Motivational interviewing and social support to promote behavior change

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Motivational interviewing and social support to promote behavior change

by

Kathryn A. Bus

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Nutritional Sciences

Program of Study Committee:
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CHAPTER 1
INTRODUCTION

As of 2012, almost half - 117 million - of the U.S. adult population had one or more chronic diseases and 25% of the adult population had two or more (Ward, Schiller, & Goodman, 2014). Some of these chronic conditions (ie type 2 diabetes) can be controlled with physical activity. Unfortunately, only about half (48%) of the adult population is active enough to accomplish the recommendations in the 2008 Physical Activity Guidelines according to the Centers for Disease Control (2014). According to the Academy of Nutrition and Dietetics, adults can improve overall health through a lifestyle change by managing weight, healthy eating, and physical activity (Seagle, H., Strain, G., Makris, A., & Reeves, R., 2009). Self-monitoring and health coaching can help people make the transition from unhealthy and sedentary to healthy and active. Currently, national standards governing health coaching practices are being discussed (Jordan, M., Wolever, R., Lawson, K., & Moore, M., 2015). It is important to systematically evaluate health coaching to advance research on best practices and behavioral outcomes.

The Physical Activity and Health Promotion Lab at Iowa State University has been systematically studying a health coach model by studying the impact of different programming strategies on behavior change. The programming has been built on the self-monitoring capabilities of an advanced physical activity monitor called the Sensewear® Pro Mini-Fly Armband (BodyMedia, Inc). The SenseWear is a non-invasive monitoring technology that uses a pattern recognition technology to accurately assess physical activity and energy expenditure throughout the day. It provides detailed information about physical activity levels, steps walked, as well as an indicator of sleep efficiency. The data from the
monitor can be uploaded into a web tool (BodyMedia FIT 3.0) to show data on behaviors over time. The software also provides a detailed dietary record to help individuals monitor food consumption and energy intake. Previous studies have shown the SenseWear to assist in weight loss programming (Polzien, Jakicic, Tate, & Otto, 2007; Shuger, et al., 2011) so it has served as the basis for the programming in the Health Coach Study.

In a preliminary study (called the BonSanté Project), the use of the SenseWear® monitor was shown to be as effective as a guided behavior change curriculum (BonSanté) in promoting weight loss (Paulson, 2011; Walsh, 2011). There were trends for more favorable outcomes for the group that received both the armband and the educational programming but the results were not statistically significant. Therefore, it is still possible that using the armband in combination with a health coaching intervention could enhance the effectiveness. A follow-up study (Davis, 2012) evaluated the factors influencing the retention of weight loss over a four month follow-up. Participants with higher levels of self-efficacy and social support were more successful at keeping the weight off that was lost during the intervention. It was not clear what factors in the intervention helped to build these skills but it showed that the model could help promote sustained behavior change.

After the BonSanté study, subsequent studies tested other ways to enhance the utility of the SenseWear Pro® Armbands. Several studies (Nelson, 2014; Webb, 2013) tested whether the use of the SenseWear® Pro Armbands plus text messaging or online health coaching could help encourage behavior change. These studies determined that in-person health coaching may have advantages over a self-monitoring group and that improvement in behavior change strategies is not determined by the healthy behavior people chose to pursue.
These findings have led to the specific design of the Health Coach Study which directly compares the effectiveness of in-person and virtual health coaching on behavior change.

An innovative aspect of the present Health Coach Study is that participants were given choices about how they would like to receive the intervention. Participants were allowed to choose whether they would like to follow an independent (online) path or be guided through in-person health coaching support. Allowing participants to choose is important since it is consistent with principles of motivational interviewing that underlie the health coaching process. Participants also had the freedom to select what behavior they want to prioritize. The expectation is that participants would be more focused on lifestyle change if they actively chose the behavior that they wanted to work on. The Health Coach Study has been piloted in a recent study but has not been systematically evaluated.

To further expand on the current health coach model, this thesis directly examined two key questions. The first aim of the study was to compare the efficacy of in-person versus online health coaching. The hypothesis was that in-person health coaching was expected to have a greater effect since it can more effectively utilize principles of motivational interviewing, the coaching theory used in the health coach model. The second aim of the study was to determine the moderating effects of social support on the behavior change process. As already stated, social support was studied for maintenance of weight lost during an intervention 4 months after the Bonsante intervention ended. However, in that previous study, social support was not assessed at baseline and behavior change was not documented. Therefore, the present study measured social support at baseline and at the end of the intervention, in addition to utilizing an established battery of items designed to evaluate
behavior change. The hypothesis was that higher social support would lead to increased behavior change.
CHAPTER 2

LITERATURE REVIEW

Obesity: Making a Case for Behavior Change

Obesity is a condition that is caused by an imbalance between energy intake and energy output. Unfortunately, in today’s society with an increase in a fast-paced lifestyle, obesity rates are higher than ever. According to the national surveillance data from the National Center for Health Statistics (Ogden, Carroll, Kit, & Flegal, 2012), approximately 78 million adults 20 years of age or older are considered obese. This is approximately 35.7% of the adult population. There are also wide-ranging effects and consequences associated with obesity. A few of the comorbidities associated with obesity include coronary heart disease, stroke, high blood pressure, diabetes mellitus, infertility, and cancer (Khaodhiar, McCowen, & Blackburn, 1999).

The condition of being obese is not caused by just one factor, but a compilation of many. A challenge in treating the condition is that some factors are more easily modifiable than others. One factor that contributes to obesity is genetics. With increasing evidence linking different genes to obesity, this condition may be a compilation of many genes working together, not just one. This suggests that epigenetics plays a role in the expression of these genes and that there may be environmental influence during fetal life that determines which genes are expressed and the likelihood of that human being developing obesity later in life (Bouchard, 2007). Another strong predictor is socioeconomic status. The effects of socio-economic status are likely due to reduced access to resources, healthy food (Dubowitz, et al., 2012), or lower education (Ogden, Lamb, Carroll, & Flegal, 2010). Education is another factor that is considered when searching for causes or correlations for obesity.
Although data has shown that there is no difference in rates of obesity among men with different education levels, this is not true of women (Ogden, Lamb, Carroll, & Flegal, 2010). Even though socioeconomic status and education do not directly cause obesity, they can be indicators of the possibility that a person may become obese and may help prevent obesity. Regardless of the underlying causes, obesity is ultimately determined by an imbalance between energy intake and energy expenditure. Therefore, focus needs to be on helping individuals learn behavior and cognitive skills needed to maintain a healthy lifestyle.

Adopting healthy lifestyles is the most important consideration for weight maintenance and preventing chronic diseases. A study examining the effects of a lifestyle intervention in pregnant women with gestational diabetes mellitus achieving postpartum weight loss goals showed that the intervention group had a greater percentage of women reaching their goals than the control group (Ferrara, et al., 2011). Part of the intervention was to encourage the women to exercise at a moderate intensity or higher for 150 min per week. Another study aimed to increase fruit and vegetable intake in cancer survivors to promote healthy living (Campbell, et al., 2009). Telephone sessions and newsletters were utilized to encourage fruit and vegetable consumption. The greatest effect was seen in the treatment group that received both the telephone calls and the newsletters. With regards to weight loss, one study used a Group Lifestyle Balance (GLB) program, which was based on the social cognitive theory, to reduce weight (Piatt, Seidel, Powell, & Zgibor, 2013). The intervention groups included a face-to-face interaction in one group, one group received DVDs to watch, and another group received the GLB intervention via the internet. The GLB program was effective in decreasing weight no matter the method of delivery. Based on these studies and many more, lifestyle and behavior interventions work and should be utilized more.
This literature review will first examine the strategies of self-monitoring and other behavior skills that influence healthy lifestyles. It will then describe social support and its role in weight loss. This document will conclude with a discussion of health coaching and specifically motivational interviewing as a tool for making a lifestyle change. The literature review will provide background and justification for the approach and methods in the study.

Self-Monitoring and Behavior Skills

Self-monitoring has been shown to be an important behavioral skill in helping people create and sustain lifestyle changes. It can be effective in helping people learn what they are currently eating or learn how active (or inactive) they are. A recent review indicates that there are numerous studies that found self-monitoring has led to an increase in weight loss (Burke, Wang, & Sevick, 2011). Self-monitoring can take the form of paper diaries, online diet programs, pedometers, and many other activity trackers. A lifestyle change is probably the most effective and sustainable method to treat obesity and associated chronic diseases and self-monitoring can help with that. As society becomes more technologically advanced, smartphones and applications have made keeping track of diet and exercise easier.

Numerous electronic devices have been released into the market that facilitate self-monitoring. One example of these devices is an internet-based food and exercise diary. In a study that utilized this self-monitoring mechanism, they found that greater adherence and use of electronic food and exercise diaries, in addition to social support, correlated with an increase in weight loss (Johnson & Wardle, 2011). More examples of electronic self-monitoring devices include pedometers and accelerometers. The results of one study indicated that simply wearing a pedometer helps increase awareness of physical activity
(Rooney, Smalley, Larson, & Havens, 2003). Another study used pedometers and accelerometers in addition to a physical activity intervention to increase physical activity in adults who had colon adenomas (Wolin, Fagin, James, & Early, 2012). The study found that the intervention and electronic devices significantly improved physical activity. Pedometers and accelerometers can be cheap and are easy self-monitoring tools. However, some of these devices can be very inaccurate.

One particularly effective tool is the SenseWear® Pro Mini-Fly Armband monitor. The technology involved in this armband makes it accurate and reliable (Johannsen, D.L., Calabro, M.A., Stewart, J., Franke, W., Rood, J.C., & Welk, G.J., 2010). This armband contains an accelerometer that not only measures motion, but also steps when walking and running, which is one advantage over pedometers. The SenseWear® Armband also has heat sensors that measure the heat from a person’s skin, which can differentiate between moderate and vigorous activity (Bodymedia, 2013). The accompanying online program also provides a diet record component, which allows participants to record their diet and see the breakdown of their eating habits (e.g. how much carbs/fat/protein they are eating, etc). Thus, the SenseWear® Armband is effective both for research and for providing participant feedback.

A study at the University of South Carolina has also shown promising results from the use of the SenseWear® Armbands (Shuger, et al., 2011). The four treatment groups in this 9 month intervention were (1) a control group that received a weight loss manual, (2) a behavioral weight loss group, (3) an armband group, and (4) a combination of the behavioral weight loss group and armbands. One of the primary outcomes from this study was weight loss. At 4 months, Groups 3 and 4 lost a significant amount of weight from the respective baseline measurements. At month 9, all intervention groups lost a significant amount of
weight throughout the intervention and the control group did not. However, Group 4 was the only group that had significant weight loss when compared to the control group, or Group 1. This study supports the idea that self-monitoring can be useful in behavior change.

Another study compared the effectiveness of constant versus intermittent use of the SenseWear® Pro Armband (BodyMedia, Inc.) in weight loss. During the weeks that the intermittent group was not using the armband, participants were asked to use paper diaries to keep track of their diet. The results from this study reveal that participants that constantly used the technology, in this case the SenseWear® Pro Armband, lost more weight than those in the intermittent technology group and the control group, who only used paper diaries (Polzien, Jakicic, Tate, & Otto, 2007).

These past studies formed the foundation for a series of studies conducted in the Physical Activity and Health Promotion Lab at Iowa State University. In one study (called the Bonsante project), subjects were placed into one of three treatment groups: (1) a guided weigh loss program with in-person health coaching, (2) a self-monitoring group with the SenseWear® Pro Armband, and (3) a combination group of both the self-monitoring device and in-person health coaching. The results from this study indicate that having a self-monitoring device is just as effective as receiving in-person health coaching (Paulson, 2011; Walsh, 2011). Participants in Group 1 lost an average of 3.69 kg (±3.14), those in Group 2 lost 4.05 kg (±2.87) and those in Group 3 lost 4.88 kg (±3.21). There were no significant differences between groups, but the group that received the combined treatment had slightly better effects. The results support the idea that self-monitoring devices can be as effective as guided counseling in promoting behavior and lifestyle change. The results also showed some evidence for larger effects in the group that received counseling and the self-monitoring
device. This suggests that programming may be enhanced if combined with other treatments (Paulson, 2011; Walsh, 2011).

In a follow-up study, the SenseWear® Armband was used to specifically try to promote physical activity in sedentary individuals. A total of 60 participants were provided with the SenseWear® Armband and randomized into two treatment groups. Group 1 received texting prompts in addition to the SenseWear® Pro Armband and an online health coach and Group 2 received the SenseWear® Pro Armband with limited access to an online health coach. The results of this study indicate that both treatment groups reported over 500 MET minutes per week as measured by the armband data. There was no significant difference between the two treatment groups with regards to an increase in physical activity. Therefore, the results support the idea that self-monitoring works just as well as online health coaching plus text message reminders for increasing physical activity (Webb, 2013). There was limited use of the health coaching interface in this study so additional refinements were deemed important to improve the programming.

