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THE EFFECTS OF A WORKSITE WELLNESS PROGRAM ON PRESCRIPTION CLAIMS

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THE EFFECTS OF A WORKSITE WELLNESS PROGRAM ON PRESCRIPTION CLAIMS

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Education in the College of Education at the University of Kentucky

By

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ABSTRACT OF DISSERTATION

THE EFFECTS OF A WORKSITE WELLNESS PROGRAM ON PRESCRIPTION CLAIMS

The purpose of this study was to determine the effectiveness of the worksite wellness weight loss program called Weight Loss Matters (WLM) for employees at the University of Kentucky. The three main objectives were to measure the effect of Weight Loss Matters for employees from June 2006 to December 2011 in the following areas (1) prescription claims for hypertension, diabetes, and dyslipidemia, (2) weight loss, and (3) food diary compliance. Participants included 591 employees who participated in WLM for at least one session from 2006 to 2011 for whom there were data. This study employed a Quasi-experiment, longitudinal design. Data were collected from WLM records and UK health plan records. Data obtained from WLM included attendance, physical activity reported, food diary compliance, participation goal, height, and weight. Measures from the health plan database were prescription claims for hypertension, diabetes, and cholesterol at twelve months prior to start date, six months post-start date, and 12 months post-start date for each participant. Data analysis included Chi Square, Fishers Exact, ANOVA, ANCOVA, linear and logistic regression. After completing two sessions of WLM, a significant number of participants ceased taking hypertension medications at six and 12 months post-WLM. There was significant weight loss for all participants after one class. For continued attendance (multiple sessions,) participants continued to have small weight losses. Analysis showed a significant relationship between weight loss and food diary completion, with the more food diaries completed, the more weight was lost. Food diary compliance and attendance were significant predictors of weight loss. Information gained from this study will be helpful in designing future weight loss programs at the University of Kentucky and may be useful for similar worksite wellness weight loss programs.

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August 3, 2017

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Introduction

Among the leading causes of death in the United States, heart disease, diabetes, and obesity-related illnesses are among the top ten (Centers for Disease Control and Prevention, 2009). Many worksites address these issues by implementing worksite wellness programming. "The worksite, where Americans spend roughly one-third of their average day, may be the most well-suited environment for health-behavior change (i.e., health promotion programs) because of convenience and accessibility" (Astrup, McGovern, & Kochevar, 1992, p. 42). Traditional worksite wellness efforts include such programs as smoking cessation, stress management, physical activity, and nutrition/weight loss. Weight loss programs within worksite wellness programs are of particular interest because of the impact they may have on diabetes, hypertension and dyslipidemia; all of which are contributors to heart disease, diabetes, or obesity related illnesses. In order to effectively evaluate a specific worksite wellness weight loss program, the evaluation must consider the impact of these three conditions.

When evaluating worksite wellness programs, return on investment (ROI) is the process used to determine if the financial cost of administering the program is paying off in return. In others words, is the program a wise investment? Worksite wellness ROI is not often separated into individual program evaluations, but evaluated as a whole. Different studies have attempted to evaluate ROI in different ways; some looking just at weight loss programs, others looking at many types of intervention programs. Astrup, McGovern, and Kochevar (1992) looked at health care claims and absenteeism. Bungum, Satterwhite, Jackson, and Morrow (2003) assessed only obesity related health

care costs and absenteeism. Renaud et al. (2008) included overall health profiles, employee absenteeism and turnover, and qualitative interview data from managers. Trogdon, Finkelstein, Reyes, and Dietz (2009) assessed medical costs and absenteeism with average weight loss. The interest of this study is to only evaluate a weight loss program, separate from other interventions, and its effect on prescription claims. Instead of conducting a return on investment in dollar amounts, this study hoped to find value on the investment.

Avenell et al. (2004) reported lifestyle modifications are comparable to drug treatments in terms of effectiveness, but Gustafson et al. (2009) specifically showed *cost* effectiveness of weight loss compared to life years gained. Wang et al. (2006) examined higher BMIs compared to cost and showed a lower BMI was associated with lower healthcare costs. Finkelstein, Linnan, Tate, and Leese (2009) and Carls et al. (2011) completed longitudinal studies comparing weight loss and health care costs, demonstrating more weight loss correlated with lower costs. Hughes, Girolami, Cheadle, Harris, and Patrick (2007) also reviewed the cost savings of weight loss in worksite wellness programs by checking prescription drug claims of employees in three Fortune 500 companies and found a decrease in prescription drug usage. These studies all demonstrated a reduction in weight led to a reduction in healthcare costs. The current study hoped to find a reduction in weight associated with a cessation of medication, showing value.

Worksites function as a community all on their own, having a particular culture specific to the workplace. Individual health behavior changes have been proven to be more effective in the workplace than organizational interventions; however, interventions aimed at a specific culture can be beneficial (Goldgruber & Ahrens, 2010). Goldgruber

and Ahrens concluded that worksite wellness programs must be adapted to the specific culture or community for which they are intended, but still be aimed at the individual level. In a study by Renaud, et al. (2008) personalized health promotion programs in the workplace were successful. The UK Health and Wellness program for employees conducts a weight loss program entitled Weight Loss Matters (WLM), which is an example of the type of program discussed by Goldgruber and Ahrens and Renaud, et al. WLM, while aimed at the individual, has been personalized over the duration of the program to meet the cultural needs of the UK Community.

The literature supports utilizing the Transtheoretical model (TTM) of behavior change for worksite wellness weight loss programs. Weight Loss Matters is loosely based on the TTM. While it frames the program, the TTM does not frame the study, necessarily. Johnson and colleagues found, "individualized stage-matched, multiple behavior interventions had significant effects on progression to Action/Maintenance for healthy eating, exercise, managing emotional distress, and weight among those most at risk (i.e., those in pre-action) one year post intervention" (2008, p. 244). This study is similar to WLM in that the main goal was weight loss; and the study showed that weight loss was sustained post-intervention. Similarly, WLM addresses several health behaviors. Logue et al. (2004) found that the longer a person spends in the action or maintenance stages of change, the more likely that person is to lose weight successfully. WLM allows participants to repeat the program as many times as desired and this can aid in weight loss and maintenance of the healthy behavior, thereby being successful. As Logue et al. (2004) pointed out, the longer people are actively losing weight or maintaining their weight, the more successful they are with weight loss. DiNoia and Prochaska (2010) examined the decisional balance relationship to stages of change for dietary behaviors.

The authors discovered during precontemplation, the cons are higher than the pros and during action and maintenance, the reverse is true (DiNoia & Prochaska, 2010). In other words, when a person is considering a change, but has made no attempt at changing, there are more negative thoughts toward the behavior than positive ones. However, when a person has taken steps toward the change or is maintaining a change there are more positive thoughts toward the behavior than negative thoughts. Because participants are allowed to stay in WLM without a fee as long as they are meeting their goals, more time is allowed to build more pros than cons and therefore end in more successful weight loss. Participants are more likely to keep the weight off and change their behaviors if they accept more pros than cons. O'Connell and Velicer (1988) pointed out two studies where decisional balance pro/con decisions demonstrated a successful behavior change of weight loss. Finally, O'Connell and Velicer (1988) added that the move from contemplation to action may be the time most important in terms of decisional balance. The TTM has been demonstrated as highly important in changing health behaviors related to weight loss and control, particularly the constructs of decisional balance and stages of change (O'Connell & Velicer, 1988). UK Health and Wellness has employed the TTM in the development of WLM, but this model lacks sensitivity to the culture of the worksite to promote behavior change.

To address culture in health promotion programming, the ecological model has been used and adapted over time. McLeroy, Bibeau, Steckler, and Glanz (1988) give a history of how the model has been adapted and changed over time to not only address the individual, but also the individuals support network (family and friends), the social environment, community factors, and public policy. The model was adapted again by Bronfenbrenner in 1979 into three main systems: the microsystem, mesosystem, and

exosystem and called the socio-economic model. The idea of this model is that all three levels effect each other. When one changes, the other levels change, too. The socio-economic model serves as a better framework for this study.

Purpose of the Study

The worksite is an opportune place to conduct weight loss programs which can have a significant impact on disease, certain causes of death and possibly ROI due to the reduced cost of medications for lifestyle behavior changes. Weight loss programs have proven effective in the management of many chronic diseases, including hypertension, diabetes, and dyslipidemia. But, few programs have evaluated the effect of a weight loss program or weight loss on specific medications prescribed for weight-related conditions such as blood pressure, high cholesterol and diabetes in a worksite wellness environment.

Astrup, McGovern, and Kochevar (1992), Bungum, Satterwhite, Jackson, and Morrow (2003), Renaud et al. (2008), and Trogdon, Finkelstein, Reyes, and Dietz (2009) all show promise in demonstrating the cost effectiveness and positive health effects of worksite wellness weight loss programs, but further research needed to be conducted. Determining the effectiveness of the worksite wellness weight loss program at UK needed to be researched, as it had yet to be evaluated and had collected enough data for analysis.

The purpose of this study was to determine the effectiveness of the worksite wellness weight loss program called Weight Loss Matters for employees at the University of Kentucky. More specifically, the purpose of this study was to measure the effect of Weight Loss Matters on prescription claims, weight loss, and food diary compliance's effect on weight loss from June 2006 to December 2011.

Research Questions/Hypotheses

The following are the research questions and research hypotheses:

1. Will UK employees who complete one 10-week session of WLM cease taking blood pressure medication six months after WLM compared to those who did not complete one session of WLM?
2. Will UK employees who complete one session of WLM cease taking blood pressure medication 12 months after WLM compared to those who did not complete one session of WLM?
3. Will UK employees who complete one session of WLM cease taking diabetes medication six months after WLM compared to those who did not complete one session of WLM?
4. Will UK employees who complete one session of WLM cease taking diabetes medication 12 months after WLM compared to those who did not complete one session of WLM?
5. Will UK employees who complete one session of WLM cease taking cholesterol medication six months after WLM compared to those who did not complete one session of WLM?
6. Will UK employees who complete one session of WLM cease taking cholesterol medication 12 months after WLM compared to those who did not complete one session of WLM?
7. What is the attendance compliance rate that best affects weight loss after the first session?

