how to better design weight loss information technology for women.

PUBLICATION STATEMENT
The results of this study may be published in academic journals or conferences proceedings, but no individual participant will be identified.

MORE INFORMATION
If you have any questions concerning this project, you may contact Andrea Barbarin (Principal Investigator and University of Michigan School of Information PhD Candidate) at andbar@umich.edu -or- Tiffany Veinot (Faculty Advisor and University of Michigan School of Information Associate Professor) at tveinot@umich.edu. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, University of Michigan, 2800 Plymouth Rd. Building 520, Ann Arbor, MI 48109, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu.Once you have read the consent information above, please select one of the two options in the next section.

Q_XX Please select one of the following responses:
○ YES, I am a woman 25 years or older. Any questions I have about this study have been answered. I voluntarily agree to participate.
○ NO, I do not want to participate.
Condition: NO, I do not want to partic... Is Selected. Skip To: End of Block.

Ineligible Thank you for taking the time to answer our screening questionnaire. We appreciate your interest in this project. Unfortunately, based on your response you do not meet the eligibility requirements for this research study. Again, we thank you for your time and your interest. Regards, Andrea Barbarinandbar@umich.edu

Q_XXX PART 1: Eligibility Screening

Q_Uniq1 Do you currently live in the United States (50 states or District of Columbia)?
○ Yes
○ No

Q_Y What is your gender identity?
○ Woman
○ Man
○ Nonbinary / Gender non-conforming

Q1 Age

Display This Question:
    If What is your gender identity? Man Is Selected
    Or What is your gender identity? Nonbinary / Gender non-conforming Is Selected
    Or Age Text Response Is Less Than 25
    Or Do you currently live in the United States (50 states or District of Columbia)? No Is Selected

Q_bbb Based on your response you do not meet the eligibility requirements for this research study.   We thank you for your time and your interest.   Regards, Andrea Barbarin andbar@umich.edu

Q2 Your Height:
    Feet
    Inches

Q3 Your Weight (pounds):

Q4 Your BMI is: [Calculated BMI Display]

Q_XXXX PART 2: Background Information

Q5_1 What is your racial/ethnic identity? (Select all that apply)
- ❑ American Indian or Alaska Native
- ❑ Asian
- ❑ Black or African American (non-Hispanic)
- ❑ Latino or Hispanic
- ❑ Native Hawaiian or Pacific Islander
- ❑ White or Caucasian (Non-Hispanic)
- ❑ Other Identity Not Listed (fill in blank): _____

Q5_2 Please specify your Latino/Hispanic identity (select all that apply):
- ❑ Mexican/Mexican American
- ❑ Puerto Rican
- ❑ Other identity not listed (fill in blank): _____

Q6 What is the HIGHEST level of school you have completed or the highest degree you have received?
- ❍ 1st grade to 12th grade, no diploma
- ❍ High School Diploma or GED or equivalent
- ❍ Associate Degree
- ❍ Bachelor's Degree (Examples: BA, AB, BS, BBA)
- ❍ Master's Degree (Examples: MA, MS, MEng, MEd, MBA)
- ❍ Professional Degree (Examples: MD, DDS, DVM, JD)
- ❍ Doctorate Degree (Examples: PhD, EdD)

Q_XX PART 2: Background Information

Q5_3 Where were you born?
- ❍ United States (50 states or District of Columbia)
- ❍ U.S. territory (Puerto Rico, Guam, U.S. Virgin Islands, American Samoa, Northern Mariana Islands)
- ❍ Other Country (fill in blank): _____
- ❍ Don't know

Q5_4 Which U.S. territory were you born in?
○ Puerto Rico
○ Guam
○ U.S. Virgin Islands
○ America Samoa
○ Mariana Islands

Q5_5 How many years have you lived in the United States (50 states or District of Columbia)?