Another follow-up study tested whether text messaging or health coaching could enhance the effectiveness of self-monitoring features of the SenseWear® monitor when used in a worksite (Nelson, E., 2014). Forty-one participants completed the intervention. This study contained three treatment groups. Group 1 was the control group who only received the SenseWear® Armband for self-monitoring, Group 2 received both the SenseWear® Armband plus online health coaching, and Group 3 received the SenseWear® Armband plus text message reminders twice a week. There were no significant differences in the use of behavior change strategies from the three groups so focus in this study shifted to studying the differences in behavior change strategies depending on the goal that participants chose to
work on throughout the intervention: diet, physical activity, and weight management. The behavior change process was measured by the Nothwehr Behavioral Objectives Survey. This survey contains three main categories associated with healthy behavior change strategies: diet, physical activity, and meal planning. The results did not show differences in the use of strategies between groups, but significant pre-post changes showed that participants had increased use of all behavior change strategy categories (Nelson E., 2014).

Due to the results of the study, the data were examined based on the behavior change strategies related to selected goals rather than the method of intervention (text messaging or online health coaching). Looking at the data this way, it was expected that those with a diet goal would show the most improvement in the diet behavior change category compared to those with a physical activity or weight management goal. Even though the results were not statistically significant, those with a diet goal did show a greater increase in the diet behavior change strategies category. Also, those with a weight management goal had greater changes in the diet, physical activity, and meal planning behavior change strategies. There were no differences in the reported changes in physical activity strategies, but this may be because all groups were directly monitoring their physical activity through the SenseWear® Armband monitors (Nelson E., 2014). This study helped to document the challenges with online health coaching since it proved difficult to use motivational interviewing electronically. It also led to the current Health Coach design in which participants are provided with choices about what behaviors they want to target and how they would like to receive the treatment. Additional detail is provided in a subsequent section.

Another behavior skill that has shown to be useful in weight loss and behavior change interventions is goal setting. One study examined the effectiveness of a telephone-based
versus a community resource follow-up in maintenance of conditions of people with type 2 diabetes after all participants received a basic goal setting intervention (Glasgow, Toobert, Hampson, & Strycker, 2002). There were no significant differences in conditions between the two treatments. The authors suggest that goal setting intervention may have been enough to cause effective behavior changes. A recent review article examined the usefulness of goal setting as part of an intervention and concluded that goal setting is useful in behavior change interventions, especially when the goals are related to diet and physical activity (Pearson, 2012). The author even suggests that goal setting may be key in fighting and preventing obesity. A recent study done in the Physical Activity and Health Promotion Lab utilized goal-setting throughout the intervention (Nelson E., 2014). Based on this and previous research, goal-setting has been systematically incorporated into the current Health Coach Model. Participants are challenged with making preliminary goals for a specific behavior they are targeting and then are supported in their efforts to monitor their progress.

**Importance of Social Support for Behavior Change**

Social support is thought to have important effects on the ability of people to adopt and maintain healthy lifestyles but a challenge in research is that it has been defined and evaluated in many ways (Williams, Barclay, & Schmied, 2004). Cobb defines social support as “information leading the subject to believe that he is cared for and loved, esteemed, and a member of a network of mutual obligations” (1976). An alternative definition of social support is given by Uchino, who stated “…social support is usually defined to include both the structures of an individual’s social life (for example, group memberships or existence of familial ties) and the more explicit functions they may serve (for example, provision of
useful advice or emotional support)” (2004). House’s concept of social support includes emotional, instrumental, informational, and appraisal support. These four categories not only incorporate all definitions of social support, but also provide examples of where social support can be found and how it is given (1981). These concepts are commonly accepted as part of the construct of social support. For the purposes of the present study, the definition used is similar to Cobb’s theory in that participants will be asked about their perceived social support, ie how s/he feels s/he is “cared for and loved”.

Social support can be provided by friends, family, and peers. Support groups are effective in providing social support to people (Livhits, et al., 2011). In today’s society, support groups are prevalent in helping people manage chronic and behavioral conditions. A recent study examined the effectiveness of internet chat groups in providing social support and found that people who actively and passively participated in these groups were satisfied with the emotional support they received (Ballantine & Stephenson, 2011). Along with the different people who provide social support, social support can be delivered in both helpful and unhelpful ways. Deterrence, indifference, temptation, encouragement, and compliments are verbal ways that people provide and receive support. Encouragement and compliments are positive and helpful; whereas, deterrence, indifference, and temptation may be helpful, but are mostly viewed as unhelpful and some people take offence to these verbal support forms (Drummond, 2005).

**Social support in weight loss**

Social support can take the form of a workout buddy, group sessions, or relying on family and friends for that verbal encouragement. Research has shown that those who had social support through support groups, either as a set group or a group composed of family
and friends, after bariatric surgery had a higher amount of weight loss than those with low social support (Livhits, et al., 2011). A key study that clearly shows the importance of social support in weight loss recruited individual participants and participants with friends who also wanted to lose weight (Wing & Jeffery, 1999). These two groups of people were split up into two additional groups, one that received a social support intervention and one that did not. The group who was recruited with friends and received the social support intervention lost the most weight and was able to maintain that weight loss.

**Social support and healthy behavior**

Current literature both supports and refutes the notion that social support aids in behavior change and maintenance of healthy behaviors. A study examining the effects of social support on diet with Hispanics diagnosed with type 2 diabetes found that those with a reportedly higher level of social support was correlated with less barriers to diet self-care (Wen, Parchman, & Shepherd, 2004). Higher levels of physical activity and diet social support were also associated with better physical activity habits and higher diet quality scores, respectively (Kim, McEwen, Kieffer, Herman, & Piette, 2008). Even though some studies show social support helps with physical activity and diet behaviors, not all studies found the same results. A study examining physical activity adherence of the elderly found that exercise social support was not a mediator associated with increased exercise adherence. However, self-efficacy has been shown to be an effective factor in exercise adherence (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002). Social support for diet and physical activity were also found to have no association with BMIs (Kim, McEwen, Kieffer, Herman, & Piette, 2008). In a recent pilot study, midlife women used self-monitoring and took part in group meetings as well as online social interactions to help increase physical
activity. Physical activity did increase significantly, but social support did not change throughout the intervention (Butryn, Arigo, Raggio, Colasanti, & Forman, 2014). However, the differences in results may be due to the specific gender and race some studies choose to focus on. Thus, these studies may not be applicable to the general public.

**Social support in research**

Social support can be defined even further for research purposes as perceived social support and available social support. Perceived social support is support that people feel they actually have, whereas available social support is the amount of social support that people have that they can use, but they either do not use it or they do not feel that they actually have that source of support. In a study examining the effects of social support resources and lifestyle changes, the results showed that the intervention increased social support resources, which improved lifestyle behaviors. However, in this intervention, even though it provided more social support resources, the participants did not experience an increase in perceived social support (Barrera, Toobert, Angell, Glasgow, & Mackinnon, 2006). In today’s society, people are looking towards the internet for support groups, either in an online chat group or even on a social media network, such as Facebook (Roffeei, S., Abdullah, N., & Basar, S., 2015). One study found that internet support groups do increase a person’s perceived social support system (Barrera, Glasgow, McKay, Boles, & Feil, 2002). Social networks and online support groups increase social support for people. One paper examined the potential use of online social networking among health care providers and patients and their social groups. Although further research and development needs to be done on the effectiveness of online social networking, these platforms can help connect patients with others that have the same
or similar condition, increase access to information, and increase provider-patient interaction (Griffiths, et al., 2012).

Due to the two types of social support in research, there are many different surveys used to evaluate social support. One common social support survey is the Medical Outcome Study (MOS): Social Support Study. This survey takes into account emotional/informational, tangible, affectionate, and positive interactions. The MOS Social Support Survey has a high internal reliability with a Cronbach’s alpha of 0.97 and validity (r) for all items was greater or equal to 0.72, however, is not specific to diet and exercise (Sherbourne & Stewart, 1991). Another social support survey is the Multidimensional Scale of Perceived Social Support (MSPSS). The MSPSS is a 12-item survey that was designed as a shorter social support survey to save time for both researchers and participants (Zimet, Dahlem, Zimet, & Farley, 1988). The MSPSS measures social support in three scales: social support from family, from friends, and from significant others. This survey has shown to have good internal reliability with a Cronbach’s alpha of 0.88. The MSPSS also had a good test-retest score of 0.85. In terms of validity, the MSPSS was negatively correlated with a depression scale with \( r = -0.25 \), which was to be expected. Questions included in this survey ask about perceived social support, for example “I get the emotional help and support I need from my family” and “I can count on my friends when things go wrong” (Zimet, Dahlem, Zimet, & Farley, 1988). Similar to the MOS Social Support Survey, the MSPSS looks at general social support and does not have any items related to diet and exercise. A more specific social support survey related to diet and exercise and the one used in this study are the Healthy Eating Habits Survey and the Exercise Habits Scale developed by Sallis, et al. These 10- and 13- item surveys, respectively, contain both positive and negative social support behaviors that are
performed by family and friends. The Healthy Eating Habits Survey contains subscales that look at social support from family and from friends in the form of encouraging and discouraging behavior. Some example questions are “During the past three months, my family or friends complemented me on changing my eating habits” and “During the past three months, my family or friends offered me food I’m trying not to eat”. The Exercise Habits Scale also has subscales that examine the participation of family and friends in exercise habits, for example “During the past three months, my family or friends offered to exercise with me”. The Cronbach’s alphas ranged from 0.61-0.91 for the different scales and the test-retest reliability values ranged from 0.55 to 0.86. To measure validity, the Diet Scale was compared to a dietary index that was calculated based on a food frequency questionnaire. The Exercise Scale was compared to results of a physical activity questionnaire. The encouraging items on the Diet Scale and the diet index were significantly correlated for both the family, -0.27, and the friends scales, -0.19. The Exercise scale was significantly correlated with the survey for the family, 0.35, and the friends scale, 0.46. (Sallis J. F., Grossman, Rinski, Patterson, & Nader, 1987).

Health Coaching and Motivational Interviewing

What is health coaching?

A health coach can be defined as “…behavior change specialists who know how to partner with patients to identify health goals that put them on the road to confident self-management for their chronic condition(s)” (ClinicalHealthCoach.com, 2015). Health coaching is an increasingly popular methodology that helps guide a person on an independent path to behavior change. It has utility for weight loss programming, but also for helping
people to make other lifestyle changes. However, national standards are new for health coaching, which means there are health coaches that have had different training and not everyone is nationally certified. This makes it confusing for people and may even cause people to shy away from looking to health coaches for help with weight maintenance. There are a few options to receive Clinical Health Coach training through the Iowa Chronic Care Consortium, including online, in-person, or a combination of both. The National Society of Health Coaches defines health coaching very similarly to the Iowa Chronic Care Consortium, but highlights the use of motivational interviewing skills to help patients (Miller & Huffman Outcome Architects, 2015). A recent case study validates the success people can have with the help of a health coach. In this case study, a man tried to lose weight and was unable to until he got the support and guidance from a health coach (Sherman, Crocker, Dill, & Judge, 2013).

With regards to current research, health coaches in most studies are health care providers. Many studies trained nurses to act as a health coach in managing cancer pain (Thomas, Elliott, Rao, Fahey, Paul, & Miaskowski, 2012), while others call physical activity experts and Registered Dietitians health coaches (Hardcastle, Taylor, Bailey, Harley, & Hagger, 2013). Physicians have also been used as the health coaches in studies (Neuner-Jehle, Schmid, & Gruninger, 2013). A recent pilot study examined the effectiveness of three different types of health coaches; 1) professional, 2) peer, and 3) a mentor (someone who was already successful in losing weight). The data indicated that more people lost 10% or more of their initial body weight if their health coach was a professional or a peer, rather than a mentor (Leahy & Wing, 2013). Clearly, there are various health coaches defined within
each study. The difference between them, which may contribute to the effectiveness of each, is the training the health coaches received to be considered a health coach for the study.

Health coaching can be delivered in a variety of methods; however, research has shown different levels of effectiveness with each type. The most common and effective way of health coach delivery is face-to-face (Leahey & Wing, 2013; Sahlen, Johansson, Nystrom, & Lindholm, 2013). Telephone calls are a convenient and effective way to deliver advice and support to clients (Thomas, Elliott, Rao, Fahey, Paul, & Miaskowski, 2012; Caswell, Craigie, Wardle, Stead, & Anderson, 2012). Some studies even delivered health coaching via both telephone calls and face-to-face interactions (Caswell, Craigie, Wardle, Stead, & Anderson, 2012; Linden, Butterworth, & Prochaska, 2010). Another study used email newsletters and in-person sessions, which helped increase weight loss in participants (McDoniel, Wolskee, & Shen, 2010). Delivery of health coaching can take many forms and some are more effective than others, but a factor that may be influencing the effectiveness is the type of health coaching used or the psychological thought implemented during the coaching session.