8. Is there a statistically significant relationship between percent body weight lost in UK employees and compliance rate after one session of WLM controlling for sex?
9. Is there a statistically significant relationship between body weight lost in UK employees and food diary compliance in UK employees who completed one session of WLM?
10. Will physical activity level, sex, food diary compliance, weight loss goal, and age predict a change in weight for UK employees who completed WLM?
11. Will food diary compliance, physical activity level, sex, age, weight loss goal, and weight change predict a change in blood pressure prescription claims six or 12 months after one session of WLM?
12. Will food diary compliance, physical activity level, sex, age, weight loss goal, and weight change predict a change in cholesterol prescription claims six or 12 months after one session of WLM?
13. Will food diary compliance, physical activity level, sex, age, weight loss goal, and weight change predict a change in diabetes prescription claims six or 12 months after one session of WLM?

Hypotheses:

1. Hypothesis 1: UK employees will cease taking blood pressure medications six months after completing one session of WLM compared to UK employees who did not complete one session of WLM.

2. Hypothesis 2: UK employees will cease taking blood pressure medications 12 months after completing one session of WLM compared to UK employees who did not complete one session of WLM.
3. Hypothesis 3: UK employees will cease taking diabetes medications six months after completing one session of WLM compared to UK employees who did not complete one session of WLM.
4. Hypothesis 4: UK employees will cease taking diabetes medications 12 months after completing one session of WLM compared to UK employees who did not complete one session of WLM.
5. Hypothesis 5: UK employees will cease taking cholesterol medications six months after completing one session of WLM compared to UK employees who did not complete one session of WLM.
6. Hypothesis 6: UK employees will cease taking cholesterol medications 12 months after completing one session of WLM compared to UK employees who did not complete one session of WLM.
7. Hypothesis 7: The higher the attendance rate (attendance of WLM classes), the more weight lost in UK employees at the end of the first WLM session.
8. Hypothesis 8: Percent of body weight lost (weight lost/starting body weight) for male and female UK employee will increase with increase attendance compliance after one session of WLM.
9. Hypothesis 9: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase with increased food diary compliance.

10. Hypothesis 10: A composite of variables: physical activity level, sex, food diary compliance, weight loss goal, and age will significantly predict a change in percent body weight.
11. Hypothesis 11: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in blood pressure prescription claims.
12. Hypothesis 12: A composite of variables including food diary compliance, physical activity, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in cholesterol prescription claims.
13. Hypothesis 13: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in diabetes prescription claims.

Definition of Terms

For this study, the following terms and their definitions were used:

Transtheoretical model-"an integrative framework for understanding how individuals and populations progress toward adopting and maintain health behavior change for optimal health" (McKenzie, Neiger, Smeltzer, 2005, p.155.)

Prescription claims-Claims made against the health plan by University of Kentucky employees for prescription medications. These data provide number of doses, days, refills filled, and dosage.

Compliance-For medications, a Medication Possession Ratio (MPR) of 80% is considered compliant. MPR is the number of days' supply of medication filled divided by the number of days of intended treatment.

Completion-Those who attended at least 60% of WLM classes in one session were considered completers. This criterion is used by the WLM program to define completion. For food diaries, 60% per session is complete, also. A participant who turns in 6 out of 10 food diaries in 10 weeks is complete.

Adherence-"The extent to which a person's behavior-taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider" (WHO, 2003).

Significance of the Study

The findings of this outcome evaluation can be further utilized to make changes to WLM and other worksite wellness weight loss programs. The results of this study could improve programming of future weight loss intervention strategies at the University of Kentucky (UK) or other worksite wellness programs. If weight loss programs of this type can be shown to reduce the prescription claims, this could be used as a justification for the implementation of more onsite weight loss programs. Fewer prescription claims might mean better health for the individual, lower cost to the employee and the employer. The health plan costs would also potentially decrease, reducing premiums across the community. For an organization with a self-funded health plan (like UK), fewer claims against that health plan means lower premiums for all users of the plan.

If successes are found with the weight loss program, participants might be more likely to engage in other health promotion programs on the worksite. Successful weight loss can give participants the motivation they need to make other health behavior changes through worksite wellness programs such as joining fitness classes, engaging in tobacco cessation programs, or completing a health screening. Building trusted relationships with the Health and Wellness staff and other employees through WLM can lend itself to

joining other Health and Wellness programs. Success in WLM and fewer prescription claims can act like a springboard to beginning a healthier lifestyle.

Limitations of the Study

The research study design is a longitudinal pre-experimental pre/post design. Essentially, this is a pre-test/post-test design using several evaluation methods. There is no random sampling because there is only one treatment group and no control. Since there is no control group, the study suffers from some threats to validity. The first threat is history. Each participant brings in his or her own history that could affect the results. For example, previous attempts at weight loss, bariatric surgeries, and psychological factors could have an effect on the results, but are beyond the scope of this study. There is no way to control this threat. The next threat is testing. Each weekly weigh in could be on a different scale or conducted by a different tester. This variability isn't captured. Finally, instrumentation is a threat. Participants self-report physical activity upon registration as well as food diary entries throughout the sessions. The result could be an increase in physical activity beyond what is their norm or better food choices than were actually consumed.

Additionally, participants are in the study once they begin WLM (starting in 2006). This study will look at each participant over time (no matter the amount of sessions). So, a limitation will be that some participants will have attended only one session and some will have multiple sessions of WLM with the understanding that those who stay in for multiple sessions are likely staying in for weight maintenance. A final limitation is differing medications. If a participant changes from one category drug to another in the same category, he/she are still considered on a medication. The influence

of the drug may be reduced (meaning a decrease in medication in either dosage, amount, or days' supply), but it is beyond this study to determine dosage power difference.

The possible threats to external validity are social desirability and expectancy effect (McKenzie, Neiger, & Smeltzer, 2005). Social desirability is when participants answer questions or report certain activities because they think that is the answer the researcher wants to hear. The expectancy effect "is when attitudes projected onto individuals cause them to act in a certain way" (McKenzie, Neiger, & Smeltzer, 2005, p. 324). One way to control this threat is to repeat the program with a variety of participants over time. WLM has done this by conducting the program since 2003 with a variety of participants. The threat of the expectancy effect is reduced by learning to treat everyone the same. Finally, these results may not be generalizable to all worksite wellness weight loss programs.

Conclusion

Because worksite wellness programs are an ideal location for weight loss interventions that are sustained over time thereby increasing the amount of time spent in the action stage of the TTM, they are thus set up for success. Cost effectiveness is important to the institution of higher learning, the health plan, and the individual. However, health outcomes are just as important as cost and are the main focus of this study. The literature was lacking research in this area when this study was completed. Therefore, WLM at the University of Kentucky needs to be evaluated to determine the value of the program in relation to the health outcomes of prescription cessation and percent body weight lost.

The rest of this dissertation is organized as follows. In the next chapter, the researcher assessed the literature related to the Transtheoretical model, the costs of

behavior change compared to drug treatments, hypertension, diabetes, dyslipidemia, the socio-economic model, and the costs of worksite wellness. Chapter 3 describes the research design, a description of population, the WLM program, procedures used to gather the data, description of measures, and the methods used to analyze the data. The results in Chapter 4 reveal the effects of each analysis, a brief discussion, and the limitations of the study. The main findings of the study were: the more classes attended, the more weight lost; the more food diaries completed, the more weight lost; and after two sessions of WLM completers were more likely to stop taking their hypertension medications than non-completers. The discussion summarizes the findings, draws conclusions, and describes the implications of the study.

Chapter 2

Literature Review

The purpose of this review is to discuss the existing literature regarding the Transtheoretical Model (TTM); worksite wellness weight loss programs using the TTM; the cost of behavior change compared to drug treatments; weight loss related to medication reduction in hypertension, dyslipidemia, and diabetes; the Socio-Economic model which is the framework for the study; and costs of worksite wellness.

Worksite wellness programs often encompass several behavior change programs targeting many health outcomes. Typical worksite wellness programs target nutrition, physical activity, tobacco cessation, and stress with outcomes around weight loss, staying quit, and improving well-being. In many places, the Transtheoretical model serves as the health promotion model of choice.

Transtheoretical Model

Prochaska's Transtheoretical Model of behavior change is not only popular, but useful for many programs including worksite wellness weight loss programming. Weight Loss Matters (WLM) is loosely based on the Transtheoretical Model (TTM) of behavior change with the intent of making lifestyle modifications in health behaviors toward weight loss. The constructs for this model include: stages of change, decisional balance, self-efficacy, and processes of change (McKenzie, Neiger, & Smeltzer, 2005).

Stages of change. This theory is based on stages of change toward healthy behaviors. The stages are defined in Table 2.1. For participants in the precontemplation and contemplation stages, awareness, education, and motivation are the key areas of action. Awareness, education, and motivation also help move participants toward the preparation stage. Key actions in preparation might be registering for the program (with

fee), attending class, and turning in food diaries. To move participants into action, attendance and food diary completion are important steps to changing behaviors to lose weight. Participants in action are making behavior changes to lose weight and are in maintenance when he or she has been doing so for six months or more. Relapse can happen at any stage and participants can then work back through the stages using these action steps above. Termination stage happens when there is no temptation to return to old habits that counteract weight loss.