Q7_1 Where was your FATHER born?
○ United States (50 states or District of Columbia)
○ U.S. territory (Puerto Rico, Guam, U.S. Virgin Islands, American Samoa, Northern Mariana Islands)
○ Other Country (fill in blank): _____
○ Don't know

Q7_2 Which U.S. territory was your father born in?
○ Puerto Rico
○ Guam
○ U.S. Virgin Islands
○ America Samoa
○ Mariana Islands

Q8_1 Where was your MOTHER born?
○ United States (50 states or District of Columbia)
○ U.S. territory (Puerto Rico, Guam, U.S. Virgin Islands, American Samoa, Northern Mariana Islands)
○ Other Country (fill in blank): _____
○ Don't know

Q8_2 Which U.S. territory was your mother born in?
○ Puerto Rico
○ Guam
○ U.S. Virgin Islands
○ America Samoa
○ Mariana Islands

Q9 What is your marital status?
○ Married
○ Widowed
○ Divorced
○ Separated
○ Never married
○ Living with a partner as a couple

Q12_1 What kind of business or industry do you work in? (Examples: healthcare, retail clothing store, State Department of Labor)

Q12_2 What kind of work do you do? (Examples: childcare worker, retail sales worker, software developer)

Q14 Has a doctor or other health professional ever told you that you had the following condition(s)?(select all that apply)
❑ Arthritis
❑ Asthma
❑ Cancer
❑ Chronic Kidney Disease
❑ Diabetes (Type II)
❑ Gout
❑ Heart Disease
❑ High Blood Pressure
❑ High Cholesterol
❑ Hypertension
❑ Pre-Diabetes
❑ Sleep Apnea
❑ Stroke
❑ NONE

Q_X PART 3: Weight History

Q15 Do you consider yourself now to be...(select one of the following) (If you are currently pregnant, what did you consider yourself to be before you were pregnant?)
○ Overweight
○ Underweight
○ About the right weight
○ Don't know

Q16 Would you like to weigh...
○ More
○ Less
○ Stay about the same

Q17 How much did you weigh a year ago? (pounds)

Display This Question:
    If CONSENT TO PARTICIPATE IN RESEARCH Thank you for your interest in our study (mHealth Support to A... Is Not Displayed

Q18 Is your current weight less than your weight one year ago?
○ Yes
○ No

Q19 Is your current weight less than your weight one year ago because you tried to lose weight?
○ Yes
○ No

Q20 During the past 12 months, have you tried to lose weight
○ Yes
○ No

Q21 How did you try to lose weight during the past 12 months? (select all that apply)

❑ Ate less food (amount)

❑ Ate fewer calories

❑ Ate fewer carbohydrates

❑ Exercised

❑ Joined a weight loss program (Examples: Weight Watchers, Jenny Craig, Tops, Or Overeaters Anonymous)

❑ Followed a special diet (Examples: Dr. Atkins, South Beach, Other high protein or low carbohydrate diet, Cabbage Soup Diet, Ornish, Nutrisystem, Body-For-Life, etc.)

❑ Changed eating habits (Examples: didn't eat late at night, ate several small meals a day)

❑ Other (please specify): _____

Q22 How many times have you lost 10 pounds or more because you were trying to lose weight?

○ 1 to 2

○ 3 to 5

○ 6 to 10

○ 11 times or more

○ Never

Q_Uniq2 I am paying attention to this survey. (Select "Agree" for your answer.)

○ Disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Agree

Condition: Agree Is Not Selected. Skip To: End of Block.

Q23 How much did you weigh 10 years ago? (pounds)

Q24 How much did you weigh at age 25? (pounds)

Q25 What is the most you have ever weighed? (pounds)(Do not include any times when you were pregnant.)

Q26 How old were you when you weighed the most?(Do not include any times when you were pregnant. Enter the last time you were that weight.)

Q27 Have you ever had weight loss surgery, also called bariatric surgery?
❍ Yes
❍ No

Q_X PART 4: Eating and Weight Management

Q28 Do you have a previous or current eating disorder diagnosis?
❍ Yes
❍ No
❍ Prefer not to answer

Q29_1   Have you ever tracked your weight, diet, or physical activity?
❍ Yes
❍ No

Display This Question:
    If Have you ever tracked your weight, diet, or physical activity? Yes Is Selected

Q29_2 How have you kept track of your weight, diet, or physical activity? (Select all that apply)
❑ Paper Notebook/Journal
❑ Website
❑ Mobile phone app
❑ Wearable fitness device (Examples: FitBit, pedometer, etc.)
❑ Medical device
❑ In your head
❑ Other (fill in the blank): _____

Q30_1 Do you ever eat in reaction to stress or negative emotions?
❍ Yes
❍ No

Display This Question:
    If Do you ever eat in reaction to stress or negative emotions? Yes Is Selected

Q30_2 Are you concerned that stress eating or emotional eating is negatively affecting your health?
❍ Yes
❍ No

Q30_3 When you eat because of negative emotions or stress, what kinds of foods (general or brand names) do you usually eat? (Examples: "crunchy food," "doughnuts," "Skittles," etc.)