Health coaching can be dynamic and requires the use of different schools of thought that are implemented in health coaching. Some common theories used in health coaching include social cognitive theory, goal systems, and social ecological theory and they have even been used as a combination of all three. When the combination was utilized in an intervention study, the intervention group had higher behavioral improvements than the usual care group (Toobert, Glasgow, Strycker, Barrera, Ritzwoller, & Weidner, 2007). Other health coaching studies used self-determination theory, which is very similar to motivational interviewing (Deci & Ryan, 2012). Motivational interviewing is another theory that has been successfully used in health coach interventions to promote behavior changes (Hardcastle,

**What is motivational interviewing?**

Motivational interviewing (MI), predominantly based on self-determination theory, is a client-centered approach to behavior change. This theory helps the client find the motivation within themselves to make a change, as well as setting their own goals to accomplish that change. The four principles of MI are: 1) resist the righting reflex, 2) understand the client’s motivation, 3) listen to the client, and 4) empower the client (Rosengren, 2009; Miller & Rollnick, 2013). These principles help to create a sense of self-efficacy in the clients to change their behavior and accomplish their goals. The four principles of MI also reflect the essentials of the spirit of MI, which includes collaboration, evocation, and autonomy (Rosengren, 2009; Miller & Rollnick, 2013). The counselor and client work together to formulate goals and steps to achieve those goals. The counselor uses his/her knowledge to provide options for change to the client. The client figures out what is feasible for themselves and comes up with the idea for accomplishing their goal. This gives the client a feeling of responsibility and independence because they came up with the goal themselves (Rosengren, 2009; Miller & Rollnick, 2013).

In order for the advisor or counselor to properly use MI, there are tools used to encourage self-efficacy. The acronym for these tools is OARS: open-ended questions, affirmations, reflective listening, and summaries. With these tools, the client is positively encouraged to stay on track and accomplish those goals (Rosengren, 2009; Miller & Rollnick, 2013). The role of the counselor is to create a comfortable environment to allow the
client to open up, actively listen to the client and summarize what the client is saying. This way, the client feels that s/he is respected by the counselor. Important phrases to listen for as the client is talking are those that express elements of change. This is called “change talk” (Rosengren, 2009; Miller & Rollnick, 2013). When the client is ready and willing to change, the counselor must encourage the client to continue thinking about their motivation for wanting to change. This then leads to the client creating a plan to accomplish his/her goals. With encouragement from the counselor, the client will develop self-efficacy and accountability to take charge of and accomplish their lifestyle change.

**Effectiveness of motivational interviewing**

Motivational interviewing was first used as a therapy to treat alcoholics and drug addiction (Lundahl & Burke, 2009; Miller & Rollnick, 2013). Since then, MI has been used to help people manage chronic illnesses and other medical issues. One study used MI as a tool in a worksite program to help employees manage chronic illnesses (Linden, Butterworth, & Prochaska, 2010). This study found that interventions using MI helped employees increase self-efficacy and motivation, along with other characteristics associated with MI. Another study found that MI is effective in helping others manage cancer pain (Thomas, Elliott, Rao, Fahey, Paul, & Miaskowski, 2012). In terms of weight management and physical activity, there have been many studies that used MI as the tool to help people become healthier. A study examining the anthropometric measurements over a 14 week intervention of 5th and 6th graders showed that those students receiving MI had a larger decrease in body fat percentage, as well as BMI and waist circumference (Wong & Cheng, 2013). MI has also been shown to decrease BMI and increase physical activity in adolescents (Gourlan, Sarrazin, & Trouilloud, 2013). Infertile overweight and obese women decreased caloric intake and increased physical
activity more with the MI intervention than with the control group (Mahoney, 2013). Based on these studies, motivational interviewing can be an effective tool for people across all ages and conditions to help make a healthy change.

Additional studies related to diet and weight loss show mixed results of the effectiveness of motivational interviewing. Resnicow et al. (2001) showed that a motivational interviewing intervention increased fruit and vegetable intake more effectively than self-help and control groups. This increase was significant. The results of another study that used a motivational interviewing-approach intervention showed a significant decrease in dietary fat consumption in the treatment group when compared to the normal (or non-motivational interviewing) group (Bowen, et al., 2002). Another study examined the effects of motivational interviewing on weight loss in women with type 2 diabetes and found that those in the motivational intervention group not only lost significantly more weight, but kept track of their diets and had a higher compliance to the protocol (Smith West, DiLillo, Bursac, Gore, & Greene, 2007). Thus, this study supports motivational interviewing as an effective strategy in diet and weight changes. However, there were a few studies that did not find any significance between the motivational interviewing and control groups. For example, one study found that training dietitians in motivational interviewing helped significantly decrease their patients’ fat intake, but the changes in BMI and waist circumference were not significant compared to the control group (Brug, Spikmans, Aartsen, Breedveld, Bes, & Fereira, 2007). Another study compared a standard intervention and a motivational interviewing intervention and found no significance in cholesterol levels at the end of the study between the two groups (Mhurchu, Margetts, & Speller, 1998). A review article presents evidence of the effectiveness of motivational interviewing for health
behaviors. This author recognizes there are some studies that show no effect of motivational interviewing, but that there are some limitations with these studies and suggests more research needs to be done to address issues such as training and treatment dose (Martins & McNeil, 2009).

Even though MI has been used as an effective intervention strategy, each study varied in the length and frequency of the MI sessions. This brought up the question of how intense and how many sessions does it take for MI to be effective. One study was a 6 month long intervention where the subjects met once a month for 30 minute sessions. This study found no statistically significant results in terms of self-efficacy and anthropometric measurements (Walpole, Dettmer, Morrongiello, McCrindle, & Hamilton, 2013). Studies with more frequent MI sessions have shown significant results. For example, one study had five MI sessions over a 14 week period (Wong & Cheng, 2013). This may suggest that MI sessions should be delivered within a certain time frame of each other in order to be effective with subjects. MI has also been delivered over the phone with face-to-face sessions when participants requested it and has also been shown to have positive outcomes with regards to chronic care management (Linden, Butterworth, & Prochaska, 2010). Another study delivered MI over the phone once a month for six months and found a significant difference in lowering BMI and increasing physical activity (Gourlan, Sarrazin, & Trouilloud, 2013).

Research on motivational interviewing has also examined the sustainability of this technique for promoting lifestyle change. One study evaluated 1 year follow-up outcomes after a six month intervention. Based on the results, the MI intervention group was able to decrease some cardiovascular disease risk factors after the intervention period and maintain them a year later (Hardcastle, Taylor, Bailey, Harley, & Hagger, 2013). This shows promise
that MI is a sustainable, cost-effective technique that can be used in behavior and lifestyle changes.

**Past health coach studies in the PAHP lab**

As described in the section on self-monitoring, the Physical Activity and Health Promotion Lab at ISU has conducted a number of health coach studies to examine and determine the most effective way of helping people lose weight and make behavior changes. The projects evolved to adopt health coaching strategies with an emphasis on motivational interviewing. In Spring, 2014, members from the lab piloted a new format for intervention called the “Health Coach Study”. This study capitalized on the self-monitoring capabilities of the SenseWear® monitor and also incorporated lessons learned from previous behavior change studies. The key feature of the design is choice since participants are provided with a choice about what behavior target they want to pursue and also what method they would like to use for the intervention (in person or online). The programming was tested on 20 participants and the model proved to work well. This model will be used in the main aspect of the proposed study.

A new feature planned for the study is to incorporate indicators of social support since it has been shown to have an impact on the outcomes of interventions. In a follow-up study to the original Bonsante study, a student (Davis, 2012) evaluated whether psychosocial factors helped maintain weight loss or prevent weight regain. The study used the same participants that were in Walsh’s study, but looked at the retention or regain of weight from the end of the intervention to four months after the intervention. Self-efficacy and social support were surveyed. The results indicate that self-efficacy and social support have a role in weight loss/maintenance. A limitation of the past study is that social support was not
obtained at baseline since it was conducted as a follow-up study. The present study builds on this by specifically testing if social support moderates the effectiveness of a guided MI-based behavior change program.

**Health Coaching, Motivational Interviewing, and Social Support**

This literature review presented evidence that both health coaching and motivational interviewing are effective in promoting weight loss and behavior change. Research has shown that social support also enhances weight loss. In this thesis research, participants receiving face-to-face health coaching with high social support were expected to have the best outcomes and to lose the most weight. The participants in the face-to-face health coaching treatment group will be able to be guided more effectively with motivational interviewing. This is expected to create a positive environment and better outcomes. The impact of social support is also expected to moderate the outcomes. With belief in themselves and family and friends supporting them, these participants would experience the greatest weight loss. High social support, face-to-face health coaching, and motivational interviewing are expected to create a positive environment for a sustainable behavior and lifestyle change.
CHAPTER 3

METHODS

This project involved the evaluation of an 8-week health coaching intervention study designed to promote lifestyle behavior change in adults. The study used a quasi-experimental design with participants self-selecting into a treatment (motivational interviewing) or control (standard health coaching). Consistent with themes of autonomy, participants were also given the choice of working on one of three behavioral goals (diet, physical activity, or weight management). The first hypothesis was that in-person health coaching would aid in great behavior change and increased improvement in the objective outcomes compared to the online participants. It was also hypothesized that individuals with higher perceived social support would have more favorable outcomes than those with lower levels of social support and that this effect would be more pronounced in the group that received in-person health coaching. The following sections outline the specific aspects of the proposed study.

Participants

The participants for this study included 87 adults (18 years of age and older) that voluntarily enrolled in the health coach study. The primary interest in the study was on the impact of social support on weight management but effects were examined for all target behaviors. Exclusion criteria included anyone who had physical handicap limitations, a metal allergy, a pacemaker, used portable oxygen, and anyone who was participating in another guided weight loss program (e.g. Kosama, CrossFit, etc). Participants were recruited through a variety of methods including physician referral, flyers, email communication to ISU faculty and staff, and direct recruitment through partnerships with other local worksites.
Measures

Observed behavior change measurements

Behavior change was assessed using the behavior data tracked in the BodyMedia FIT 3.0 System as well as from clinically oriented outcomes captured from the participants. The details about each specific outcome measure are described below.

**Diet:** Diet measures were obtained at both baseline and week 8 by computing an overall index of quality using the self-reported data that participants entered on a 3-day diet record through the BodyMedia software. These diet logs were then entered into the Food Processor program 10.14 (ESHA Research, Salem, OR). A Healthy Eating Index score was computed to determine each participant’s diet quality both pre- and post-intervention. The Healthy Eating Index 2010 accounts for both healthy eating (i.e. whole fruit, total vegetables, whole grain, dairy, etc.) and unhealthy eating (i.e. sodium intake, empty calories, and refined grains) and helped to evaluate changes in overall diet quality. The Healthy Eating Index (HEI) measures how closely a person follows the recommendations outlined by the *Dietary Guidelines for Americans*. The HEI provides a score out of 100, thereby giving a single numerical value to diet data. Higher scores indicate a higher quality diet. There are 12 components to the Healthy Eating Index: total fruit, whole fruit, total vegetables, beans and greens, dairy, whole grains, total protein, seafood and plant protein, fatty acid ratio (which is the ratio of polyunsaturated fats to saturated fats), empty calories, sodium, and refined grains. The HEI-2010 average score across the population is 49.9. Men typically score around 49.8 and women score around 52.7 (Guenther, et al., 2014). The Health Eating Index of 2010 proved to have reliability with a Cronbach’s alpha of 0.68. The HEI 2010 was used to score four high quality menus and each menu scored high, which supports the validity of the HEI
(Guenther, et al., 2014). See Appendix B for the breakdown of potential scores earned for each category. Dr. Christina Campbell’s lab at Iowa State University created an excel spreadsheet that calculated scores for each of the 12 components and the overall HEI score. This spreadsheet was used to analyze participant’s diet data. The ESHA program provided all the values needed for this spreadsheet, except for the empty calories, refined grains, and whole grains. To determine these values, certain food items were entered into either NutritionistPro™ Diet Analysis (Axxya Systems, Stafford, TX) or into FoodTracker on the USDA SuperTracker website.

**Physical Activity** Levels of physical activity were obtained at both baseline and week 8 by extracting the recorded minutes of physical activity from the SenseWear® monitor. Total physical activity minutes, vigorous activity minutes, and number of steps were recorded and analyzed, but focus was on the combined amount of recorded moderate to vigorous physical activity (MVPA).