Table 2.1
Stages of change

Precontemplation	No plans to make change in the next 6 months
Contemplation	Thinking of making changes in the next 6 months
Preparation	Intends to take action in the next 30 days
Action	Overtly making changes in behavior
Maintenance	Have been making changes for last 6 months
Termination	Have no temptation to return to old habits

Adapted from McKenzie, Neiger, and Smeltzer, 2005

Decisional balance. Decisional balance is simply working through the pros and cons of changing. By weighing the pros and cons of the changes necessary to lose weight, people can choose to participate in a wellness program such as Weight Loss Matters (WLM). The marketing for the program is one way of highlighting the pros of weight loss. The pros will be different for each person. For example, a pro might be feeling better, fitting into smaller clothes, or improving a medical condition. The professional certifications of the program facilitators (registered dietician, licensed dietician) is also a pro in the decisional balance construct that can persuade participants to engage in healthy behaviors for weight loss. Another pro is the continued support of the program with other employee based health and wellness programs.

Processes of change. Processes of change are consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, self-liberation, helping relationships, counterconditioning, reinforcement management, stimulus control, and social liberation (McKenzie, et al., 2005). These processes are all activities that people use to work through the stages and therefore achieve the behavior change. There are ten processes of change included in the TTM (Glanz, et al., 2008) each of which is described below and how they are employed in WLM at UK.

Consciousness raising is defined as "finding and learning new facts, ideas, and tips that support the healthy behavior change" and is addressed through the educational classes held once per week by the registered dieticians and support of the other participants (Glanz, Rimer, & Viswanath, 2008, p. 99). The common website used (OneHub.com) is also a resource for educating the participants, as well as the binders issued to them at the beginning of the 10 week session. Components or topics of the education include the exchange system, portion control, reading food labels, and how to prepare quick meals. Dramatic relief may also be associated with the support and collaboration of other participants sharing stories and personal emotions. When a person shares a negative effect in a group of people with common goals, the effect is transferred to the supporting members thereby causing the person to want to change to avoid that negative effect.

Self-reevaluation is "realizing that the behavior change is an important part of one's identity as a person" and is addressed by the facilitators during the sessions and also reinforced with the weight loss (Glanz, Rimer, & Viswanath, 2008, p. 99). The facilitators reiterate how important weight loss is and how it can become part of their identity. The weight loss itself is a positive reinforcer to self-reevaluation.

Environmental reevaluation is learning how the behavior impacts a person's social and physical circles, either positively or negatively. By realizing the negative impact of being overweight or obese and the positive impact of weight loss, it often becomes contagious. That is, the participant encourages others in their social circles to participate, thereby improving their environment for weight loss. WLM becomes a new part of the participant's social circle as it meets regularly for ten weeks. The other participants become part of the new social grouping. Also, the healthy options on campus (the physical environment) are pointed out and discussed.

Self-liberation is "making a firm commitment to change" (Glanz, Rimer, & Viswanath, 2008, p. 99). It is a process that happens both during and after the program. A participant must decide for him or herself to begin WLM, making some decision for weight loss. However, continuing the behaviors associated with weight loss typically comes after time, learning, and experience.

Helping relationships can be found with the facilitators, the other participants, a participant's family, or other social circles. Any relationship that supports the behavior change can be a helping relationship.

Counterconditioning lessons are also part of once a week educational session held by the facilitators. Counterconditioning is the process of substituting healthier behaviors for the unhealthy behaviors (Glanz, et al., 2008). The dieticians help to identify mindless sources of eating and bring a more positive behavior into play to counter any bad eating habits. Other topics based on counterconditioning are healthy snack choices and healthy options for eating out.

WLM demonstrates reinforcement management by allowing each participant to make both short-term and long-term goals, specific to their own behavior. Because every

person is motivated differently, rewards for healthy behaviors will look different for each participant. WLM often hosts challenges within each class for one participant to earn a prize each week. The challenges reflect healthy behaviors that help participants work toward their goals. Also, the very act of attending WLM week after week helps to reinforce the ideas and actions to make the behavior change.

Stimulus control is not completely addressed in WLM. The negative cues cannot be completely removed from life, but positive reinforcements can be learned in place of negative ones to cue good health behavior. WLM address emotional eating as a topic to help control mindless eating, eating out of boredom or an emotional response.

Social liberation can only happen if the participant's social circles are also willing to make such changes or the social circle itself changes to one that is more supportive. Being overweight and obese are world-wide problems, and therefore social norms surrounding weight loss are not easily changed. Because WLM is conducted in small groups, in a niche culture of a college campus in Kentucky, among university employees, social liberation can be accomplished to an extent. This is another reason the socio-economic model was used as the framework for the study. The model takes the different interacting levels of microsystem, mesosystem, and exosystem into consideration.

These processes of change take time to implement and result in change. Depending on the participant's readiness to change, a person may or may not be ready to move through any of these processes at one time. An employee weight loss program based on the Transtheoretical model helps people move through the stages of change using the above-mentioned constructs. Many studies are cited below which support using the TTM as a basis for worksite wellness weight loss programs.

TTM in the Workplace

Because American workers spend so much time at work, worksite wellness programs are an ideal place to implement health promotion programs. Worksites function as a community all on their own, having a particular culture specific to the workplace. Individual health behavior changes have been proven to be more effective in the workplace than organizational interventions (Goldgruber & Ahrens, 2010). However, interventions aimed at a specific culture can be beneficial, according to Goldgruber and Ahrens. Their conclusion is that worksite wellness programs must be adapted to the specific culture or community for which they are intended, but still be aimed at the individual level. In a study by Renaud et al. (2008) personalized health promotion programs in the workplace were successful. WLM has been personalized over the duration of the program to meet the cultural needs of the UK community. Time and location are one way WLM has been molded over time to fit the UK employee community. Class times are typical lunch hours and after work hours. Class locations are on campus near the center of campus and within the healthcare campus of the University. Another way is to use examples that come from campus or local options when discussing healthy choices when eating out. Also, challenges and competitions with WLM are formed around University sports bringing out the "fan" in the participants.

The literature also supports utilizing the Transtheoretical model of behavior change for worksite wellness weight loss programs. Johnson and colleagues found, "individualized stage-matched, multiple behavior interventions had significant effects on progression to Action/Maintenance for healthy eating, exercise, managing emotional distress, and weight among those most at risk (i.e., those in pre-action) one year post intervention" (2008, p. 244). This study also showed that weight loss was sustained post-

intervention. This study is similar to WLM in that the main goal is weight loss; additionally, WLM addresses several health behaviors, as did this study. Like the research study, WLM also address exercise as a topic and emotional eating as a topic. Logue et al. (2004) found that the longer a person spends in the action or maintenance stages of change, the more likely they are to lose weight successfully. Given that WLM allows participants to repeat the program as many times as desired, this can aid in weight loss and maintenance of the health behavior, thereby being successful. As Logue et al. (2004) pointed out, the longer people are actively losing weight or maintaining their weight; the more successful they are with long term weight loss. DiNoia and Prochaska (2010) examined the decisional balance relationship to stages of change for dietary behaviors. They discovered during precontemplation, the cons are higher than the pros and during action and maintenance, the reverse is true. This is reinforced in WLM, with maintenance and then termination as the goal. Participants are more likely to keep the weight off and change their behaviors if they accept more pros than cons. O'Connell and Velicer conducted two studies where decisional balance pro/con decisions demonstrated a successful behavior change of weight loss (O'Connell & Velicer, 1988). Finally, O'Connell and Velicer (1988) added that the move from contemplation to action may be the time most important in terms of decisional balance. TTM is highly important in changing health behaviors related to weight loss and control, particularly the constructs of decisional balance and stages of change (O'Connell and Velicer, 1988). WLM has employed the TTM in the UK worksite wellness programming to promote behavior change.

Behavior Change Compared to Drug Treatments

Avenell et al. (2004a) concluded that low-fat diets and exercise interventions in individuals at risk of obesity-related illness, such as diabetes, are of comparable cost to drug treatments. Their statement is supported by other literature as well, indirectly. Though Avenell et al. (2004a) reported comparable costs of drug treatment versus lifestyle modifications; many studies reported cost savings through weight loss. Specifically, in a study by Gustafson et al.(2009), cost effectiveness was evaluated by life years gained compared to the cost of conducting the weight loss program. "The Weight-Wise intervention cost of $61 per kg lost ($27.72/lb) also compares favorably to costs reported by other studies, …" (Gustafson et al., 2009, p. 393). The life years gained were scaled to all costs, indicating the Weight-Wise intervention was effective. In a study by Wang et al.(2006), body mass index (BMI) was reviewed as a linear relationship with cost when BMI is 25 or higher. "Within the BMI range of 25 to 45 kg/m2, medical costs and pharmaceutical costs increased $119.7 (4%) and $82.6 (7%) per BMI unit, respectively, adjusted for age and sex" (Wang et al., 2006, p. 668). Because of the linear relationship, the dollar amounts can also be thought of in the reverse. Not only is higher BMI associated with higher cost, lower BMI (in the normal range) should have lower costs. A longitudinal study was performed by Finkelstein et al. (2009) on weight loss and the associated medical costs. They found that pharmacy expenditures were significantly decreased in the group that lost weight as compared to the control group. Emphasis in this study was placed on the long-term weight loss of employees and not simply short term to see the greatest cost savings. Hughes, Girolami, Cheadle, Harris, and Patrick (2007) also reviewed the cost savings of weight loss in worksite wellness programs by reviewing prescription drug claims of three Fortune 500 companies (N = 512). "The

number of participants taking prescription drugs decreased from 48 to 39 (19%) between baseline and 1-year post intervention in a subgroup of 61 participants" (Hughes et al., 2007, p. 1215). After applying a current (to the time) annual drug cost average, they estimated that this could result in a $2382 decrease per participant. This is about a 50% savings (Hughes et al., 2007). Though these results are positive, such a small sample size could be limiting. Carls, Goetzl, Henke, Bruo, Isaac, and McHugh (2011) conducted a longitudinal study of the Johnson & Johnson Corporation and the impact of weight gain or loss and health care costs. This study had major significance as it was one of the first to use both longitudinal data and find significant savings with weight loss. They found "Employees who added weight risk (moved from BMI < 30 kg/m^2 to BMI $\geq$ 30 kg/m^2) increased their average annual medical costs to $1267, about $982 (95%CI: 255-$1710) more than employees who remained at lower risk, whose cost increased an average of $285 each year" (Carls et al., 2011, p. 11). In addition, those who gained weight risk also increased their health care costs by 9.9% (Carls et al., 2011).