Q30_4 When you eat because of negative emotions or stress, where do you usually eat? (Examples: "living room watching TV," "at desk while on computer," "alone in bathroom stall," etc.)

Q30_5 When you eat because of negative emotions or stress, what time of day do you usually eat? (Examples: "after dinner," "during weekly staff meeting," "first thing in the morning," etc.)

Q30_6 When you eat because of negative emotions or stress, how do you usually feel after you finish eating? (Examples: "full," "guilty," "relaxed," etc.)

Q30_7 When you eat because of negative emotions or stress, what would make you stop eating that way? (Examples: "avoiding stress," "nutrition information for the food I'm eating," etc.)

Q_X PART 5: Stress

Q_Uniq3 The following questions refer to feelings and thoughts during the LAST MONTH.

Q37_PS_1 In the last month, how often have you been upset because of something that happened unexpectedly?
❍ Never
❍ Almost Never
❍ Sometimes
❍ Fairly Often
❍ Very Often

Q37_PS_2 In the last month, how often have you felt that you were unable to control the important things in your life?
- ○ Never
- ○ Almost Never
- ○ Sometimes
- ○ Fairly Often
- ○ Very Often

Q37_PS_3 In the last month, how often have you felt nervous and "stressed"?
- ○ Never
- ○ Almost Never
- ○ Sometimes
- ○ Fairly Often
- ○ Very Often

Q37_PS_4 In the last month, how often have you felt confident about your ability to handle your personal problems?
- ○ Never
- ○ Almost Never
- ○ Sometimes
- ○ Fairly Often
- ○ Very Often

Q37_PS_5 In the last month, how often have you felt that things were going your way?
- ○ Never
- ○ Almost Never
- ○ Sometimes
- ○ Fairly Often
- ○ Very Often

Q37_PS_6 In the last month, how often have you found that you could not cope with all the things that you had to do?
- ○ Never
- ○ Almost Never
- ○ Sometimes
- ○ Fairly Often
- ○ Very Often

Q37_PS_7 In the last month, how often have you been able to control irritations in your life?
○ Never
○ Almost Never
○ Sometimes
○ Fairly Often
○ Very Often

Q37_PS_8 In the last month, how often have you felt that you were on top of things?
○ Never
○ Almost Never
○ Sometimes
○ Fairly Often
○ Very Often

Q37_PS_9 In the last month, how often have you been angered because of things that were outside of your control?
○ Never
○ Almost Never
○ Sometimes
○ Fairly Often
○ Very Often

Q37_PS_10 In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
○ Never
○ Almost Never
○ Sometimes
○ Fairly Often
○ Very Often

Q_X We are interested in how people respond when they confront difficult or stressful events in their lives.Answer what you usually do when you experience a stressful event. There are no right or wrong answers, so choose the most accurate answer for you—not what you think most people would say or do.

Q100_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
1) I turn to work or other activities to take my mind off things.	○	○	○	○
2) I concentrate my efforts on doing something about the situation I'm in.	○	○	○	○
3) I say to myself "this isn't real."	○	○	○	○

Q101_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
4) I get emotional support from others.	○	○	○	○
5) I just give up trying to deal with it.	○	○	○	○
6) I take action to try to make the situation better.	○	○	○	○

Q102_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
7) I refuse to believe that it has happened.	○	○	○	○
8) I say things to let my unpleasant feelings escape.	○	○	○	○
9) I get help and advice from other people.	○	○	○	○