**Weight Control** Anthropometric measurements including height, weight, BMI, and body fat percentage were obtained at baseline and the end of the study to evaluate change in weight status. Height was measured using an Ayerton stadiometer model S100 (Prior Lake, MN) and replicate measures were obtained. Weight was similarly measured twice using a Cardinal Detecto digital scale Model 758C (Webb City, MO). This average was used for determining BMI. The average height and weight were computed at both time points and these values were used to compute the Body Mass Index (BMI) using the established formula \[\text{BMI} = \frac{\text{Wt (kg)}}{\text{Ht (m)}^2}\]. Body fat was measured using a handheld Omron device HBF-306C (Lake Forest, IL).
**Reported behavior change strategies**

Behavior change was measured by having participants fill out a comprehensive battery of behavioral measures developed by Nothwehr at baseline and post-intervention (Healthy Eating and Exercise in the rural Midwest, 2003). The battery includes nine different scales capturing behavior change strategies related to diet, physical activity, and weight control. The specific survey items (3 to 6 per scale) are scored on a four-point likert scale and have been shown to have good utility for predicting weight management outcomes in past research (Nothwehr, Dennis, & Haotong, Measurement of Behavioral Objectives for Weight Management, 2006; Nothwehr, Weight control behaviors of low-income, African American women, 2002). The alpha reliability coefficients ranged from .62 to .85 for the individual scales (Nothwehr & Peterson, Health eating and exercising: Strategies for weight management in the rural Midwest, 2005), but past research from the Health Coach Study showed that the 9 scales can be combined into 3 component scales that capture behavior change strategies specific for diet, physical activity and weight control (Nelson E. M., 2014). The composite scale for Diet includes subscales of Diet Monitoring, Diet Social Strategies and Diet Cognitive Strategies (alpha = .90). The composite scale for Physical Activity includes subscales of Activity Monitoring, Activity Social Strategies and Activity Cognitive Strategies (alpha = .89). Finally, the Weight Control composite scale includes scales capturing Meal Planning, Meal Preparing/Buying, and Meal Portion (alpha = .91). These more robust scales were shown in the past Health Coach Study to relate to the specific behavior change efforts and serve as effective mediating variables to evaluate change (Nelson E. M., 2014). For the purpose of this study, however, the nine scales were collapsed into different components than the previous study just like it was done in previous theses. For
the Diet scale, the Diet Monitoring, Diet Social Strategies, Diet Cognitive Strategies, Meal Planning, Meal Preparing/Buying, and Meal Portioning were combined. The Physical Activity behavior scale combined the Activity Monitoring subscale, the Activity Social Strategy subscale, and the Activity Cognitive Strategies subscale. The Weight behavior strategies scale takes into account all nine scales since all nine pertain to weight loss behaviors.

**Social support measurements**

Social support was measured at baseline and at week 8 during the final measurements by the Social Support and Eating Habits and the Social Support and Exercise surveys developed by Sallis, et al (1987). These 10- and 13-item questionnaires (respectively) capture social support of family and friends through both physical and verbal encouragement, discouragement, and participation. Each question is ranked on a 5-point Likert scale with 1 being “None” and 5 being “Very Often”. For each scale, the responses are summed to create an overall score. The coding produces separate subscales of social support for both eating and physical activity and each can be computed separately for family and friends. Higher scores indicate a higher perceived social support in these measures. Social support was evaluated as a moderating variable that may influence the effectiveness of the overall health coaching process (See Appendix for items).

**Other measurements**

Additional measurements were obtained to control for other variables that may influence the success of individuals in a health coaching program. Two supplemental measures were Perceived Stress Survey and a Personality Survey.
**Perceived Stress Survey:** The Perceived Stress Survey is a commonly used survey that measures how stressed a person feels within the past month and is a validated measure (Cohen, Kamarck, & Mermelstein, 1983). With a correlation of 0.65, this survey proved to be highly correlated with depressive symptoms (Cohen, Kamarck, & Mermelstein, 1983). Some questions express negative feelings about the past month (e.g., “…how often have you felt nervous and ‘stressed’?” and “…how often have you been angered because of things that were outside of your control?”). Other questions are geared more towards positive, less stressful feelings (e.g., “…how often have you felt that things were going your way?” and “…how often have you felt that you were on top of things?”). Each question is measured using a likert scale with 0 signifying “none” and 4 signifying “very often”. To score this survey, the positive questions, which are questions 4, 5, 7, and 8, should be reverse scored and summed with the other six questions (See Appendix). A higher score indicates more perceived stress.

**Personality Survey:** This survey came from the extraversion scale of the Eysenck Personality Questionnaire (EPQ). The EPQ is a well-known 100-item personality questionnaire. This survey has four scales: an extroversion scale, a neuroticism scale, a psychosis scale, and a lie scale. Each question is answered either “yes” or “no”. For the purposes of this study, only the extroversion scale was used so as not to overwhelm the participants with too many surveys (See Appendix B). Using this scale will attempt to determine if more extraverted individuals chose in-person health coaching than online health coaching. To score this survey, questions 6, 8, and 12 are reverse scored and the amount of “yes” responses were counted. The more “yes” responses, the more extroverted a person is (Eysenck, H. J., & Eysenck, S. B. G., 1975). The extroversion scale, neuroticism scale, and
lie scale were all found to have high reliabilities, 0.82, 0.82, and 0.71, respectively (Loo, 1979).

**Intervention Design**

The study was conducted through an ongoing behavior change program called the “Health Coach Study” that is evaluating the utility of motivational interviewing and self-monitoring on behavior change in adults. The intervention was delivered by a team of trained student health coaches enrolled in a service learning course (KIN 391 Practicum in Health Coaching) class at Iowa State University. Student coaches were trained by faculty and graduate research assistants working in the Physical Activity and Health Promotion (PAHP) Lab. The health coaches received specific training in motivational interviewing through the practicum classwork.

The graduate students involved in this project completed the Clinical Health Coach® Training Program through the Iowa Chronic Care Consortium. This training included 26 hours of online training, three exams, and four teleconferences exploring and practicing skills learned. This program also required participants to attend a two-day in-person workshop to help refine coaching skills. These graduate students trained the other health coaches for this study to ensure consistency in programming.

The key principles of motivational interviewing were covered in 3-4 one to two-hour long sessions followed by role-playing sessions and practice. Sessions covered the principles of MI, the spirit of MI, and the OARS technique used in MI. The health coaching field, the future of health coaching, past health coach studies in the Welk lab, and an overview of this study were covered in these sessions as well. There was a one hour long session in which the
trainees role played, as well as critiqued each other in order to become more comfortable in delivering MI. Between each session, trainees were also given activities to practice MI and remember key concepts. Once training was complete, student health coaches were assigned 4-5 clients to work with during the semester. Each health coach met with or corresponded with the research participants at least once a week. Team meetings and discussions helped to ensure that health coaches were providing similar types of feedback and support to the participants.

**Procedures**

The health coaching and data collection session were completed with a series of weekly visits. Weekly visits are described below:

**Week 1 visit**

During this visit, participants completed a battery of surveys as part of existing baseline measurements. They filled out a basic Demographic survey, a PARQ survey, the Nothwehr Behavior Change surveys, and the social support survey (Sallis J. F., Grossman, Pinski, Patterson, & Nader, 1987). Each participant was given a SenseWear® Armband and was asked to wear it for a week and record their diet for three days (two weekdays and one weekend day) into the associated BodyMedia Weight Management software. Anthropometric measurements were also taken at this time, which included height, weight, BMI, and body fat percentage.

**Week 2 visit**

The participants met with a health coach and were asked if they wanted in-person or online health coaching, which meant they had to meet with a health coach or to correspond with
their health coach throughout the remainder of the study. The participant was also given the choice of one of three goals to work on throughout the study: diet, physical activity, and weight management.

- **Face-to-Face.** These face-to-face health coach sessions were the intervention group that received motivational interviewing. Participants were asked to meet with their health coach once a week during the 8 weeks. Each week the participants set up a new goal with guidance from their health coach.

- **Online.** The online health coaching occurred through an email system, which allowed the health coach to send and receive emails to the participant. Participants were asked to correspond with their health coach once a week and allow the health coach 48 hours to respond.

Regardless of the condition, participants were provided with similar information about how to use the armband and BodyMedia FIT online system. Participants completed the corresponding “Reason for Change” survey for their target goal.

**Weeks 3-8**

During these weeks, each participant met with or corresponded with their health coach once a week. Each participant was encouraged to set up goals each week that ultimately helped them achieve their overall goal for the study.

**Week 9 visit**

Participants returned to the lab to turn in their monitors and to fill out the final surveys, including the Behavior Change, Social Support surveys, a Health Coach Experience Survey, a Personal Preferences survey, a Perceived Stress survey, and an experience survey with the Sensewear Monitors and accompanying software. Final anthropometric measurements were
also taken, including weight, BMI, and body fat percentage. This study was approved by the
Iowa State University Institutional Review Board (Appendix A).

Analyses

The focus of the analyses was on evaluating the impact of in-person versus online
health coaching and social support on the behavior change strategies and outcomes. Since
there was not an equal number of participants in each group and goal and participants were
not randomly assigned to groups, baseline characteristics were first examined to determine
any significant differences in baseline values. Descriptive statistics (Mean and SD) were
computed for all change outcomes, as well as percent change to summarize the overall
outcomes from the behavior change programming.

To analyze Aim 1, which was to determine the effectiveness of in-person versus
online health coaching, a series of two-way ANOVA analyses (group x goal) were conducted
to compare outcomes by group and goal. Separate analyses were run for each of the targeted
behavioral goals (diet, activity and weight loss) as well as for the separate behavior change
strategies (nutrition scale, meal scale, activity scale, and weight control scale), since it is
possible for effects to be different for some outcomes than for others. The two way ANOVAs
enabled interactions and main effects to be examined for each of the two factors. Effect sizes
were also calculated to determine the magnitude of change between in-person and online
health coaching and also to quantify the actual magnitude of behavior change (post-
intervention –baseline) for each goal.

For Aim 2, the focus was on examining the impact of social support on the outcomes.
A series of linear regressions were modeled to analyze the effects of social support on
outcomes. Each linear regression analysis controlled for the baseline value of the dependent variable as well as a number of other factors including group, goal, stress, the baseline independent variable (either social support or behavior change strategy), and the change in the independent variable.

The Sallis social support survey contains a number of subscales that would allow a variety of different ways to analyze the data. For the purpose of this study, the diet social support was computed as the average of the ‘Encouragement’ subscale of the diet scale and the activity social support was computed as the average of the ‘Participation’ subscale. The indicators of diet social support, activity social support, and weight social support (diet social support + activity social support) were each examined to determine if social support influenced the associated behavioral outcomes of the intervention, as well as the reported utilization of the associated behavior change strategies. For example, diet social support was included in models to examine the impact on change in HEI score as well as the change in nutrition strategies. Similarly, the activity social support score was used to evaluate change in MVPA and change in activity strategies while the weight control social support was examined relative to change in weight outcomes and change in weight control strategies. The impacts of the behavior change strategies on the associated outcomes were also tested to determine if the behavior changes were associated with the changes in the outcomes.

The stress survey and personal preferences survey were examined in supplementary analyses to provide additional information and to help explain the results. The stress survey was analyzed as a covariate to determine any effects of stress on the self-reported and observed outcomes. The personal preferences survey was used to possibly explain why participants chose in-person health coaching or online health coaching. It was hypothesized
that the more introverted a person was (the lower number of “yes’s”), the more likely that person will be in the online health coaching group. Here, the frequency of introverts versus extroverts in each group was examined.
CHAPTER 4
RESULTS

Participants were recruited in two cohorts, one starting in the Fall semester and one starting in the Spring semester. A total of 87 participants (23 males, 64 females) completed the eight-week intervention. Of those participants, 51 participants (15 males, 36 females) selected in-person health coaching and 36 participants (8 males, 28 females) chose online health coaching (Figure 1). Out of the 87 participants, 15 chose a Diet goal, 24 chose a physical activity goal, and 48 chose a weight management goal (Figure 1). Since participants were allowed to self-select both the goal they wanted to work on and how they received health coaching, there was not an equal number of participants in each treatment group. There were 9 participants who chose in-person health coaching with a diet goal, 10 participants with in-person health coaching and a physical activity goal, and 32 participants in the in-person group with a weight management goal. For those who received online health coaching, there were 6 who chose a diet goal, 14 with a physical activity goal, and 16 with a weight management goal.