Part of the picture of drug costs includes compliance and adherence to the prescribed therapies. In 2001, the World Health Organization (WHO) launched a global initiative to study and make recommendations for long-term adherence. Their work group chose 'adherence' as opposed to 'compliance' to better reflect the patient's agreement with the health care provider's recommendations (WHO, 2003). In addition, adherence is not only to drugs, but any health-related behavior recommended by the health care provider. This might include taking medication, following a diet, or implementing lifestyle changes. For developed countries, the adherence rate of lifestyle behavior changes averages 50% and is lower in developing countries (WHO, 2003, p.13). Separately, compliance is a term utilized by the pharmaceutical industry and is a

calculation of number of days' supply of medication filled divided by the number of days intended treatment (Lucy Wells, personal communication, July 23, 2014).

Furthermore, the WHO suggests greater incidence of non-adherence in asthma, hypertension, diabetes, and HIV/AIDS. In diabetes, specifically, adherence refers to taking medications, self-monitoring of blood glucose, dietary restrictions, regular foot care, and ophthalmic exams. Not only does non-adherence negatively affect the patient, but also societal and economic costs, as well. The worksite would also be affected by the above.

Hypertension

Hypertension or elevated blood pressure (BP) is specifically linked to overweight and obesity. A review study by Johnson et al., (2006) found that three specific interventions demonstrated improvement in medication adherence. "Although drug therapy can effectively lower BP and prevent stroke and heart disease, it does not address the underlying causes of elevated BP, including obesity, unhealthy dietary habits, and limited physical activity" (Funk, et al., 2008, p. 272). Therefore, compliance to pharmacotherapy may not be the answer to helping cure hypertension. Lifestyle modifications have shown better rates of adherence thereby decreasing hypertension. "Weight-loss incorporating lifestyle modifications have been found to decrease resting BP [15], and [they] found that 4.3-kg loss in weight (4.6%) was sufficient to significantly decrease resting SBP by 3 mmHg" (Torres & Nowson, 2007, Discussion, para 1). Lifestyle modifications can include increasing healthy dietary habits and physical activity, as well as decreasing stress and alcohol intake. "These lifestyle modifications are recommended in non-hypertensive individuals with above –optimal BP. For individuals taking BP medication, lifestyle modification is recommended as

adjunctive therapy to lower BP" (Appel et al., 2003, p. 2004). These also happen to be the same lifestyle modifications recommended to decrease risk of diabetes and cancer.

Other studies have shown similar results. Miller et al. (2002) noted that comprehensive lifestyle changes can be powerful interventions for those who use blood pressure medication. In a weight loss study, Horvath et al. (2008) discovered those who lost weight needed less medication than the non-weight loss groups. Not only did medication need decrease, other studies found a decrease in BP with adjunctive therapies. Torress and Nowson (2007) noted a 2.8 + 1.4 mmHg decrease in systolic blood pressure with weight loss. Alcohol restriction and relaxation therapy proved to lower BP (Blumenthal et al., 2002). Appel et al. (2003) and Blumenthanl et al. (2002) demonstrated that when lifestyle modifications are combined there is a greater and more significant effect than one intervention alone.

Diabetes

Several studies have demonstrated lifestyle modifications can positively affect glycemic control, perhaps even better than pharmacological therapy. However, there has been little evidence to show a removal of medication using lifestyle modifications alone. Lifestyle modifications include behaviors such as weight loss, physical activity, and healthier food choices. Weight loss is the key lifestyle intervention most greatly associated with decreasing risk and key markers for diabetes. A recent study reported "In overweight and obese individuals with type 2 diabetes, weight loss is associated with improvements in risk factors" (Horton, Silberman, Davis, & Berria, 2010, p. 1759). "Changes in body weight were significantly associated with reductions in A1C" (Horton et al., 2010, p. 1761). A person's risk of diabetes increases 9% with every 1 kg of weight

gain, according to Mokdad et al. (2000). Again, (Hamman et al. (2006)) suggested weight loss had more of an impact on diabetes than diet or physical activity.

According to studies by Aucott (2008); Delhanty (2002); Elhayany, Lustman, Abel, Attal-Singer, and Vinker (2010); Fujioka (2010), Albu et al. (2010); Eakin et al. (2010); and Kempf, Kruse, and Martin (2010), the benefits of weight loss on diabetes are reduction of risk and specific markers. Albu et al. (2010) studied metabolic changes in type 2 diabetics after 1 year of diet and exercise interventions and found significant improvements in insulin sensitivity, fasting glucose, and circulating free fatty acids among other results. Delahanty (2002) made the point that even a small amount of weight loss can show improvements in diabetic markers. Elhayanay and colleagues (2010) studied an Israeli population and repeated the same results: that weight loss improves type 2 diabetes. "In these studies some weight loss (3-5 kg) was associated with a reduced risk of developing diabetes when compared with the weight-stable group, by >10% (upper CI)" (Aucott, 2008, p. 55-56.) Kempf et al.(2010) and colleagues reiterated the effectiveness of lifestyle modifications for type 2 diabetes. Participants who completed their study had a significant reduction in weight, BMI, waist circumference, HbA1c, systolic and diastolic blood pressure, and LDL cholesterol. In addition, depression was decreased in this group, as well. After studying the correlation between weight loss and HbA1c, Kempf et al. found "a weight loss of 1 kg was associated with a mean reduction of 0.05% HbA1c" (2010, p. 550).

Aucott went on to say "evidence is now emerging that lifestyle interventions are, in the long term, more effective in reducing the risk of developing diabetes than using the diabetes mellitus-specific drug Metformin" (2008, p. 56). In this systematic review, the

conclusion is that diet, physical activity, and behavior therapy are effective for long term intentional weight loss.

Dyslipidemia

The risk factors that contribute to dyslipidemia include: genetics, ageing, diabetes, smoking, sedentary lifestyle, poor dietary habits, and overweight or obesity (CDC, 2010). Again, obesity is the major risk factor in dylipidemia as previously shown in the other two conditions. "The dyslipidemia of obesity is typically associated with insulin resistance, including higher concentrations of fasting triglycerides and lower concentrations of HDL cholesterol" (Hernandez et al., 2010, p. 578.)

To correct dyslipidemia in persons with metabolic syndrome, weight loss is the best first choice (Grundy et al., 2006). Harman, Leeds, and Griffin (2008) compared an energy restricted diet plus two eggs per day compared to the same energy restricted diet and found that both groups had a decrease in LDL cholesterol. They attributed this decrease to weight loss and suggested an increase in LDL was counter-effected by the weight loss. Pooblan et al. (2007) studied long term outcomes in the obese and found a linear relationship between weight loss and cholesterol. They went on to say, "this suggests that every 10 kg of weight loss may result in an expected drop of 0.23 mmol/L in cholesterol for a person with obesity" (Pooblan, 2007, p. 49). Santosa, Demonty, Lichtenstein, and Jones (2007) found cholesterol decreased with weight loss in women due to changes in cholesterol metabolism. Weight loss was associated with lower LDL cholesterol and increases in HDL or good cholesterol. Gustafson reported the women in the study improved their weight, systolic blood pressure, BMI, and YLL reduction (years of life lost) (2009). She added that those who attended more sessions had greater

improvements, making the case for attendance compliance (a majority of classes) among weight loss individuals.

The evidence is that weight loss improved cholesterol levels, among other measurements, over time. In 2004, Pooblan and colleagues showed that weight loss does in fact have long term effects on cholesterol. Even more recently, Meckling and Sherfey found that total cholesterol was decreased by a controlled diet and exercise as well as a high protein diet. Triglycerides were decreased in the high protein plus exercise group. All four groups (control, control plus exercise, high protein, and high protein plus exercise) lost weight, improved BMI, BP, and waist and hip circumference, indicating the efficacy of weight loss and exercise on cholesterol (2007). Matsuo et al. (2010) found weight loss improved many metabolic factors. However, the significant finding was that HDL cholesterol improved after two years of maintaining lost visceral abdominal fat levels. The mean values for triglycerides, glucose, and total cholesterol/ HDL ratio were all lower after two years, as well as with weight loss. "After 4 mo of active weight loss, the CHO group had significant reductions in TC, LDL-C, and TAG" (Layman et al., 2009, p. 519); however, these reductions were not sustained in the long term (12 mo). "After 4 mo, the PRO diet resulted in lower TAG, increased HDL-C, and improved TC:HDL-C and TAG:HDL-C ratios"(Layman et al., 2009, p. 519). These changes were sustained at 12 months. The studies just described all indicate that weight loss impacts cholesterol positively. "In two studies adding exercise to diet was associated with beneficial effects at 12 months for HDL cholesterol (change to 0.1 mmol L-1, 95% CI, 0.06 to 0.14 mmol L-1) and TGs (change -0.18 mmol L-1, 95% CI, -0.31 to -0.06 mmol L-1)". (Avenell et al., 2004, p. 308-309).

Socio-economic Model

The Socio-Economic Model or ecological model was first introduced as a systems theory model by Kurt Lewin in 1951 to explain behavior (Glanz, Rimer, & Viswanath, 2008). It has been built upon and adapted by several authors including Barker in 1968, Moos in 1980, Bronfenbrenner in 1979, and Glass and McAtee in 2006 (Glanz et al., 2008). The theory has been further utilized to guide behavioral interventions by early authors such as Skinner and Bandura to others as recently as 2005. Bronfenbrenner (1979) breaks the theory down into environmental systems. The microsystem includes interactions between family members and work groups. The mesosystem is the physical settings of family, work, and school. The exosystem is the larger systems including politics, organizations, and culture.