Q103_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
10) I try to see it in a different light, to make it seem more positive.	○	○	○	○
11) I criticize myself.	○	○	○	○
12) I try to come up with a strategy about what to do.	○	○	○	○
I am paying attention to this survey. (Select "I usually do this a medium amount." for your answer.)	○	○	○	○

Q104_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
13) I get comfort and understanding from someone.	○	○	○	○
14) I give up the attempt to cope.	○	○	○	○
15) I look for something good in what is happening.	○	○	○	○

Q105_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
16) I make jokes about it.	○	○	○	○
17) I do something to think about it less, such as go to movies, watch TV, read, daydream, sleep, or shop.	○	○	○	○
18) I accept the reality of the fact that it has happened.	○	○	○	○

Q106_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
19) I express my negative feelings.	○	○	○	○
20) I try to find comfort in my religion or spiritual beliefs.	○	○	○	○
21) I try to get advice or help from other people about what to do.	○	○	○	○

Q107_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
22) I learn to live with it.	○	○	○	○
23) I think hard about what steps to take.	○	○	○	○
24) I blame myself for things that happened.	○	○	○	○

Q108_BC What do you usually do when you experience a stressful event?

	I usually don't do this at all	I usually do this a little bit	I usually do this a medium amount	I usually do this a lot
25) I pray or meditate.	○	○	○	○
26) I make fun of the situation.	○	○	○	○

Q_Uniq4 PART 6: Eating Behavior and Stress

Q38_PEMS Below is a list of reasons that people sometimes give for eating tasty foods and drinks such as: Sweets like chocolate, doughnuts, cookies, cake, candy, ice cream, other desserts. Salty snacks like chips, pretzels, and crackers. Fast foods like hamburgers, cheeseburgers, pizza, fried chicken and French fries. Sugary drinks like soda, sweet tea, milkshakes, and sweet coffee drinks.   How often would you say that you ate/drank these kinds of foods for each of the following reasons? Mark the answer that best describes you.

	Almost never or Never	Some of the time	Half of the time	Most of the time	Almost always or Always
1) To forget your worries	○	○	○	○	○
2) Because it helps you when you feel depressed or nervous	○	○	○	○	○
3) To cheer up when you are in a bad mood	○	○	○	○	○
4) To forget about your problems	○	○	○	○	○

Q_X PART 7: Digital Technology

Q39_1 Do you have a mobile phone?
○ Yes
○ No

Q39_2 Some mobile phones are called "smartphones" because of certain features they have. Is your mobile phone a "smartphone"? (Examples: iPhone, Android, Blackberry, Windows phone)?
○ Yes
○ No
○ I don't know

Q39_3 How often, if at all, do you usually use your mobile phone?
- ○ Every day
- ○ 2-6 times a week
- ○ Once a week
- ○ Less than once a week
- ○ Never

Q39_4 I usually have my mobile phone near me.
- ○ Strongly Agree
- ○ Agree
- ○ Neither Agree nor Disagree
- ○ Disagree
- ○ Strongly Disagree

Q39_5 I am the only person who uses my mobile phone.
- ○ Yes
- ○ No

Q40_1 How often, if at all, do you usually use the internet?
- ○ Every day
- ○ 2-6 times a week
- ○ Once a week
- ○ Less than once a week
- ○ Never

Q_Uniq5 Are you paying attention to the survey? (Select "Yes" for your answer.)
- ○ Yes
- ○ No

Q40_2 Do you currently have internet access AT HOME?
- ○ Yes
- ○ No

Q40_3 What kind of internet connection do you have AT HOME?
- ❍ Dial-up
- ❍ High speed/Broadband (DSL, Cable, fiber optic)
- ❍ BOTH dialup and high speed
- ❍ Only access internet via wireless phone service provider (Examples: AT&T, Boost Mobile, Straight Talk, Verizon, etc.)
- ❍ Other (please specify): _____

Q41_1 I feel confident using computers, smartphones, or other electronic devices to do the things I need to do online.
- ❍ Strongly Agree
- ❍ Agree
- ❍ Neither Agree nor Disagree
- ❍ Disagree
- ❍ Strongly Disagree

Q41_2 When I get a new electronic device, I usually need someone else to set it up or show me how to use it.
- ❍ Strongly Agree
- ❍ Agree
- ❍ Neither Agree nor Disagree
- ❍ Disagree
- ❍ Strongly Disagree

Q87 Some questions may have been of a sensitive nature. Below is a helpful resource for issues addressed in this survey.