Most participants were white (90.8%), were married (71.26%), earned a graduate degree (58.62%), and had an income of $100,000 or more (40.23%). The average age was 42.95 years with a range of 23-73 years old (Table 1). Because this was not a randomized study, it was important to test for possible differences in the baseline data across the participants (see descriptive statistics in Table 2). Baseline characteristics were not significantly different among groups and goals for the key outcomes including HEI $[F(3,43)=0.43, p=0.736]$, weight $[F(3, 82)=0.11, p=0.95]$, and moderate/vigorous activity in minutes $[F(3,68)=1.42, p=0.24]$. Similar analyses were run to test baseline differences in the
use of the various behavior strategies (Table 3). Non-significant difference by group and goal were observed for the Nutrition Strategy Scale \([F(3,83)=0.22, p=0.8812]\), Meal Strategy Scale \([F(3,83)=0.27, p=0.8444]\), and Weight Control Strategy Scale \([F(3,83)=1.4, p=0.2482]\). However, the Activity Strategy Scale baseline values were statistically significant \([F(3,83)=4.87, p=0.0036]\). A Tukey test revealed that those with a diet goal had a higher baseline Activity Strategy score than participants in the other two goals \((F=5.93, p=0.0039)\).

**Evaluation of Differences in Behavioral Strategies by Group and Goal**

The health coaching led to significant changes in the adoption or utilization of behavioral strategies related to Nutrition (17.39% change, \(t=7.1, p<0.0001\)), Meal Planning (10.08% increase, \(t=5.95, p<0.0001\)), Activity (18.38% change, \(t=6.44, p<0.0001\), and Weight Control (14.19% increase, \(t=7.47, p<0.0001\)). Each of these indicators is a macro-scale made up of several component items so supplemental analyses were run to examine the changes in individual items.

A series of four two-way (group x goal) ANOVAs were used to evaluate differences in the adoption of the main behavioral strategies by the differences in the four specific components of the Nothwehr behavioral strategies survey: Nutrition Scale, Meal Scale, Activity Scale, and Weight Control Scale (Figure 2).

**Nutrition Scale** The interaction term (group x goal) was not significant for the percent change of the Nutrition Scale \([F(5,81)=0.11, p=0.99]\). Non-significant main effects were also found for group \([F(1,81)=0.02, p=0.88]\) and goal \([F(2,81)=0.11, p=0.90]\).
**Meal Scale** The interaction term (group x goal) for the Meal Scale percent change was not significant \( F(5,81)=1.21, p=0.31 \) and neither were the group main effect \( F(1,81)=1.15, p=0.29 \) and the goal main effect \( F(2,81)=0.05, p=0.95 \).

**Activity Scale** The percent change of the ANOVA for the Activity Scale \( F(5,81)=0.77, p=0.58 \), the group main effect \( F(1,81)=0.01, p=0.93 \), and the goal main effect \( F(2,81)=1.44, p=0.24 \) were all not statistically significant.

**Weight Control Scale** The interaction term (group x goal) for the percent change of the Weight Control Scale was not significant \( F(5,81)=0.43, p=0.83 \), and neither were the group main effect \( F(1,81)=0.08, p=0.78 \) or the goal main effect \( F(2,81)=0.33, p=0.72 \).

**Examining group improvements from baseline and effect sizes**

These analyses demonstrated that there were no differences in outcomes between groups or goals in the changes but it was also important to test the actual significance of the behavior changes by goal and group. Examination of those in the in-person group revealed significant increases for percent change of the Nutrition Scale \( t=5.49, p<0.0001, ES=-0.26 \), the Activity Scale \( t=4.83, p<0.0001, ES=0.07 \), Weight Control Scale \( t=5.74, p<0.0001, ES=0.15 \), and the Meal Scale \( t=5.13, p<0.0001, ES=0.37 \). Online health coach participants also increased significantly in the Nutrition Scale \( t=4.44, p<0.0001 \), Activity Scale \( t=4.26, p=0.0001 \), the Weight Control Scale \( t=4.79, p<0.0001 \), and the Meal Scale \( t=3.15, p=0.0033 \). Effect sizes (ES) were also calculated to determine the magnitude of change (percent change) between in-person and online health coaching (Table 4). The effect sizes were low with the largest ES observed for the Meal Scale (ES= 0.37) when comparing the in-person group to the online group.
Examining goal improvements from baseline and effect sizes

Differences over time were also examined separately for each of the goals as well. Significant increases were found for percent changes on the Nutrition Scale ($t=2.93, p=0.0110$, ES= -0.55), Weight Control Scale ($t=2.65, p=0.0191$, ES= -0.45), and Meal Scale ($t=2.67, p=0.0184$, ES= -0.39) for those participants who pursued a Diet goal. However, the Activity Scale ($t=1.62, p=0.1274$, ES= -0.28) did not significantly increase from baseline. For those with an Activity Goal, significant changes were observed on the Nutrition Scale ($t=4.24, p=0.0003$, ES= -0.71), Activity Scale ($t=4.773, p<0.0001$, ES= -0.87), Weight Control Scale ($t=5.19, p<0.0001$, ES= -0.82), and the Meal Scale ($t=4.06, p=0.0005$, ES= -0.43). Those with a Weight Management goal also significantly increased from baseline in the Nutrition Scale ($t=4.86, p<0.0001$, ES= -0.68), Activity Scale ($t=4.81, p<0.0001$, ES= -0.72), Weight Control Scale ($t=5.22, p<0.0001$, ES= -0.82), and the Meal Scale ($t=4.01, p=0.0002$, ES= -0.57). See Table 5 for effect size calculations.

Closer examination of the behavior change strategies by goal revealed that participants with a Weight Management goal tended to have a higher percent change compared to the other two goals in Activity Strategy (21.63%, SD=31.14), Meal Strategy(10.72%, SD=18.51), and Weight Control Strategy (15.25%, SD=20.25). Participants with a Physical Activity goal had a slightly higher percent change in the Nutrition Scale when compared to the other two goals (19.02%, SD=21.98).
Examination of Change in Weight, MVPA, and HEI Score

The health coaching intervention led to significant changes across all participants in the following outcomes: weight change ($t=-3.55$, $p=0.0006$) and moderate/vigorous minutes($t=-4.74$, $p<0.0001$).

Similar to the analyses above, three two-way (group x goal) ANOVAs were used to evaluate differences in the specific outcome measures by both group and goal.

**HEI Score** The interaction effect was not significant for the change in HEI score [$F(5,41)=1.88$, $p=0.12$]. The group main effect was significant [$F(1,41)=7.62$, $p=0.01$], however the goal main effect was not [$F(2,41)=1.26$, $p=0.29$]. The participants in the in-person group had significantly larger changes in HEI scores ($M=6.15$, $SD=14.69$) than the online participants ($M=-4.5$, $SD=11.05$).

**MPVA** The interaction effect was not significant for MVPA change [$F(5,66)=1.14$, $p=0.35$]. There was no significance for the goal main effect [$F(2,66)=0.06$, $p=0.94$] or the group main effect [$F(1,66)=0.00$, $p=0.96$].

**Weight Change** The interaction effect was not significant for weight change [$F(5,80)=0.28$, $p=0.92$]. The main effect of goal was not significant [$F(2,80)=0.23$, $p=0.80$]. The main effect of group was not significant [$F(1,80)=0.06$, $p=0.81$].

Examination of Percent Change in HEI, MVPA, and Weight Change

Since magnitude of behavior change can be influenced by the person’s baseline levels, it is important to also examine percent changes in these indicators. The intervention led to significant changes overall participants in the following outcomes: percent change of
weight \((t=3.2, \ p=0.0019)\) and percent change in moderate/vigorous minutes \((t=-4.32, \ p=<0.0001)\).

Three two-way ANOVAs (group \(\times\) goal) were run for percent change of weight loss, percent change of HEI, and percent change of MVPA (Figures 3, 4, 5).

**HEI Percent Change** The interaction effect revealed that percent change of the Healthy Eating Index score interaction was significant \([F(5,41)=2.7, \ p=0.03]\). See Figure 6. The main effect of group was also significant between in-person and online health coaching \([F(1,41)=10.21, \ p=0.003]\). With a mean of 21.57% change, the participants who received in-person health coaching significantly increased their HEI score when compared to those who received online health coaching with a mean of -8.89% (Figure 4 and Table 4). The goal main effect was not significant \([F(2,41)=2.33, \ p=0.11]\).

**MVPA Percent Change** The moderate/vigorous minutes (MVPA) percent change interaction was not significant \([F(5,66)=1.22, \ p=0.31]\). MVPA percent change decreased in both groups with a 14.49% decrease in the in-person group and a 25.87% decrease in the online group (Figure 5); however they were not significant from each other \([F(1,66)=0.24, \ p=0.63]\). The goal main effect was not significant as well \([F(2,66)=0.18, \ p=0.84]\).

**Percent Weight Change** The weight percent change interaction term was not significant \([F(5,80)=0.18, \ p=0.97]\). Even though the in-person group had a higher percent change weight loss of 0.802% when compared to the online group with 0.642% change weight loss (Figure 3), these observed outcomes were not statistically significant \([F(1,80)=0.00, \ p=0.98]\). The goal main effect was not significant \([F(2,80)=0.04, \ p=0.96]\).
Percent change compared to baseline in groups

T-tests revealed significant percent changes in weight (t=2.72, p=0.0090), percent change of HEI score (t=2.46, p=0.0205), and the percent change of moderate/vigorous minutes (t=-2.37, p=0.0224) for those who received in person health coaching. Similarly as above, the only percent change of an outcome that was significantly different from baseline was the percent change of moderate/vigorous minutes (t=-4.10, p=0.0003). Similar t-tests run for online participants revealed that the only outcome that significantly changed from baseline was the percent change of moderate/vigorous minutes (t=-4.1, p=0.0003). Effect sizes were also calculated to compare the magnitude of change between in-person and online health coaching. The HEI percent change showed a large effect size of 0.77 (Table 4).

Percent change compared to baseline with goals

T-tests were also run and effect sizes (Table 6) were calculated on the percent HEI change, percent MVPA change, and percent weight change to determine if there was a significant change from baseline for each goal. The HEI percent change (t=0.69, p=0.5084, ES= -0.17), MVPA percent change (t=-1.83, p=0.1000, ES= 0.67), and weight percent change (t=1.17, p=0.2617, ES= 0.03) were not significant from baseline values for the participants with a Diet goal. For those participants with a Physical Activity goal, the HEI percent change (t=1.11, p=0.2937, ES=-0.25) and weight percent change (t=1.61, p=0.12, ES= 0.04) were not statistically significant compared to baseline values. However, the MVPA percent change did significantly decrease (t=-2.37, p=0.0289, ES= 0.41). HEI percent change (t=0.93, p=0.3609, ES= -0.08) was not statistically different from baseline values for those with a Weight Management goal. However, MVPA percent change went in the unexpected direction and significantly decreased (t=-3.13, p=0.0032, ES= 0.35) and percent
weight change was significant with a mean of 0.75% (SD= 2.09) decrease in weight (t=2.48, 
\( p=0.0168 \), ES=0.03).

The Effects of Social Support on Behavioral Strategies

A key goal in the study was to examine whether social support influenced the adoption of healthy lifestyles and the outcomes from the health coaching. Because few group or goal effects were observed, these analyses used the combined sample while still controlling for group and goal in the statistical models. Three multiple linear regressions were run to evaluate the moderating effects of social support on percent change of nutrition behavior strategies, activity behavior strategies, weight control strategies, and meal strategies. The results are summarized below and in Table 7.

**Diet Social Support and Nutrition Strategies** The percent change nutrition strategy regression model controlled for baseline diet social support, the baseline nutrition strategy score, as well as group, goal, and stress. The main predictor variables were the change in diet social support and the interaction term that captured change in diet social support by group. The model with these predictors was significant (\( R^2=0.45 \), \( F(8,76)= 7.75 \), \( p<0.0001 \)). The change in diet social support was not a significant predictor in the model (\( \beta=9.47 \), \( p=0.06 \)). The interaction term was not significant (\( \beta=6.95 \), \( p=0.25 \)).

**Physical Activity Social Support and Activity Strategies** The activity percent change strategy regression model controlled for baseline physical activity social support, baseline activity strategy score, as well as group, goal, and stress. The main predictor variables were the change in physical activity social support and the interaction term that captured change in physical activity social support by group. This model was significant as well (\( R^2=0.53 \),
It was found that the physical activity social support change was significantly associated with the reported activity strategies ($\beta=15.71$, $p=0.0014$). The interaction term was not significant ($\beta=3.9$, $p=0.55$).

**Weight Social Support and Weight Control Strategies** The percent change weight control strategy regression controlled for baseline weight social support, baseline weight control strategies score, as well as group, goal, and stress. The main predictor variables were the change in weight social support and the interaction term that captured change in weight social support by group. The results indicated the predictors in the model explained 58% of the variance in weight strategy ($R^2=0.58$, $F(8, 76) = 13.16$, $p<0.0001$) and the weight social support change significantly predicted weight control strategy ($\beta= 15.66$, $p<0.0001$). The interaction term was not significant ($\beta= 3.78$, $p=0.5$).