The premise of the model is that all levels of an environment work together to influence both the person and reciprocally, the environment, as noted by the term reciprocal determinism. "The ultimate purpose of ecological models of health behavior is to inform the development of comprehensive intervention approaches that can systematically target mechanisms of change at several levels of influence" (Glans, Rimer, & Viswanath, 2008, p. 466). Glanz and colleagues (2008) explained there are four core principles of the ecological model: multiple influences on specific health behaviors (intrapersonal, interpersonal, organizational, community, and policy levels); these influences interact across levels; the model should be behavior specific (using the most relevant influences at each level); and interventions that are multi-level are the most effective for behavior change. Simply stated, just because a person is educated for a health behavior change does not mean that person will make a change. In order for health behavior change to occur, the total environment must support the healthy behavior.

All the levels of influence must change. For example, intrapersonal-food education, interpersonal-support network encouragement, community-institution supported changes, and policy-broader policy change to support healthy eating would be needed to affect healthy eating.

The ecological model has been widely used by such entities as the World Health Organization's Global Strategy on Diet, Physical Activity and Health (World Health Organization, 2011) and Healthy People 2020 (U.S. Department of Health & Human Services, 2010). The model has been used in tobacco cessation efforts with success and researchers have high hopes of applying it to the obesity epidemic "by improving environments and policies that drive physical activity and nutrition behaviors" (Glanz, Rimber, & Viswanath, 2008, p. 479). The obvious strength of the model is its use of many influences and across levels making interventions at several levels more effective. The weakness of the model is not being specific about which influences might have the most effect on the behavior change (Glanz et al., 2008).

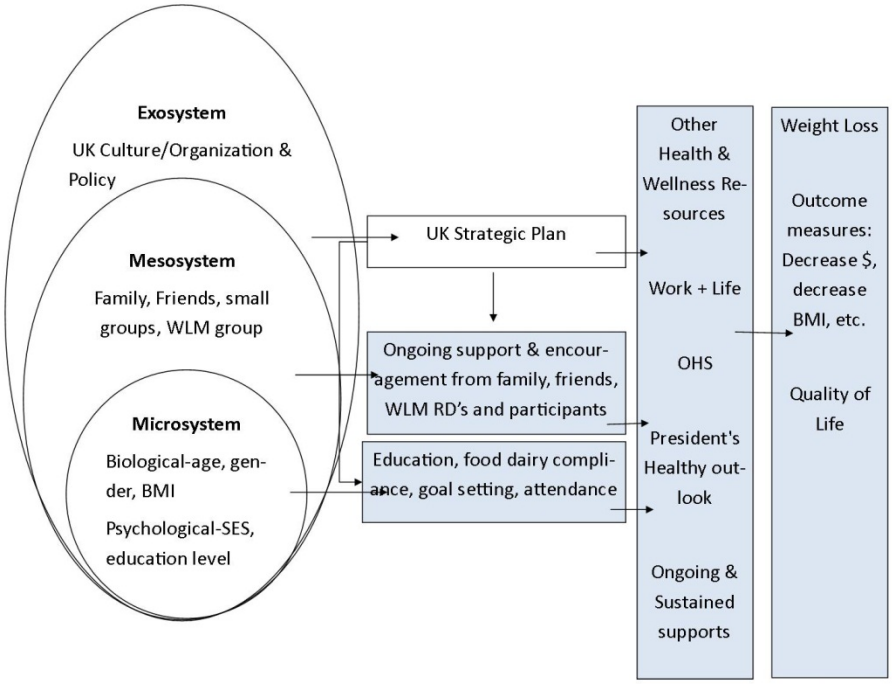
A more recent study by Karlsen, Sohagen, and Hjelmesaeth (2013) suggests using a "bio-psycho-social model" to study predictor variables on weight loss. They strongly advise using a model that will take all of the above levels of interaction into consideration stating "In a real life context, as in a weight loss program, individual physiological and psychological factors, often genetically influenced interact with social and environmental factors, giving a multitude of individual responses to both the magnitude and rate of weight changes" (Karlsen, Sohagen & Hjelmesaeth, 2013, p. 2). This is a good description of how the ecological model works.

As related to WLM, the ecological model works within the context of UK. The multiple influences on weight loss might include: the particular WLM class, the person's

work group and family/friends network, the institution's culture, the available food on campus, the socio-economic status (SES) of the person, and the physical activity avenues available on campus and in the person's network. All of these influences interact across levels; meaning the food available on campus is influenced by the UK culture and the UK culture is influenced by the employees and students of the University and the employees and students are influenced by their family and friends network. There are multiple levels of interaction. The specific behavior is weight loss and there can be changes at many of these levels to affect weight loss.

On the microsystem level, there are several variables: age, sex, BMI, and SES. On the mesosystem level, the variables include: family, friends, small groups (work groups), and the specific WLM group. The exosystem includes UK culture, UK as an organization, and UK policy. The University of Kentucky 2009-2014 strategic plan comes from the exosystem level. However, the strategic plan influences the resources and supports offered on the other levels. "The five goals of this Strategic Plan identify the principal areas of activity in which the talents and resources of the University will be invested over the next five years. Under each goal are several objectives, strategies, and metrics that make specific the intentions of the University of Kentucky" (http://www.uky.edu/Provost/strategic_planning/plan.htm). There are several ongoing supports and resources that are a result of the group programs and strategic plan. All of these systems: microsystem, mesosystem, and exosystem, interact with each other. There are resources and supports that come from each system level and interact upon one another. Variables at each level could not be tested for the scope of this research. Figure 2.1 is a diagram of the Socio-economic model as applied to WLM at UK.

Figure 2.1



Ecological model in the literature. McLeroy, Bibeau, Steckler, and Glanz (1988) discussed the ecological model and interventions on both the individual and social level for health promotion programming. They suggested five levels of an ecological model: intrapersonal, interpersonal, institutional, community, and public policy (McLeroy, Bibeau, Steckler, & Glanz, 1988). Intrapersonal factors include participant information such as knowledge, attitude, behavior, self-concept, and developmental history. Interpersonal factors are formal and informal social network, support systems such as family, work, and friends. Institutional factors include formal and informal rules and regulations for operation. Community factors are relationships among organizations, institutions, and networks within those communities. Public policy includes local, state, and national laws and policies (McLeroy et al., 1988).

Baranowski, Cullen, Nicklas, Thompson, and Baranowski (2003) reviewed several research studies utilizing the ecological or social ecological model and suggested incorporating cognitive variables into the model to address cues to action, facilitation of healthy options by only having certain facilities or food choices available, inhibiting or prohibiting a behavior by controlling availability or access, and altering the attractiveness of the alternatives. After reviewing the most popular health behavior change models, they stated "behavior-and ecology-based problems require behavior-and ecology-based solutions" (2003, p. 38S). Therefore, they suggested further research to correlate causative variables and then focused on procedures that would manipulate the variables in order to be the most effective against obesity. In summary, these authors (2003) suggested changing both the environment and individual characteristics for the most positive results of behavior change.

An example of the above idea is by Karlsen, Sohagen, and Hjelmesaeth (2013) who found several variables that had direct influence of weight loss at 1 year post intervention: weight lost at 12 weeks, age, mental HRQL (emotional quality of life), and employment status. Using these three variables, they found a direct influence on weight loss.

Costs of Worksite Wellness

Van Dongen and colleagues (2011) completed a systematic review of 18 studies on the financial return on investment of worksite health promotion programs targeting nutrition and physical activity. They assessed ROI, net benefits, and benefit cost ratio (BCR). Return was estimated in terms of absenteeism and medical benefits. Net benefits were calculated as benefits (difference of intervention and control groups monetized outcome measures) minus costs (difference in program costs between intervention and

control groups). BCR was calculated as benefits divided by costs. ROI was calculated as benefits minus costs divided by costs and multiplied by 100 for a percentage. The researchers made all values in terms of US dollars as of 2010 by standardizing to consumer price indices and purchasing power parities (van Dongen, 2011). In the 18 studies, interventions included assessment (including self-assessments), educational/informational components, behavioral, exercise, environmental and/or an incentive component that lasted from six months to five years. "The financial return was positive in 14 out of 21 interventions" (van Dongen et al., 2011, p. 1043). The differences were between randomized control trials and non-randomized studies, where the randomized control trials had the most promising results. Therefore, worksite health promotion programs aimed at improving nutrition and physical activity were found to have a positive return on investment during the first years of implementation as well as reducing employee health care costs (van Dongen et al., 2011). They also noted the intangible benefits go beyond the financial benefits to also increase worker satisfaction and improve reputation (van Dongen et al., 2011).

In summary, the implications of weight loss interventions in the worksite are many: improved morale, decreased presenteeism and absenteeism, and improved health risk and health care costs to both the employee and the employer. Regarding employer medical costs for employees, there are several conditions or behaviors that are highly prevalent and therefore have high associated costs. Table 2.2 below displays data from the American Heart Association (2009) indicating prevalence, medical costs, and performance loss associated with various heath conditions/behaviors.

Table 2.2

Prevalence Data and Associated Medical Costs and Performance Loss Costs

Condition/Behavior	Prevalence	Direct medical costs	Performance loss
HBP	High (1 in 3 adults have elevated BP)	Very high ($101 billion/yr across the nation in estimated costs)	Potentially high
Cholesterol	High (27% of adults have cholesterol of 240 or above)	Very High ($60 billion in medical costs related to elevated cholesterol)	Unknown
Exercise-general	Very High (58% of employees are sedentary)	Potentially very high (linked to 23% of deaths from CHD, stroke, colorectal cancer, diabetes)	Unknown
Nutrition	Very High (80% of adults consume too much fat; 1/3 are overweight)	Potentially very high (related to 5 conditions costing $146 billion)	Unknown

Adapted from the AHA (2009)

A healthy employee costs less than an employee with health conditions. "The truth is healthy employees not only cost less in medical care, they also are more functional at work, absent less often, experience fewer injuries, and arrive back on the job more quickly after they do get injured" (Lynch, 2002, p. 17) (Thompson et al., 2005). It is not all about the bottom line of cost. Employees are valuable assets to companies, regardless of their 'price tag'.