SAMHSA National Helpline   1-800-662-HELP (4357)   http://www.samhsa.gov/find-help/national-helpline   *You may want to print this page for your records*

- ❍ I have read this page. (Click here to finish survey)

Appendix F: Pilot Study Interview Protocol

PART 1: WEIGHT MANAGEMENT HISTORY/EXPERIENCES

1.) Tell me about your weight loss [management?] story.

- Think about the last time you tried to lose weight.
    - How did you decide that you needed to try to lose weight?
    - What did you do to try to lose the weight?
        - Did you use any tools or programs? (E.g., mobile apps, Weight Watchers, etc.) If so, which ones?
        - What did you like the most about it? What did you dislike the most about it?
        - [If not still trying to lose weight]: Why did you stop what you were doing?
        - Did you end up regaining any of the weight you lost?
        - Overall, did you have a good experience with trying to lose weight?
- What is a particularly **GOOD / BAD** experience you have had trying to lose weight? (cycle through good and bad separately)
    - Did you use any tools or programs? (E.g., mobile apps, Weight Watchers, etc.) If so, which ones?
        - What did you like the most about it? What did you dislike the most about it?
    - How many times over your life have you tried to lose weight?
        - Have you ever regained the weight you loss?
        - Did you do anything different at those other times in which you lost weight?
    - Would you currently like to lose weight?

2.) If regained weight: Why do you think you regained the weight?

If response related to exercise: What has happened for you that you don't you [do that activity (e.g., exercise more, do a different kind of exercise, etc.)]?

- If response related to eating: What has happened for you that you don't you [do that activity (e.g., eat less, eat healthier food, eat more often, etc.)]?
- What gets in the way of meeting your weight loss goals?

3) We've talked a fair bit about your experiences with weight loss already.

- Now thinking about weight loss more generally, what comes to your mind when you hear the term "weight loss"?
- How would you describe your relationship with food? Let's take a look at the photos you emailed me. (Review photos together.)

PART 2: STRESS
4.) Tell me about the last time you felt stressed.

- What was the situation?
    - How did you handle the situation?
        - What did you do? Did you try to make yourself feel better?
    - How typical is that situation for you?
- Are there situations that you experience on a regular basis that you find stressful? (Draw examples from *Perceived Stress Scale* Responses)
- Are there any stressful experiences that have been going on for a long time? Tell me about that--what's an example of one?
- Are there any people in your life who tend to make you feel stressed?
- How do you know that you are stressed? What did the stress feel like in our body?
- Can you think of ways to manage the stress you feel? (Draw examples from *Ways of Coping Scale* Responses)
    - Do you try to do these things? Why/Why not?

5.) Does your eating behavior change at all when you feel stress? (Draw examples from *Eating and Appraisal Due To Stress/Emotional Eating Scale* Responses)

- Do you eat more/less? Do you tend to eat certain foods?

- o Is there anything you could do to stop [the eating behavior (e.g., over-eating, eating high-density foods)] when you feel stressed?
  - ▪ Do you try to do these things? Why/Why not?
- On your *Eating and Appraisal Due To Stress/Emotional Eating Scale* you answered [xxxx] to the question about [xxxxx]. Do you have an example of how this happens in your life? When was the last time you remember this happening?
- Continue to ask 3-4 for examples from the *Eating and Appraisal Due To Stress/Emotional Eating Scale* depending on survey results.

6.) Do you think the ways that you eat when you are stressed is a problem?
- Are you interested in changing this eating behavior?
  - o Is it behavior that you think you are capable of changing? Why or why not?
  - o Is anything standing in your way to making a change with your stress-related eating?
- Is there any information that you think could be helpful in changing how you eat when you are stressed?
- What advice would you give to someone who struggles with eating differently while stressed?