**Weight Social Support and Meal Strategies** The percent change of meal strategies regression model controlled for baseline social support for weight, baseline meal strategies, as well as group, goal, and stress. The main predictor variables were the change in weight social support and the interaction term that captured change in weight social support by group. The model was significant ($R^2=0.56$, $F(8, 76) = 12.15$, $p<0.0001$). The baseline meal strategies ($\beta=-16.99$, $p<0.0001$), change in weight social support ($\beta=12.6$, $p=0.0006$), and group ($\beta= 5.64$, $p=0.02$) were all significant predictors. The interaction term was not significant ($\beta= 1.79$, $p=0.7$).

**The Effects of Behavior Change Strategies on Observed Outcomes**

The above results show that social support was associated with the participants’ reported behavior changes, but it was also important to evaluate whether the change in adoption of
behavior strategies influenced the outcomes of HEI, MVPA minutes, and weight change, as measured by percent change. Therefore, three additional linear regressions were run to determine if the behavior change strategy predicted a successful outcome (Table 8).

**Nutrition Strategies and HEI Percent Change** The percent change HEI model controlled for baseline HEI scores, baseline nutrition strategy scores, as well as group, goal, and stress. The main predictor variables were the change in nutrition strategies and the interaction term that captured HEI percent change by group. The result of the model explained 49% of the HEI score ($R^2=0.49$, $F(8,37)= 453$, $p=0.0007$). However, the strategy predictors were not significant; baseline nutrition strategy score ($\beta=10.44$, $p=0.41$) and nutrition strategy change ($\beta=3.48$, $p=0.82$). The interaction term was not significant ($\beta=-19.24$, $p=0.37$).

**Physical Activity Strategies and MVPA Percent Change** The percent change MVPA model controlled for baseline MVPA minutes, baseline activity strategy scores, as well as group, goal, and stress. The main predictor variables were the change in physical activity strategies and the interaction term that captured MVPA percent change by group. This model explained only 3.5% of the variation ($R^2=0.035$, $F(8,63)= 0.29$, $p=0.97$). The baseline activity strategy score ($\beta=10.6$, $p=0.39$) and the activity strategy change ($\beta=3.69$, $p=0.83$) were not significant predictors. The interaction term was not significant ($\beta=-4.12$, $p=0.85$).

**Weight Control Strategies and Percent Weight Change** The percent change weight model controlled for baseline weight, baseline weight strategy scores, as well as group, goal, and stress. The main predictor variables were the change in weight control strategies and the interaction term that captured change in weight control strategies by group. The model was not significant ($R^2=0.08$, $F(8,77)= 0.93$, $p=0.5$). The baseline weight control strategies ($\beta=$
0.07, \( p=0.92 \)) and the weight strategies change (\( \beta=-0.16, \ p=0.88 \)) were not significant predictors of weight change. The interaction term was not significant (\( \beta=1.95, \ p=0.16 \)).

The Effects of Social Support on Observed Outcomes

The analyses above did not support associations between the changes in behavior strategies and the outcomes. However, it is possible for social support to have a more direct effect. Therefore, three additional linear regression models were run to determine any direct effects of social support on the percent change of objective outcomes of HEI score, MVPA minutes, and weight change. The results of these analyses are summarized below and in Table 9.

**Diet Social Support and HEI Percent Change** The percent change HEI regression model controlled for baseline HEI score, baseline diet social support, as well as group, goal, and stress. The main predictor variables were the change in diet social support and the interaction term that captured change in diet social support by group. The model explained 47% of the variation (\( R^2=0.47, \ F(8,36)= 3.96, \ p=0.0019 \)). The only predictor that was significant was the baseline HEI score (\( \beta=-1.62, \ p=0.0001 \)), meaning for every unit increase in baseline HEI score, there was -1.62 unit decrease in the change in HEI score. Also, Group was a predictor (\( \beta=28.38, \ p=0.04 \)). The interaction term was not significant (\( \beta=7.02, \ p=0.7 \)).

**Physical Activity Social Support and MVPA Percent Change** The MVPA percent change regression model controlled for baseline MVPA, baseline physical activity social support, as well as group, goal, and stress. The main predictors were the change in physical activity social support and the interaction term that captured physical activity social support change by group. With these predictors, this model was not significant (\( R^2=0.04, \ F(8,62)= 0.33, \ p=0.87 \)).
Here, the social support for physical activity at baseline ($\beta=5.5$, $p=0.46$) and the change in physical activity social support ($\beta=5.69$, $p=0.62$) were both not significant predictors of MVPA minutes. However, the trend shows that a unit increase in physical activity social support change is associated with a 5.69 unit increase in MVPA minutes. The interaction term was not significant ($\beta=3.18$, $p=0.84$).

**Weight Social Support and Percent Weight Change** The weight percent change model controlled for baseline weight, baseline weight social support, as well as group, goal, and stress. The main predictor variables were change in weight social support and the interaction term that captured weight social support change by group. This model explained 6% of the variation ($R^2=0.06$, $F(8,76)=0.6$, $p=0.78$). There were no significant predictors from this model. A 1 unit increase in weight change social support led to a 0.39 unit increase in weight loss ($\beta=0.39$, $p=0.6$). The interaction term was not significant ($\beta=0.49$, $p=0.61$).

**Change in Behavior Change Strategies by Group**

Throughout this thesis, the Nothwehr Behavior Change Survey was examined as a composite of four scales: meal strategies, activity strategies, nutrition strategies, and weight control strategies (the average of all scales). However, additional analyses were conducted to determine which of the nine behavior change strategies changed the most throughout the intervention (Figure 7 and Table 10). The nine scales are diet monitoring, diet cognitive, diet social, activity monitoring, activity cognitive, activity social, meal planning, meal proportioning, and meal preparation. These analyses revealed a clear pattern as participants who received in-person health coaching improved more than those in the online group in all
subscales, except diet monitoring (online group mean= 0.53, SD= 0.59) and physical activity social (online group mean= 0.26, SD= 0.67).

Stress as a Predictor of Successful Outcomes

The stress variable was used as a covariate in all of the regression analyses. Stress was first examined as a covariate in the models for behavior strategies percent change. The only two scales in which stress were significant was the weight strategies percent change ($\beta=0.47$, $p=0.02$) and the activity strategies percent change ($\beta=0.87$, $p=0.005$). Looking at the objective outcomes, stress was not a significant predictor of HEI percent change ($\beta=-0.43$, $p=0.62$), MVPA percent change ($\beta=0.58$, $p=0.43$), and weight change ($\beta=-0.03$, $p=0.41$) in the social support regression models. Stress was also not a predictor of HEI percent change ($\beta=-0.05$, $p=0.96$), MVPA percent change ($\beta=0.45$, $p=0.55$), and percent weight change ($\beta=-0.05$, $p=0.18$) in the behavior strategies regression models. The trends indicate that a unit increase in stress causes a decrease in HEI score, an increase in MVPA, and a decrease in weight loss.

Personal Preferences and Group Selection

Introversion/extroversion was measured to determine if personality was associated with group selection. Out of the 87 participants, 56 were scored as extroverts and 31 were introverts. Thirty participants of the 56 chose in-person health coaching and 26 chose online health coaching. Twenty-one participants of the 31 chose in-person health coaching and 10 chose online health coaching (data not shown).
CHAPTER 5
DISCUSSION

The study evaluated results from an eight-week lifestyle intervention to examine the mediating influence of behavior strategies and the moderating effects of social support on behavior change. The specific goals of this study were to determine if the method of health coaching influences behavior change and if there was a moderating effect of social support on behavior change. The two main hypotheses were: (1) In-person health coaching would lead to a higher increase in behavior change strategies and objective outcomes compared to online health coaching, and (2) higher social support would lead to an increase in behavior change strategies and objective outcomes.

The examination of the effects of in person and online health coaching for the behavior strategies showed that there was no significant difference between the delivery modes for health coaching. All participants improved their strategies regardless of which group they were in. This may be due to the fact that everyone received a Sensewear armband for the duration of the study. Even though some participants already had activity monitors before the study started, self-monitoring through the armband and the accompanying diet log software allowed participants to see where they stood and where they could improve. Several studies have shown that self-monitoring is an effective aid in weight loss (Burke, Wang, & Sevick, 2011; Shuger, et al, 2011). In addition to self-monitoring being consistent across all participants, goal-setting was done by all participants as well. Participants set weekly goals to help aid in behavior change. Goal-setting has been an important tool in weight loss, too (Pearson, 2012). In addition to weight loss, the frequency of goal-setting has been shown to increase the use of behavior change strategies (Nothwehr & Yang, 2006).
In terms of the objective outcomes, the HEI Score was the only outcome that improved significantly more in the in-person group compared with the online group. This may be due to the fact that it is easier to have a discussion face-to-face and deliver motivational interviewing in-person than via email. Even though the other outcomes were not significantly different between the two groups, there seemed to be a trend for those in the in-person health coaching group to have more favorable outcomes than the online participants. For example, the percent change in weight may not have been significantly different between the two groups, but those in the in-person group tended to lose more weight than those in the online group. This may be due to a number of reasons. First of all, in-person health coaching may have held participants more accountable since it would be easier for an online participant to ignore an email reminder or prompt. Secondly, face-to-face meetings allowed more of a conversation to occur so the exchange of ideas/goals was considerably easier than writing an email and waiting for a response back. Lastly, in-person health coaching allowed for an easier transmission of knowledge, if the participant wanted to know more about a certain topic, than online health coaching.

It is also interesting to note that participants in the in-person group had significant changes in all outcomes, whereas those in the online group only had significant differences in MVPA minutes from baseline. Again, this may be due to in-person health coaching holding participants more accountable or the more effective implementation of motivational interviewing. While the results showed a tendency for different outcomes, the statistical results from the in-person versus online analyses did not reveal significant differences. The lack of differences in these groups supports the potential utility of online programming and virtual programming- particularly in this study since participants were able to choose what
group they wanted to be in. Other studies have found that online interventions for treatment of depression is just as effective as face-to-face interventions and even proved to be more effective for long term management (Wagner, Horn, & Maercker, 2013). Another study found that online nutrition education was just as effective as the traditional education program for women, infants, and children (Bensley, Anderson, et al., 2011). Therefore, the results from this study are similar to other published studies that support the use of online programming. It was hypothesized that participants receiving in-person coaching would have better outcomes due to increased accountability, but the results of the present study did not support this hypothesis.

A surprising finding from the study was that moderate/vigorous minutes decreased across all participants from baseline. These results may have been due to the start and end time of the intervention. The Fall cohort ended the study in November (prior to holidays). Thus, it is possible that participants exercised less because the weather was too cold or because of preparation for holidays and for the end of the semester. The timing issue cannot explain the similar outcomes for participants in the second cohort, which began in February and ended in April. However, it is also possible that when participants first received the monitors, they exercised more during that baseline week than they normally would because of high initial motivation. This effect has been shown in other studies (Motl, McAuley, & Dlugonski, 2012; Clemes & Deans, 2012) and was perhaps more likely in the present study due to the naturalistic design.

Examining the differences between goals in behavioral strategy changes, the participants with a weight management goal improved the most in meal strategies, activity strategies, and weight control strategies than the other goals. This is not surprising since all
of those strategies are necessary for successful weight loss. Those in the Activity goal improved the most in the Nutrition strategies scale compared to the other two goals, which was unexpected. However, this is also explained by the “real world” nature of this study. As mentioned above, if a participant chose the activity goal that did not mean that s/he could only discuss physical activity with his/her health coach. This is also reflected in the objective outcomes. Although it was not significant there was a trend showing that participants with a Physical Activity goal improved their HEI score more and lost more weight than participants with the other goals.

While the outcomes of the intervention were of interest, the key research questions focused on the potential impact of social support on behavior change. Social support was first examined as a potential moderator of behavior change. The regressions revealed that diet social support increased adoption of nutrition strategies, physical activity social support increased adoption of physical activity strategies, and weight social support increased adoption of weight control strategies. Diet social support has been shown to increase healthy eating and a higher physical activity social support score correlates with an increase in healthy activity (Kim, McEwen, Kieffer, Herman, & Piette, 2008). However, that study used self-report of moderate/vigorous activity and a telephonic- adaptation of the Healthy Eating Index as indicators for behavior change.