Chapter 3

Methods

This chapter includes the methodology by which the study was conducted. Included are research design, description of the population and participants, how the data were collected, description of measures, description of the program, data coding and reorganization, statistical analysis, and categorization.

Research Design

The research design was a quasi-experimental, longitudinal design in which the same participants were followed over time, measuring the same variables at different intervals. Data were collected post-hoc from historical records kept by UK Health and Wellness staff and UK Healthcare. Prescription claims data were gathered 12 months prior to program participation, six months post program, and 12 months post program. This longitudinal design was particularly appropriate given the length of time it takes to change health behaviors or to see a decline in medication use (Finkelstein et al. 2009, Hughes et al., 2007).

Description of population

The population included 14,000 University of Kentucky employees from 2006 to 2011. The University of Kentucky is a public institution in the city of Lexington, and Commonwealth of Kentucky. The setting for Weight Loss Matters (WLM) was the University of Kentucky campus.

There are several factors within the University that contribute to a distinctive culture. Due to so many different subgroups of employees, each one has unique elements. The two main categories of participants were faculty and staff. Staff persons typically worked during the day with regular office hours. There are several subgroups of

staff, including full-time, part-time, administrative, support staff, and skilled workers. The subgroups of faculty included: full-time, adjunct, part-time, and lecturers. The faculty had different schedules than staff persons. Where a staff person may work the typical schedule with a one hour lunch break around noon, faculty persons varied greatly with no set hours, thereby, making programming or access to programming difficult. Typically, faculty were more educated, had higher incomes, and therefore higher socioeconomic status (SES) than a staff person. A higher SES correlates with increased health and conversely, lower SES correlates with decreased health (REPORT, heathcare.gov). Therefore, faculty were potentially healthier, yet with a more difficult programming schedule in a culture different from the rest of the UK community. The staff had the widest range of socio-economic possibilities from top level administration to skilled technical workers. All of these factors make for a melting pot of employees creating a challenging environment to practice worksite wellness.

WLM Program Goals and Objectives

Goals are overarching expectations of what a program will accomplish. According to McKenzie, Neiger, and Smeltzer (2005, p. 129), a goal is "much more encompassing, or global, written to include all aspects or components of a program, provides overall direction for a program, more general in nature, usually takes longer to complete, does not have a deadline, usually is not observed, but rather must be inferred because it includes words like *evaluate*, *know*, *improve*, and understand, is often not measurable in exact terms." The overall goal of Weight Loss Matters was for participants to lose weight through behavioral lifestyle changes learned through educational sessions.

Objectives are "more precise and represent smaller steps than program goals-steps that, if completed, will lead to reaching the program goal(s)" (McKenzie et al., 2005, p.

130). Objectives are broken into hierarchical levels, becoming more specific with each level (McKenzie et al., 2005).

Learning objectives are the first level and focus on steps given to the participants to achieve weight loss. There were three main learning objectives for the student: (1) to exhibit nutritional knowledge by food choices reflected on the food diaries, (2) to identify cognitive or mental barriers weekly as smaller goals, and (3) to learn the Exchange system as reflected in their food choices and recording of food diaries all turned in on a weekly basis. These objectives were assessed by the registered dieticians (RDs) on a weekly basis. Sessions included information on how to read a food label, proper portion sizes, mindless or emotional reasons for eating, the importance of exercise, eating smart while eating out, and easy meals. These topics help satisfy the first learning objective. These were the steps given to the participants to make a lifestyle change and lose weight.

Behavioral objectives are action oriented. There were four behavioral objectives for WLM: by the end of WLM, participants will be able to apply the nutritional information to their lifestyle; utilize a support network through discussions; participate in weigh-ins for accountability; and to self-monitor using food diaries.

Outcome objectives "are the ultimate objectives of a program and are aimed at changes in health status, social benefits, risk factors, or quality of life" (McKenzie et al., 2005, p. 132). Since the overarching goal of WLM was for participants to make lifestyle changes through weight loss, then the outcome objectives included weight loss, improvement in health literacy/education, maintenance of weight loss, reduction in risk for chronic diseases, decreased morbidity and mortality, and increased quality of life.

Program Description

The Weight Loss Matters (WLM) program was a 10-week weight loss program designed for University of Kentucky (UK) employees, retirees, spouses, and sponsored dependents. WLM was designed by the UK Health & Wellness program dietician in 2003. Participants were charged a $50 fee; however, they could re-enroll in another session of 10-week classes for free as long as they were meeting their weight loss goals and felt the program continued to help them. If the participant did not meet his/her goals or dropped out and returned, he/she were only charged $25. However, by turning in eight out of 10 food diaries, a participant could have the $25 fee waived.

The program was designed for in-person delivery and offered at set times during the year in 10-week increments. Classes were offered three times per week in different campus locations. Classes were held on weekdays with at least one class at lunch time and one class in the evening, all covering the same topic. An online class was offered every Wednesday from 12:10-12:50PM; however these data were not included in the study due to lack of data for this class. Participants registered for one of the in-person classes, but could attend any class if they missed the meeting time of the one in which they registered. If a participant had to miss a class, he or she could either come to one of the other classes offered or continue in WLM for additional cycles. Weekly class topics included, but were not limited to: decoding food labels, portion distortion, mindless eating, physical activity, eating out, easy meals, weekend warriors, emotional eating, and excuses. Food and exercise diaries were kept by participants and turned in weekly for feedback from a Registered Dietician (RD) on a voluntary basis. Also, each participant completed a weekly weigh-in by a trained staff person. Physical activity was encouraged, but not required.

In order to help participants with maintenance of the healthy behavior of weight loss; the program facilitators used several strategies. First, the participants set their own weight loss goals. Research into WLM by Dr. Maura Scott in UK's Gatton College of Business and Economics revealed that participants viewed their progress more positively if they chose a weight range to lose instead of a number of pounds (personal communication, 2010). Therefore, WLM asked participants to set weight range goals. Also, the program was self-paced which allowed stronger self-efficacy and therefore aided in maintenance. For example, one participant could lose one pound and feel successful while the same week, another participant could lose three pounds and be just as successful. Finally, the strategies taught by the RDs were behavior-change based lifestyle modifications. The support found in the group setting also aided in strategizing for barriers and issues; thus, aiding in maintenance. If there were participants who completed three sessions in a row (three ten-week sessions) they were recognized as "Veterans". They were asked to share their stories, give advice, and were featured on the One Hub website for all WLM participants to recognize.

Relapse prevention was addressed on a case by case basis. Because the classes were in person, the RDs were in touch with every participant. Also, the participants were asked to set weekly goals that were not weight related to help stay on track and encourage further modifications. For example, a non-weight related goal could be to sleep eight hours three nights per week. In the event a participant were absent two weeks in a row with no other communication, the RDs contacted that person to invite him/her back and make it easy to get re-involved. In addition, as previously mentioned, a participant could stay in WLM for a second (or more) 10 week session for free if he or she continued to meet his or her goal.

This program design demonstrates the Transtheoretical Model approach used in WLM. Moving through the stages of change by weighing pros and cons, understanding a participants own self-efficacy, and using the processes of change previously described, helps participants to change their behaviors related to weight loss.

Participants

For the purpose of this research, only UK employees who were on a UK health plan were included. The sample included employees who participated in WLM for at least one session between June 2006 and December 2011 for whom there were data. Online WLM participants were not included due to lack of data. Retirees, spouses, and sponsored dependents were not included so the results would be more comparable to other worksite wellness program evaluations. There were 591 unique participants included in this study. Participants were either full time or part time employees of the University between June 2006 and December 2011.

Data collection-Records from WLM

WLM records from June 2006 to December 2011 were examined for information on UK employees who were on a UK Health Plan and completed an in-person WLM class. These paper records were kept by WLM staff in locked file cabinets or in password protected Access database. Permission to access these records was obtained from the Health and Wellness Program Manager. Institutional Review Board approval was obtained prior to data records being accessed.

Participants were asked to complete a registration form that included several variables: sex, date of birth, current height, weight, health concerns, previous attempts at weight loss, and physical activity level (see Appendix B). Then, throughout the ten weeks, the facilitators gathered other data. Out of that data pool, this study utilized

weekly weigh-in weight measured in pounds by the program facilitators as well as food diary compliance (see appendices C and D). For this study, food diary compliance was defined as six diaries turned in out of the possible ten-week period. A weekly diary was considered complete if it held three days or more of reported food intake. Likewise, attendance completion was defined as participants having attended six classes out of ten. Also, the facilitators collected final measurements of height (self-reported) and weight (measured). All data were kept confidential by password protection, encryption, and using secure servers.

Data collection -Records from UK Health plan

The prescription claims data were collected from the UK health plan claims database by the UK Associate Director for Mental Health Data Management (second researcher) at the start date of WLM, 12 months prior to WLM, six months post WLM, and 12 months post WLM for each participant for each session. Prior to the second researcher obtaining the records, IRB approval was obtained. The primary investigator supplied the UK Associate Director for Mental Health Data Management the data for all participants for all sessions to access the prescription claims, before and after WLM, including social security numbers (a unique identifier). From the prescription claims list, the primary investigator worked with a UK Pharmacist to gather a list of drugs that fell into three categories: hypertension, cholesterol, and diabetes (see Table 3.1).