7.) Were you able to use **Lose It!** over the past two weeks?
- Could you give me a tour of **Lose It!** and show me the different features?
  - o [Discuss the different features with the participant, ask questions: did you like this? was this confusing?]
- How did you feel about using it?
  - o What did you like the most?
  - o What did you dislike the most?
  - o Did you ever get bored using it?
- Did you notice if **Lose It!** made you change any of your behavior?
  - o In what way?
- Did you think **Lose It!** is useful?
- What kind of person do you think would find **Lose It!** most helpful?
- Is there anything you would change about **Lose It!**? What?
- Do you think you will keep using **Lose It!**?

- How long do you think you would have used **Lose It!** if you were not in the study?
  -

PART 3: STRATEGIES FOR ADDRESSING STRESS-INDUCED EATING

8.) Researchers have developed some ideas for strategies that could be helpful in addressing stressed-induced eating. *Present the following in a chart when talking to interviewee.*

- **Strategy 1:** A person makes herself aware of how she feels at the present moment. This could include body scanning (i.e., focus on different body parts and concentrate on how each one feels) (*Mindfulness*)
- **Strategy 2:** A person eats a meal or snack in silence (no phone, TV, radio, etc), and slows down physical movements (fork, chewing, swallowing) to observe the entire eating process. (*Mindful Eating*)
- **Strategy 3:** A person identifies his/her patterns of negative thinking and beliefs and replaces it with a more positive thoughts. Negative thinking and beliefs could include "overgeneralizing, magnifying negatives, minimizing positives and catastrophizing" (Hassett & Gevirtz, 2009). New ways of thinking would be taught and used; these include "self-instructions (e.g. distraction, imagery, motivational self-talk), relaxation and/or biofeedback, [and] development of adaptive coping strategies (e.g. minimizing negative or self-defeating thoughts)" (Gatchel & Rollings, 2008). (*Cognitive Behavior Technique*)
- **Strategy 4:** A person looks back at a negative emotional response he/she had and reinterprets the situation to either have a less severe negative response, or to replace the negative response with a positive one. (E.g., if a person feels bad about not getting a job promotion, she reinterprets the situation by reminding herself that she will have another opportunity later down the road or that maybe it is a wake up call to seek a better work situation with a different employer.) (*Cognitive Reappraisal*)
- **Strategy 5:** A person recognizes a negative situation and doesn't try to "change it, protest, or exit" (Fish, 2014). There is an "openness to experiencing thoughts and

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emotions as they are" and does not attempt to control the situation (Hayes, S. C. & Pankey, J. (in press)). (*Acceptance*)

- **Strategy 6:** Looking at a record of times where you overate and comparing that to what events or thoughts you experienced close to or during the time of overeating. 8a.) Describe strategy.

8b.) Do you have experience with [strategy name]?

8c.) Does [strategy name] sound like a useful approach for dealing with your own eating behavior when you are stressed?

9.) If you were to design a mobile app to help women with eating related to stress, what features do you think would be the most helpful?

Appendix G: Codebook

Table 11. *Interview Analysis Codebook.*

Code Name	Subcode	Description
ADAPTATION	Weight Gain (Weight+)	Weight gain experiences
	Health problems (HlthProb)	Health issues related to eating behavior or stress
COPING EFFORT	Eating Relief (EatRel)	Eating to feel relief from stress/negative emotions (more specific than FoodCope)
	Food Coping (FoodCope)	Using food to cope with stress/negative emotions, to soothe with food; more general than EatRel; can include being unaware of this behavior
	Self-Regulation Breakdown (SRBreak)	Stress diminishes self-regulation of food intake; external food cues more salient
	Drawn to high fat/sugar foods (Drawn)	Drawn to palatable high fat/sugar foods via psychophysiological mechanisms and habit
	Problem-Focused Coping	Coping with stress/negative emotions by planning, strategizing, problem solving.
	Emotion-Focused Coping	Coping with stress/negative emotions via emotion regulation (via non-food methods)