Similar regressions were also run to determine if social support influenced the changes in the objective outcomes. Although it was not significant, a unit increase in weight social support increased weight and higher physical activity social support increased MVPA. Change in diet social support did not significantly predict percent change in HEI score and, in fact, showed a decrease in HEI percent change as the change in social support increased.
This is hard to explain. However, in terms of weight loss, the lack of significance in the results are consistent with published literature in that social support for diet and physical activity have been found to be uncorrelated with BMI (Kim, McEwen, Kieffer, Herman, & Piette, 2008). However, more often than not, social support has been shown to help aid in weight loss (Livhits, et al., 2011; Wing & Jeffery, 1999; Gorin, Phelan, Tate, Sherwood, Jeffery, & Wing, 2005). The results from the model for weight social support regression and weight loss most likely was not significant because the weight change across all participants was not large enough or there was large variation.

Another sub-aim of the study was to determine if the change in behavior strategies captured in the Nothwehr Behavior Objectives Survey were associated with change of the objective outcomes. The change in nutrition strategies scale was not a significant predictor of HEI change, the change in activity strategy scale did not predict change in MVPA, and the weight control strategy scale did not predict weight change. This somewhat refutes the utility of the Nothwehr survey for capturing behavior change strategies since it was expected that these would predict the associated outcomes. A study using the same behavior strategies survey examined self-efficacy and the use of the diet behavioral strategies in addition to diet quality (Nothwehr, 2008). The findings from that study revealed a correlation between self-efficacy and increased diet strategies; however, no relationship existed between self-efficacy and diet quality. This study did not examine the relationship between the strategies and the diet quality, however. These findings are similar to this present study in that social support aided in behavior change. This may indicate that the Nothwehr survey may not be capturing all aspects of dietary behavior change and intake. It may also be that the study was not long enough to see the effects of the behavior change reflected as the HEI score.
Strengths and Limitations

The main strength of this study is that participants were able to select the goal they wanted to work on throughout the study and also the method in which they wanted to receive the health coaching. Even though a randomized controlled trial would have more evenly distributed the participants, the self-selection design is more reflective of a real world situation. Self-selecting is also in line with the spirit of motivational interviewing, more specifically with autonomy. The decision of which goal to work on and which method to receive health coaching is up to the participant. This way the participant takes ownership of their experience in the study.

This unique, naturalistic design provides a more real-world scenario, but also complicates analyses in several key ways. First, participants were allowed to select how they wanted to receive health coaching and which goal they wanted to pursue. Therefore, the number of participants in each goal and group was not evenly distributed. Secondly, the study allowed for recruitment of typical adults with few of the common exclusion criteria used in other studies. Weight loss studies, for example, typically restrict access to those that are clinically overweight but the present study allowed participants to enroll if they had interests in behavior change. Thus, not all of the participants needed to lose weight and some were already very active. The variation in participant characteristics help explain the rather modest changes in outcomes from this study. For example, participants in the weight goal (labeled ‘Weight Management’) may not have needed to lose weight, but had an interest in learning how to more effectively manage their weight over time to prevent weight gain. This made it difficult to detect large changes in outcomes. A final complication of the design is that participants were allowed to discuss other components of their health with their health
coach besides their chosen goal. This means that if a participant chose a physical activity goal, they most likely also discussed healthy eating. Therefore, all outcomes changed in all groups regardless of what goal the participant decided to pursue. These issues complicated the interpretation of typical intervention outcomes, but did not negatively affect the evaluation of the primary research questions.

Another strength of this study is the way that behavior change is measured. Most studies measure behavior change as the change in weight, BMI, or some other clinical outcome (Kim, McEwen, Kieffer, Herman, & Piette, 2008). Those studies are not necessarily measuring a behavior or lifestyle change, but how well the intervention aids in weight loss. Past students in the Physical Activity and Health Promotion Lab measured behavior change using the Nothwehr Behavior Change Strategies Survey. This study showed similar increases in the adoption of each of the nine behavior change strategies but did not include evaluation of the key outcome measures to test if those self-reported behavior change strategies actually helped with the clinical outcomes (Nelson, E., 2014). A strength of the present study is that it included evaluation of both the self-reported behavior change and the associated observed outcomes.

A key limitation of the study was a small number of participants. Participants self-selected into groups and goals, the number of participants in each was not even. There were six treatment groups; however, the data was not analyzed in that way, but rather examined by group and by goal as well, creating two separate analyses. Another limitation to the study was the lack of diversity in the participants. Most were white, highly education women in rural Iowa. This means that the results cannot be applied to the general population. In all
intervention studies, the quality of health coaches and participant compliance can contribute to results from the study as well.

**Conclusions and Future Directions**

The study builds on an established line of work related to the “Health Coach Study” and addresses new questions. However, additional work is still needed to refine the model and methods. To further explore the concepts of moderating and mediating behaviors, it would be interesting to measure self-efficacy and other psychosocial factors in this type of health coach study. It would be interesting to see how self-efficacy, barriers, and physical activity enjoyment affect the mediating variables of behavior change. Along the same lines of a ‘real world’ intervention, exploring the amount of health coach meetings/email exchanges would predict successful behavior change. For example, if a participant meets with a health coach three times, is that as equally effective as meeting with the health coach six times.

The two main conclusions from the study are: (1) online health coaching is as effective as in-person health coaching and (2) social support aids in behavior change strategies. The results suggest that online health coaching may be more cost-effective than in-person health coaching when applied to the health care field, but this needs to be directly evaluated. The results also suggest that social support may influence behavior change. The changes in behavior strategies were not independently associated with the change in the outcomes but this may be due to the variability in social support and other factors not assessed in the study. With a larger sample, additional variables, and more intricate analyses (e.g., path analysis), the moderating effects can be more thoroughly examined.
CHAPTER 6

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Table 1. Baseline participant characteristics.

<table>
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<tr>
<th>Characteristic</th>
<th>All</th>
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<th>Online</th>
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<td>23-73</td>
<td>26-67</td>
</tr>
<tr>
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<td>1 [2.78]</td>
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<tr>
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<td>4 [7.84]</td>
<td>1 [2.78]</td>
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<tr>
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<td>32 [62.75]</td>
<td>19 [52.78]</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
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<tr>
<td>Married</td>
<td>62 [71.26]</td>
<td>37 [72.55]</td>
<td>25 [69.44]</td>
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<tr>
<td>Race (N[%])</td>
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<td></td>
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<td>45 [88.24]</td>
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<td></td>
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<tr>
<td>&lt; $25,000</td>
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<tr>
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<td>17 [19.54]</td>
<td>9 [17.65]</td>
<td>8 [22.22]</td>
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<tr>
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<td>8 [15.69]</td>
<td>9 [25.00]</td>
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<tr>
<td>&gt; $100,000</td>
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<td>20 [39.22]</td>
<td>15 [41.67]</td>
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<tr>
<td>Anthropometrics (N(SD))</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>83.62 (18.72)</td>
<td>84.33 (18.91)</td>
<td>82.63 (18.67)</td>
</tr>
<tr>
<td>BMI</td>
<td>29.46 (5.93)</td>
<td>29.49 (5.45)</td>
<td>29.42 (6.62)</td>
</tr>
<tr>
<td>Body Fat Percentage</td>
<td>33.8 (7.28)</td>
<td>33.8 (7.5)</td>
<td>33.8 (7.06)</td>
</tr>
<tr>
<td>HEI Score (N(SD))</td>
<td>52.75 (14.14)</td>
<td>52.06 (15.65)</td>
<td>53.87 (11.65)</td>
</tr>
<tr>
<td>MVPA Minutes (N(SD))</td>
<td>85.03 (45.59)</td>
<td>89.74 (48.71)</td>
<td>78.27 (40.56)</td>
</tr>
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Figure 1. Participant flow chart of self-selected health coaching group and goal. Fourteen people dropped out for various reasons. ‘Total participants’ refers to the number of participants who completed the 8 week intervention.
Table 2. Baseline behavior change strategy means (µ) and standard deviations (Sd).

<table>
<thead>
<tr>
<th></th>
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<th>Meal Strategy</th>
<th>Wt Control Strategy</th>
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</tr>
<tr>
<td></td>
<td>N</td>
<td>µ</td>
<td>Sd</td>
<td>N</td>
</tr>
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<td>2.25</td>
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<td>2</td>
<td>36</td>
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<td>2.33</td>
<td>0.62</td>
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<tr>
<td></td>
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<td>2.22</td>
<td>0.45</td>
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<tr>
<td>(Group/Goal)</td>
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<td></td>
<td></td>
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<tr>
<td>1/1</td>
<td>9</td>
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<td>0.78</td>
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<td>10</td>
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<td>0.46</td>
<td>32</td>
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<td>2/1</td>
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<td>0.33</td>
<td>6</td>
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<tr>
<td>2/2</td>
<td>14</td>
<td>2.16</td>
<td>0.5</td>
<td>14</td>
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<tr>
<td>2/3</td>
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<td>2.25</td>
<td>0.44</td>
<td>16</td>
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Note: Group 1= In Person; Group 2= Online. Goal 1= Diet; Goal 2= Physical Activity; Goal 3= Weight Management.
Table 3. Baseline objective outcome means (μ) and standard deviations (Sd).

<table>
<thead>
<tr>
<th>HEI Score</th>
<th>N</th>
<th>μ</th>
<th>Sd</th>
<th>MVPA (min)</th>
<th>N</th>
<th>μ</th>
<th>Sd</th>
<th>Weight (kg)</th>
<th>N</th>
<th>μ</th>
<th>Sd</th>
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<tbody>
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</tr>
<tr>
<td>Group</td>
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</tr>
<tr>
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<td>18.86</td>
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<td>2</td>
<td>18</td>
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<td>11.65</td>
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<td>78.27</td>
<td>40.56</td>
<td>36</td>
<td>82.63</td>
<td>18.67</td>
<td></td>
<td></td>
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<tr>
<td>Goal</td>
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</tr>
<tr>
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<td>10</td>
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<td>11.23</td>
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<td>11</td>
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<td>18.43</td>
<td>19</td>
<td>77.59</td>
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<td>19.52</td>
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<td>3</td>
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<td>13.41</td>
<td>43</td>
<td>82.55</td>
<td>50.61</td>
<td>48</td>
<td>83.92</td>
<td>19.01</td>
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<tr>
<td>(Group/Goal)</td>
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<td></td>
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<tr>
<td>1/1</td>
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<td>47.06</td>
<td>11.7</td>
<td>5</td>
<td>118.86</td>
<td>47.13</td>
<td>8</td>
<td>83.43</td>
<td>19.02</td>
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<tr>
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<td>7</td>
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<td>10</td>
<td>80.67</td>
<td>15.4</td>
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<td>55.15</td>
<td>14.33</td>
<td>30</td>
<td>85.11</td>
<td>53.89</td>
<td>32</td>
<td>86.35</td>
<td>20.08</td>
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<td></td>
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<tr>
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<td>4</td>
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<td>10.48</td>
<td>5</td>
<td>96.46</td>
<td>31.61</td>
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<td>16.47</td>
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<tr>
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<td>54.69</td>
<td>14.09</td>
<td>12</td>
<td>72.43</td>
<td>41.5</td>
<td>14</td>
<td>84.69</td>
<td>22.42</td>
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<td></td>
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<tr>
<td>2/3</td>
<td>7</td>
<td>52.58</td>
<td>11.3</td>
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<td>76.66</td>
<td>43.46</td>
<td>16</td>
<td>79.07</td>
<td>16.16</td>
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</tbody>
</table>

Note: Group 1 = In Person; Group 2 = Online. Goal 1 = Diet; Goal 2 = Physical Activity; Goal 3 = Weight Management.
Figure 2. Percent change of behavior strategies by health coaching group. *indicates percent change from baseline with $p<0.05$. 
Figure 3. Percent weight change between in-person and online health coaching. *indicates percent change from baseline with $p<0.05$
Figure 4. Percent change of HEI score between in-person and online health coaching. *indicates percent change from baseline with $p<0.05$, † indicates significant difference between in-person and online health coaching, $p<0.05$
Figure 5. Percent change in MVPA between in-person and online health coaching. *indicates percent change from baseline with $p<0.05$
Figure 6. Percent change of HEI score by group and goal. The black bars represent in-person group values; the light gray bars indicate online group values.
Table 4. Effect sizes comparing in-person and online health coaching. Effect sizes were calculated for percent change of nutrition strategies scale, physical activity strategies scale, meal strategies scale, weight control strategies scale, HEI, MVPA, and weight.