Table 3.1

Drugs used

CATEGORY ID	CATEGORY_NAME	Indication
317	antihyperlipidemic combinations	Cholesterol
316	cholesterol absorption inhibitors	Cholesterol
173	HMG-CoA reductase inhibitors	Cholesterol
252	bile acid sequestrants	Cholesterol/Lipids
241	fibric acid derivatives	Cholesterol/Lipids
174	miscellaneous antihyperlipidemic agents	Cholesterol/Lipids
216	alpha-glucosidase inhibitors	Diabetes
372	amylin analogs	Diabetes
314	antidiabetic combinations	Diabetes
214	biguanides	Diabetes
371	dipeptidyl peptidase 4 inhibitors	Diabetes
293	glucose elevating agents	Diabetes
373	incretin mimetics	Diabetes
215	insulin	Diabetes
282	meglitinides	Diabetes
309	miscellaneous antidiabetic agents	Diabetes
458	SGLT-2 inhibitors	Diabetes
213	sulfonylureas	Diabetes
271	thiazolidinediones	Diabetes
42	angiotensin converting enzyme inhibitors	Hypertension
56	angiotensin II inhibitors	Hypertension
44	antiadrenergic agents, centrally acting	Hypertension
43	antiadrenergic agents, peripherally acting	Hypertension
55	antihypertensive combinations	Hypertension
48	calcium channel blocking agents	Hypertension
274	cardioselective beta blockers	Hypertension
51	miscellaneous cardiovascular agents	Hypertension
275	non-cardioselective beta blockers	Hypertension
155	potassium-sparing diuretics	Hypertension
342	renin inhibitors	Hypertension
156	thiazide and thiazide-like diuretics	Hypertension
53	vasodilators	Hypertension

Note: *For a more detailed table of specific drugs, their purpose, use, and side effects, see Appendix D.*

The second researcher then matched the person with the claims, de-identified the data, and passed to the primary investigator. Data analysis was conducted by the primary

researcher. All data were encrypted by the secondary researcher. In other words, the data were translated into another form before being passed to the primary investigator so as not to be able to trace the identity of the participants.

Description of Measures

The following measures were collected by the WLM program: attendance, physical activity, food diary compliance, goal, height, and weight. These measures were collected via the intake form, food diaries turned in, and weekly weigh in sheets. Body Mass Index (BMI) was calculated as weight in kilograms/height in meters^2. Weight loss was calculated for each session as starting weight-ending weight. Percent body weight lost was calculated for each session as weight lost/starting body weight.

Intake form

A "completer" attended six out of 10 classes. This number was determined because it is the majority of classes, demonstrated by similar research to be the minimum effective dose, and is what the staff of WLM determined a completer for program purposes (Samuel-Hodge et al, 2009). Physical activity was measured by self-report in number of days per week and minutes per day at the intake. Physical activity questions included "Are you physically active?", "Number of days per week you are active," "Duration of activity," "Type of activity" (i.e. walking, aerobics, biking, weight training, etc). These questions are similar to the 2011 Behavioral Risk Factor Surveillance System (BRFSS) in asking frequency, duration, and type of activity. Participants were asked to provide a goal using open text response. These responses were categorized into themes: weight loss, maintain, feel better, doctor's suggestion, or any combination of these. Starting height was self-reported at the start and used throughout.

Food diaries

Food diaries were measured by quantity, one for each week of participation possible, not the content of the food diaries. Participants were asked to record all food and beverages each day for a week, categorizing them into food groups based on the Exchange system. The diabetic exchange system is a way to organize foods based on the amount of carbohydrate, fat, protein, and calories they contain. There are three main categories: carbohydrate group, meat/meat substitute group, and fat group. All choices in each category on the list is equal and can be exchanged for any other on the list (http://www.uaex.edu/publications/pdf/fshed-86.pdf . The registered dieticians then provided feedback each week to the participants. Food diaries were encouraged each week, but not mandatory for participation in the program. (See appendices).

Weekly weigh in

Weight was measured and recorded each week by trained Health and Wellness staff using calibrated digital scales. This weekly weigh in was also used to determine attendance on a weekly basis.

Health plan measures

Prescription data were collected from the University health plan database and included days' supply, quantity, and dose for the three conditions: hypertension, diabetes, and dyslipidemia starting twelve months prior to participation, six month post participation, and 12 months post participation. First, the secondary researcher pulled all prescription claim data for participants in these date ranges. From these, the primary investigator worked with the UK Pharmacist to determine which drugs were used for hypertension, cholesterol, or dyslipidemia. Then, the secondary researcher only provided the drugs for the three conditions for each person at each time frame. By having each

medication for each participant at each time frame, this allowed testing of whether or not participants ceased taking medications at different intervals.

Data Coding and Reorganization

The participant's sex was coded as male (0) or female (1). Sessions completed, number of classes per session, starting, and ending weight for each class were entered. The start and end dates of each session were also recorded. This allowed the data to be changed into subsets on a per session format. Self-report physical activity was coded as yes (1) or no (0); and further described in minimum days per week, maximum days per week, minimum minutes per day, and maximum minutes per day. Height was entered in inches. The prescription data were entered as specific prescriptions 12 months prior to start date in milligrams of dose and days' supply of dose and these same measures again at six months and 12 months from start date. Previous weight loss attempted could be no (0) or yes (1). The participant's goals were categorized as: weight loss (0), maintain (1), look better/feel better (2), doctor's suggestion/medical reason (3), combination of 0 and 1 (4), combination of 0 and 2 (5), combination of 1 and 2 (6), and combination of 3 and 0 (7). These were the combinations included because these were the combinations present.

Missing data (N = 3) were corrected where possible by checking ranges and correcting key stroke errors but when not possible, they were coded as missing (N = 1). For medications that had two drugs in one medication which had two dosages (one for each drug), the drug names and dosages were split into separate columns. For example: Hydrochlorothiazide-Triamterene with a dosage of 25-37.5 mg was split into Hydrochlorothiazide for 25 mg and Triamterene for 37.5 mg. This was in consultation with the UK Pharmacist to better understand each medication. For goals 0-7, they were changed to binary codes either 0 (not present) or 1 (present) for each goal. The same

coding was done for medication category. For each category of medication, they were given a 1 for yes and 0 for no. In order to move all the data into short form, the rows were given either 0 or 1 for presence of each health condition at each time frame. [In order to get each individual's data on one line, the data were manipulated into data sets.] Next, the records were concatenated to put all of each person's individual medications into sessions. This left the dataset in a "per session" format.

Additional columns were added as calculations: body mass index (weight in kilograms/height in meters^2), weight lost (starting weight minus ending weight), and percent body weight lost (weight lost/starting body weight). Age was also calculated using starting date minus birth year. These additional variables were also calculated per session and put into the "per session" format.

Hypotheses and Statistical Analysis

Data collected were both quantitative and qualitative. The qualitative data were categorized and into themes, then converted to quantitative. All data were then at the interval-ratio or categorical level. Descriptive statistics were calculated to determine the means and standard deviations for classes attended, food diaries submitted, weight lost in pounds, and age for sessions one through five. Mean weight lost was also calculated for classes one through 10 and then sessions one through five. SAS software package was used for data analysis and significance was determined at the .05 level. For clarity, the hypotheses are repeated below.

- Hypothesis 1: UK employees who complete one session of WLM will cease taking their blood pressure medications 6 months after WLM
- Hypothesis 2: UK employees who complete one session of WLM will cease taking their blood pressure medications 12 months after WLM.

- Hypothesis 3: UK employees who complete one session of WLM will cease taking their diabetes medications 6 months after WLM.
- Hypothesis 4: UK employees who complete one session of WLM will cease taking their diabetes medications 12 months after WLM.
- Hypothesis 5: UK employees who complete one session of WLM will cease taking their cholesterol medications 6 months after WLM.
- Hypothesis 6: UK employees who complete one session of WLM will cease taking their cholesterol medications 12 months after WLM.

For research hypotheses one through six, the dependent variable was the change in prescription data claims (specific to each condition). The independent variable was completion of WLM (yes or no). Both variables were treated as dichotomous: completed or not completed and on medications or off medications. A Chi Square test was completed for hypotheses one, two, and six. A Fisher's exact test was performed for hypotheses three, four and five.

Because there were no significant values using data from participants who completed one session, these same analyses were conducted again for those who completed two sessions of WLM. The analyses were not conducted after three or more sessions because the *n* became too small.

- Hypothesis 7: The higher the attendance rate (attendance of WLM classes), the more weight lost in UK employees at the end of the first WLM session.

For research hypothesis seven, the dependent variable was weight lost. The independent variable was the attendance rate at WLM (0-10); a continuous variable. A linear regression was conducted to compare those who registered for one session with percent lost weight. After learning there was a positive association between classes

attended and weight lost, linear regression was completed to determine if there was a certain number of classes at which there was no significance or a certain number at which the significance began.

Hypothesis 8: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase at the end of the first WLM session compared to starting weight when controlled for sex.

For research hypotheses eight, the dependent variable was body weight lost; a continuous variable. The independent variable was classes attended; also a continuous variable. A one way ANCOVA was conducted to compare percent weight loss of those who completed one session and those who did not complete one session, with sex as the co-variate.

- Hypothesis 9: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase with increased food diary compliance.

In research hypothesis nine, the dependent variable was the percent body weight lost, a continuous variable. The independent variable was food diary compliance. Linear regression was performed to test the effect of food diaries on weight loss. Food diaries were broken into three variables: compliance (6 or more), non-compliance (1-5), and non-reporting (no data). The effects of compliance versus non-compliance was compared to weight loss. Then the effects of reporting (either compliant or not) versus non-reporting was compared to weight loss.

- Hypothesis 10: A composite of variables: physical activity, sex, food diary compliance, and weight loss goal will significantly predict a change in percent body weight.

In research hypothesis 10, the dependent variable is the change in percent body weight. The independent variables were: presence of physical activity (yes or no), sex (male or female), food diaries (completers, non-completers, and non-reporting), and goal (1-7). Physical activity was included as a variable because it was part of the data set collected from the intake form. One week out of ten per session was spent on the topic of physical activity. A multiple regression analysis was completed to determine if the independent variables predicted weight loss.