ESRE BEHAVIOR DESCRIPTION	Location	Location of ESRE behavior (e.g., hidden, car)
	Nature	Nature of ESRE behavior (e.g., binge eating)
	Food Type	Types of food eaten when engaging in ESRE behavior
	Time	Time of day when engaging in ESRE behavior
	Episode	Description of situation from stressor to resulting eating behavior
APPRAISALS	Thinking about Threats	When user asks "Is anything important to me threatened?"
	Thinking about Resources	When user asks "What are my coping resources/options?
ENVIRONMENT	General stressors in Environment	Harms/losses, threats, challenges
	Short-Term Stress	Stressors affecting shorter time frame
	Long-Term Stress	Stressors affecting longer time frame
PERSON	Person Beliefs (stress context)	Beliefs held by user that are related to how/when she experiences stress
	Person Goals (stress context)	Goals held by user that are related to how/when she experiences stress
	Person Resources (stress context)	Resources accessible by user that are related to how/when she experiences stress
	Depression/Anxiety	User experiences with depression or anxiety
	Black-and-White Thinking	Rigid idea of "right", "wrong", and "should"
	You First, Me Last	Prioritizing other people's needs, not saying "no", not setting boundaries with others
	You're Not the Boss of Me	User rebels against people telling her what to do, particularly in context of weight or eating
	Shaming	User shames self

	Self-esteem	User indicates questioning of self-worth
	Rumination	User experiences with thoughts running over and over about stressors
CHANGING MINDSET		Process of changing the way you think about a problem, not just changing what you do
ESRE CONSCIOUSSNESS		Being conscious of engaging in ESRE
WEIGHT LOSS TIPPING POINT		When user knows it's time to manage weight again
RELATIONSHIP WITH FOOD (PERSON)	Food as Friend/Enemy	Food is viewed either as a friend of enemy
	Food as Lover	Food is viewed as a lover
	In Control or Out of Control	When user feels either in control of food or out of control with food
MAGIC WAND		User idea for what would make her stop an ESRE episode
FRIENDS/FAMILY/PARTNER FOOD BEHAVIOR	Family Eating	Food behavior learned from or practiced with family
	Friends Eating	Food behavior learned from or practiced with friends
	Partner Eating	Food behavior learned from or practiced with partner
DESIGN	LI! Most Liked	What user liked most about LI!
	LI! Least Liked	What user liked least about LI!
	Design Ideas	How user would design an ESRE app/tech
EATING BEHAVIOR	Habit	Regular way of doing a food-related activity (good or bad)
	Routine	Regular sequence of doing a set of food-related activities (good or bad)
	Plan	Intended course of action for achieving a food-related goal (whether or not it works)
	Social	Eating as a social activity
	Reward	Eating as a reward, whether alone or in a group
	Celebrate	Eating as [part of] a celebration

	Solo	Eating alone on purpose as a private act
SOCIAL SUPPORT	Emotional Support	User need for or when another person provides encouragement, inspires hope or confidence, makes user feel loved/cared for/valued, etc. (e.g., friend/family who encourages user after eating binge)
	Informational (general) Support	User need for or when another person provides helpful information, advice, suggestions (e.g., list of healthy foods to eat)
	Informational (appraisal) Support	User need for or when another person provides information to make a self-evaluation
	Instrumental Support	User need for or when another person provides tangible/physical assistance (e.g., has dinner cooked by friend/family when user is unable to do so for him/herself)
	Providers	Family members, friends who provide support (or don't)
	Support Needs	User acknowledges that she is in need of support
COMORBIDITY		Existence of chronic condition aside from O2
OVERWEIGHT/OBESITY EXPERIENCE	O2_Clothing	Difficulty clothing shopping; can't find size, too expensive to find affordable O2 clothing
	O2_Identity	When user describes what they perceive to be common experiences of being O2 (e.g., difficulty finding clothing)
	O2_Poverty	Difficulty purchasing healthy food on fixed budget
RACE/ETHNIC	R/E Eating Styles	Eating styles perceived by user to be related to race/ethnicity
	R/E Weight Loss	Weight management practices perceived by user to be related to race/ethnicity
	Weight Self-Image	Self-image perceived by user to be related to race/ethnicity

ESRE AND O2 CONNECTION		User idea that addressing stress will end ESRE behavior
POWERFUL QUOTATIONS		Particularly powerful quotation.
SELF CARE		Taking care of self in a healthy manner
Z_IMAGES	Clock	Eating behavior depicted with clock to show time of day
	Ice Cream	Eating ice cream
	Breakfast	Eating breakfast
	Quotation	Inspirational quotation

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