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Online</th>
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<th></th>
<th>Effect Size</th>
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<tbody>
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<td></td>
<td>N</td>
<td>X</td>
<td>SD</td>
<td>N</td>
<td>X</td>
<td>SD</td>
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</tr>
<tr>
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<td>17.54</td>
<td>22.82</td>
<td>36</td>
<td>17.42</td>
<td>23.52</td>
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<tr>
<td>PAStr%Change</td>
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<td>19.15</td>
<td>28.3</td>
<td>36</td>
<td>17.28</td>
<td>24.34</td>
<td>0.07</td>
</tr>
<tr>
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<td>12.5</td>
<td>17.42</td>
<td>36</td>
<td>6.66</td>
<td>12.66</td>
<td>0.37</td>
</tr>
<tr>
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<td>19.02</td>
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<td>12.63</td>
<td>15.84</td>
<td>0.15</td>
</tr>
<tr>
<td>HEI % Change</td>
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<td>18</td>
<td>-8.89</td>
<td>20.28</td>
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</tr>
<tr>
<td>MVPA % Change</td>
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<td>39.58</td>
<td>30</td>
<td>-25.87</td>
<td>34.57</td>
<td>0.30</td>
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<tr>
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<td>2.09</td>
<td>36</td>
<td>0.64</td>
<td>2.22</td>
<td>0.07</td>
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</table>
Table 5. Effect size calculations for each goal and each behavior change strategy.

<table>
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<th>Variable</th>
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<th>Post</th>
<th>ES</th>
</tr>
</thead>
<tbody>
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<td>15, X = 2.65, SD = 0.57</td>
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</tr>
<tr>
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<td>ActStr</td>
<td>15, X = 2.67, SD = 0.54</td>
<td>15, X = 2.82, SD = 0.53</td>
<td>-0.28</td>
</tr>
<tr>
<td>Diet</td>
<td>MealStr</td>
<td>15, X = 2.53, SD = 0.46</td>
<td>15, X = 2.72, SD = 0.50</td>
<td>-0.39</td>
</tr>
<tr>
<td>Diet</td>
<td>WtConStr</td>
<td>15, X = 2.51, SD = 0.49</td>
<td>15, X = 2.73, SD = 0.50</td>
<td>-0.45</td>
</tr>
<tr>
<td>PA</td>
<td>NutrSt</td>
<td>24, X = 2.20, SD = 0.50</td>
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<td>-0.71</td>
</tr>
<tr>
<td>PA</td>
<td>ActStr</td>
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<td>MealStr</td>
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<td>WtConStr</td>
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<td>24, X = 2.58, SD = 0.38</td>
<td>-0.82</td>
</tr>
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<td>NutrSt</td>
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<td>-0.57</td>
</tr>
<tr>
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<td>WtConStr</td>
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<td>-0.82</td>
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### Table 6. Effect size calculations for each goal and objective outcome.

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<th>ES</th>
</tr>
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<tr>
<td>Diet</td>
<td>Wt</td>
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<td>15</td>
<td>0.03</td>
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<td>HEI</td>
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<td>11</td>
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<td>MVPA</td>
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<td>19</td>
<td>0.41</td>
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<td>MVPA</td>
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<td>Wt</td>
<td>Wt</td>
<td>48</td>
<td>48</td>
<td>0.03</td>
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Table 7. Regression of the effects of social support on behavior change strategies.
*indicates percent change from baseline with p<0.05; Group 1= In Person Health Coaching; Group 2= Online Health Coaching; Goal 1= Diet Goal; Goal 2= Physical Activity Goal; Goal 3= Weight Management Goal.

<table>
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<th>β</th>
<th>SE</th>
<th>β</th>
<th>SE</th>
<th>β</th>
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</table>
Table 8. The effects of behavior change strategies on objective outcomes. Three regressions were run to determine effects of behavior strategies on HEI percent change, MVPA change, and weight percent change. *indicates percent change from baseline with $p<0.05$; Group 1=In Person Health Coaching; Group 2= Online Health Coaching; Goal 1= Diet Goal; Goal 2= Physical Activity Goal; Goal 3= Weight Management Goal.

<table>
<thead>
<tr>
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<th>Percent Change MVPA</th>
<th>Wt Percent Change</th>
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<td></td>
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<td>SE</td>
<td>β</td>
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<td>F</td>
<td>4.53</td>
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</table>
Table 9. The effects of social support on objective outcomes. Three regressions were run to determine effects of social support on HEI percent change, MVPA percent change, and weight percent change. *indicates percent change from baseline with $p<0.05$; Group 1= In Person Health Coaching; Group 2= Online Health Coaching; Goal 1= Diet Goal; Goal 2= Physical Activity Goal; Goal 3= Weight Management Goal.

<table>
<thead>
<tr>
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<th>HEI SE</th>
<th>MVPA Percent Change</th>
<th>MVPA SE</th>
<th>Wt Percent Change</th>
<th>Wt SE</th>
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Figure 7. Comparison of the nine scales on the behavior change survey. Percent change of each scale in the survey for in-person and online health coaching groups.
Table 10. Behavior scales effect size calculations for health coaching groups. Effect size calculations were calculated for the nine specific behavior strategies comparing in-person and online health coaching.

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<td>0.23</td>
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<tr>
<td>Meal Preparing</td>
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<tr>
<td>Meal Portion</td>
<td>51 0.34 0.57</td>
<td>36 0.18 0.44</td>
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</table>
APPENDIX A. IRB SIGNATURE PAGE

INSTITUTIONAL REVIEW BOARD (IRB)
Application for Approval of Research Involving Humans

Title of Project: The Health Coach Study

Principal Investigator (PI): Gregory J. Welk

University ID: Phone: 294-3583 Email Address: gwelk@iastate.edu

Correspondence Address: By IRB

Department: Kinesiology College/Center/Institute: Iowa State University

PI Level: Tenured, Tenure-Eligible, & NTER Faculty Adjunct/Adjunct Faculty Collaborator Faculty Emeritus Faculty
Visiting Faculty/Scientist Senior Lecturer/Clinician Lecture/Clinician, w/Ph.D. or DVM P&S Employee, P37 & above
Extension to Families/Youth Specialist Field Specialist III Postdoctoral Associate Graduate/Undergrad Student Other (specify: )

FOR STUDENT PROJECTS (Required when the principal investigator is a student)
Name of Major Professor/Supervising Faculty:

University ID: Phone: Email Address: @iastate.edu

Campus Address: Department:

Type of Project (check all that apply): Thesis/Dissertation Class Project Other (specify: )

Alternate Contact Person: Email Address:

Correspondence Address: Phone:

ASSURANCE

I certify that the information provided in this application is complete and accurate and consistent with any proposal(s) submitted to external funding agencies. Misrepresentation of the research described in this or any other IRB application may constitute non-compliance with federal regulations and/or academic misconduct.

I agree to provide proper surveillance of this project to ensure that the rights and welfare of the human subjects are protected. I will report any problems to the IRB. See Reporting Adverse Events and Unanticipated Problems for details.

I agree that modifications to the approved project will not take place without prior review and approval by the IRB.

I agree that the research will not take place without the receipt of permission from any cooperating institutions when applicable.

I agree to obtain approval from other appropriate committees as needed for this project, such as the IACUC (if the research includes animals), the IBC (if the research involves biohazards), the Radiation Safety Committee (if the research involves x-rays or other radiation producing devices or procedures), etc., and to obtain background checks for staff when necessary.

I understand that IRB approval of this project does not grant access to any facilities, materials, or data on which this research may depend. Such access must be granted by the unit with the relevant custodial authority.

I agree that all activities will be performed in accordance with all applicable federal, state, local, and Iowa State University policies.

Signature of Major Professor/Supervising Faculty Date
(Required when the principal investigator is a student)

Printed Name of Department Chair/Head/Director Signature of Department Chair/Head/Director Date

For IRB Use Only

Full Committee Review: Review Date:

Approval Not Required: EXPEDITED per 45 CFR 46.110(b): Approval/Determination Date:

Not Research: Letter Approval Expiration Date:

No Human Subjects: Not Approved: Risk: Minimal More than Minimal

IRB Reviewer’s Signature Date:

Office for Responsible Research
Revised: 8/15/13
### APPENDIX B. HEI INDEX AND SURVEYS

#### Healthy Eating Index Components 2010

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum points</th>
<th>Standard for maximum score</th>
<th>Standard for minimum score of zero</th>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td>No Fruit</td>
</tr>
<tr>
<td>Whole Fruit</td>
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<td>≥0.4 cup equiv. per 1,000 kcal</td>
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</tr>
<tr>
<td>Total Vegetables</td>
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<td>≥1.1 cup equiv. per 1,000 kcal</td>
<td>No Vegetables</td>
</tr>
<tr>
<td>Greens and Beans</td>
<td>5</td>
<td>≥ 0.2 cup equiv. per 1,000 kcal</td>
<td>No Dark Green Vegetables or Beans and Peas</td>
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<td>10</td>
<td>≥1.5 oz equiv. per 1,000 kcal</td>
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</tr>
<tr>
<td>Dairy</td>
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<tr>
<td>Total Protein Foods</td>
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<td>Seafood and Plant Proteins</td>
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<td>(PUFAs + MUFAs)/SFA &gt;2.5</td>
<td>(PUFAs + MUFAs)/SFA &lt;1.2</td>
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<td><strong>Moderation:</strong></td>
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<tr>
<td>Refined Grains</td>
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<td>≤1.8 oz equiv. per 1,000 kcal</td>
<td>≥4.3 oz equiv. per 1,000 kcal</td>
</tr>
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<td>Sodium</td>
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<td>≥2.0 grams per 1,000 kcal</td>
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<td>Empty Calories</td>
<td>20</td>
<td>≤19% of energy</td>
<td>≥50% of energy</td>
</tr>
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</table>

From Guenther, et al., 2012.
Health Coach Study
Social Support in Diet and Exercise

Please rate each question twice. Under family, rate how often anyone living in your household has said or done what is described during the last three months. Under friends, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

None Rarely A few times Often Very Often Does not apply

1  2  3  4  5  8

During the past three months, my family (or members of my household) or friends:

1. Encouraged me not to eat “unhealthy foods” (cake, salted chips) when I’m tempted to do so.

2. Discussed my eating habit changes with me (asked me how I’m doing with my eating changes).

3. Reminded me not to eat high fat, salt foods.

4. Complimented me on changing my eating habits (“Keep it up”, “We are proud of you”)

5. Commented if I went back to my old eating habits.

6. Ate high fat or high salt foods in front of me.

7. Refused to eat the same foods I eat.

8. Brought home foods I’m trying not to eat.

9. Got angry when I encouraged them to eat low salt, low fat foods.

10. Offered me food I’m trying not to eat.

11. Exercised with me.

12. Offered to exercise with me.
13. Gave me helpful reminders to exercise ("Are you going to exercise tonight?")
14. Gave me encouragement to stick with my exercise program.
15. Changed their schedule so we could exercise together.
16. Discussed exercise with me.
17. Complained about the time I spend exercising.
18. Criticized me or made fun of me for exercising.
19. Gave me rewards for exercising (bought me something or gave me something I like).
20. Planned for exercise on recreational outings.
21. Helped plan activities around my exercise.
22. Asked me for ideas on how they can get more exercise.
23. Talked about how much they like to exercise.
Perceived Stress Survey

The questions in the scale ask you about your feelings and thoughts **DURING THE PAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

<table>
<thead>
<tr>
<th>Question</th>
<th>0= Never</th>
<th>1= Almost Never</th>
<th>2= Sometimes Often</th>
<th>3= Fairly Often</th>
<th>4= Very Often</th>
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<tbody>
<tr>
<td>1. In the last month, how often have you been upset because of something that happened unexpectedly?</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>2. In the last month, how often have you felt that you were unable to control the important things in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. In the last month, how often have you felt nervous and “stressed”?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. In the last month, how often have you felt confident about your ability to handle your personal problems?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. In the last month, how often have you felt that things were going your way?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. In the last month, how often have you found that you could not cope with all the things that you had to do?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. In the last month, how often have you been able to control irritations in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. In the last month, how often have you felt that you were on top of things?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. In the last month, how often have you been angered because of things that were outside of your control?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Personality Quiz

The questions in the survey ask you about your personality and personal preferences. Please answer yes or no to each of the questions.

1. Do you have many different hobbies? 

2. Are you a talkative person? 

3. Are you rather lively? 

4. Can you usually let yourself go and enjoy yourself at a lively party? 

5. Do you enjoy meeting new people? 

6. Do you tend to keep in the background on social occasions? 

7. Do you like going out a lot? 

8. Do you prefer reading to meeting people? 

9. Do you have many friends? 

10. Would you call yourself happy-go-lucky? 

11. Do you usually take the initiative in making new friends? 

12. Are you mostly quiet when you are with other people? 

13. Can you easily get some life into a rather dull party? 

14. Do you like telling jokes and funny stories to your friends? 

15. Do you like mixing with people? 

16. Do you nearly always have a “ready answer” when People talk to you?
17. Do you like doing things in which you have to act quickly? 

18. Do you often make decisions on the spur of the moment?

19. Do you often take on more activities than you have time for?

20. Can you get a party going?

21. Do you like plenty of bustle and excitement around you?

22. Do other people think of you as being very lively?