- Hypothesis 11: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in blood pressure prescription claims.
- Hypothesis 12: A composite of variables including food diary compliance, physical activity, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in cholesterol prescription claims.
- Hypothesis 13: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in diabetes prescription claims.

In research hypotheses 11-13, the dependent variable was the presence of medications (specific to three conditions) at six months post and twelve months post, for each condition separately. The predictor variables included: sex (male or female), age, percent body weight lost, presence of physical activity (yes or no), food diary compliance (yes or no), goal (1-7), and attendance as a categorical variable (completers or non-completers). Logistic regression was performed for each drug category at six months post WLM and 12 months post WLM. The logistic regression was repeated treating attendance as a continuous variable for each hypothesis. The analysis was repeated again for those who

completed two sessions of WLM for hypertension only. The number of participants who completed two sessions and were on cholesterol or diabetes medication was too small to test.

Categorization

Most of the analyses were performed only for those who completed one session. This was for several reasons. In hypotheses one through six, comparisons were drawn at six months post and 12 months post WLM for each drug as compared to the start to see if participants were able to get off of any of their medications after one session. Though it seems logical that the longer a person stays in WLM, the more likely he/she is to come off his/her medications, this may not always be true. Consider the person who completes a 10 week session, waits six months, then completes a second 10 week session. This scenario may not bring about drug changes in the same way as a person who completed multiple 10 week sessions in a row. Secondly, those who complete more than one session may no longer have a goal of weight loss, but weight maintenance. In this scenario, the weight is not changing so the medications may not change either. Finally, the total n decreases significantly after each 10 week session (Table 3.2). For these reasons, which could not be controlled for, the data were analyzed in hypotheses one through six after the first session. The first six analyses were also conducted after completing two sessions of WLM, regardless if these sessions were back to back or spread over time.

Table 3.2

Number of participants who completed the corresponding number of sessions

	N
1 Session	591
2 Sessions	273
3 Sessions	155
4 Sessions	105
5 Sessions	76
6 Sessions	50
7 Sessions	36
8 Sessions	27
9 Sessions	17
10 Sessions	15
11 Sessions	12
12 Sessions	8
13 Sessions	8
14 Sessions	6
15 Sessions	5
16 Sessions	3
17 Sessions	3

This chapter describes the methods used to determine if participants stopped taking medications, if attendance was correlated with weight loss, if food diary compliance was correlated with weight loss, and if any of the variables were predictive of weight loss or medication cessation. Most analyses were conducted after one session of WLM and repeated after two sessions of WLM.

Chapter 4

Results

This chapter presents and briefly discusses the results of the study analyses. Included in this chapter are descriptive statistics; Chi Square, Fisher's Exact, logistic and multiple regression for the testing of 13 hypotheses, and discussion of the findings.

Descriptive Statistics

There were 591 people in the study (66 men and 525 women) who attended at least one session of WLM. On average, participants were 45 years old (SD 11.17), attended approximately five and one half classes (SD 2.88), and completed a little less than three-and one-half food diaries (SD 3.32) in ten weeks. Participants attended anywhere from one class to ten classes in a session. Completers were defined as those who attended six or more classes in a ten-week session (n = 309 for Session 1). The average weight loss was almost five pounds in ten weeks (SD 5.86). The majority (n = 573) of Body Mass Indexes (BMI) were between 25.77 and 40.17. Only 18 participants (3%) had a BMI of 24.17 or below, putting them into the "normal" category. The categories for BMI are: Underweight = <18.5, Normal weight = 18.5-24.9, Overweight = 25-29.9, and Obese = 30 or >. Table 4.1 displays the descriptive statistics for those who registered for one session through five sessions. Figure 4.1 shows BMI distribution for the whole sample of 591.

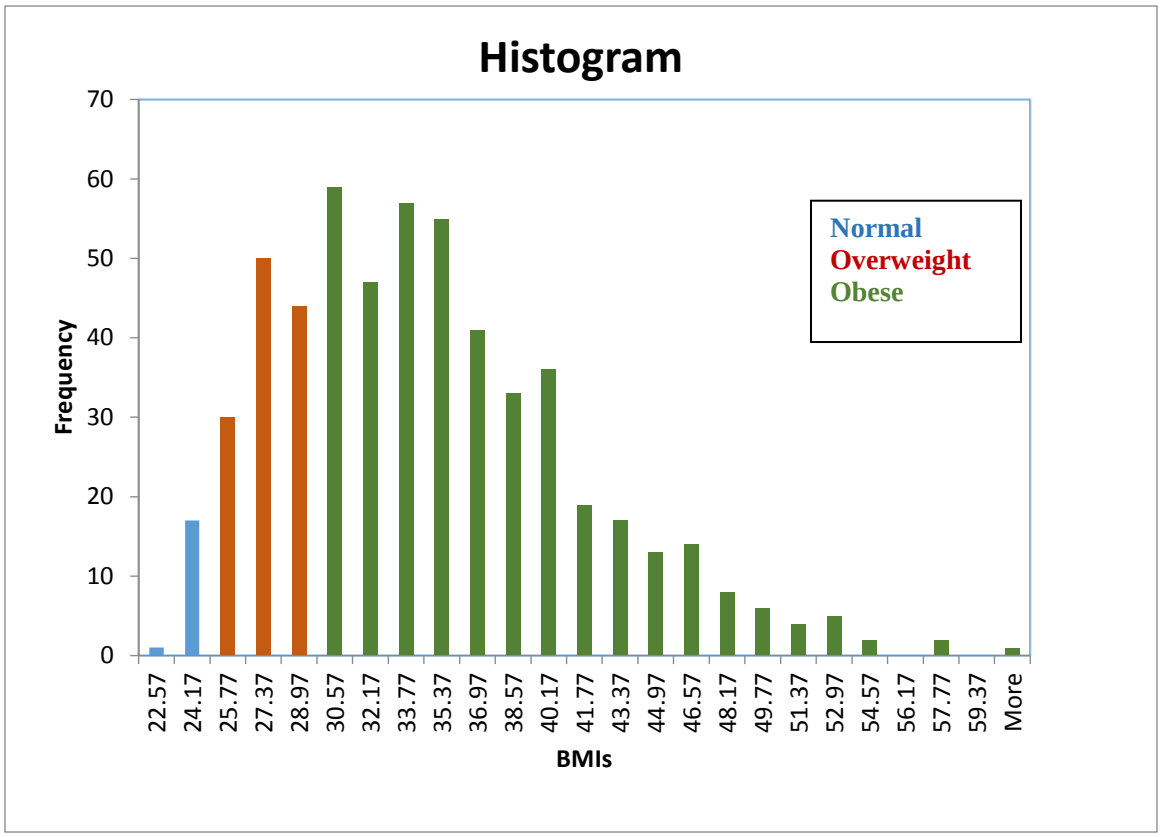
Table 4.1

Descriptive Statistics-Sessions 1 through 5

	Session 1 (N = 591)	Session 2 (N = 273)	Session 3 (N = 155)	Session 4 (N = 105)	Session 5 (N = 76)		
Variable	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Min	Max
Classes Attended	5.60 (2.88)	5.04 (2.73)	4.86 (2.54)	5.6 (2.92)	4.85 (2.62)	0	10
Food Diaries	3.43 (3.32)	2.27 (3.12)	2.21 (3.01)	2.9 (3.65)	2.23 (3.14)	0	10
Weight Loss	-4.84 (5.86)	-2.03 (3.88)	-0.95 (3.45)	-2.40 (4.9)	-0.83 (4.7)	6.8	-33.1
Age	45.28 (11.17)	46.55 (10.98)	47.46 (11.03)	47.51 (10.83)	47.29 (1.30)	22	79

Figure 4.1

BMI distribution



Out of the 591 participants, 57.6% were not on medication at all (average age = 41.7 years). With an average age of 52.6 years, 16.4% were on cholesterol medication. With an average age of 46 years, 2.3% were on diabetes medication. With an average age of 48.8 years, 23.6% were on hypertension medications. Only eight were on a combination of cholesterol and hypertension medications, one on a combination of cholesterol and diabetes medications, and two on hypertension and diabetes medications. Table 4.2 displays breakdown of the number of participants in each medication category in relation to BMI categories.

Table 4.2

BMI category and medication category totals

	Hypertension	Cholesterol	Diabetes
BMI $\leq$ 24	2	1	0
BMI 24-30	22	13	1
BMI >30	43	34	9

It is clear from this table that the higher the BMI, the more medications a participant was taking. More people were taking hypertension medications than both cholesterol and diabetes combined.

Prescription use at six and 12 months post WLM

To answer the first six research hypotheses, two analyses were completed for each: a Chi-Square as well as Fisher's Exact. A Chi Square was chosen because the two variables were categorical, i.e., either the participant completed WLM or they did not and the participant either came off the medications or stayed on the medications. The

equation for Chi Squared is $X^2 = \Sigma$ (observed value-expected value)^2/expected value. For *n* values below five, the Fisher's exact test was applied. The equation for Fisher's exact is (a+b)!*(c+d)!*(a+c)!*(b+d)!/n!*a!*b!*c!*d! where a = non-completers who got off the medications, b = non-completers who did not get off the medications, c = completers who got off the medications, and d = completers who did not get off the medications. N = the sample size for each time frame. Hypothesis 1: UK employees who complete one session of WLM will stop taking their blood pressure medications 6 months after WLM. Hypothesis 2: UK employees who complete one session of WLM will stop taking their blood pressure medications 12 months after WLM. These were two-by-two tables comparing presence of drug at six months and 12 months post-WLM for completers and non-completers for each drug category: hypertension, cholesterol, and diabetes. Table 4.3 shows the number of completers who stopped taking medications at different intervals with no substitutions. Tables 4.4, 4.5, and 4.6 are the two by two contingency tables for each medication.

Table 4.3

Completers (after completing one session) on medications

	Completers	Drug Free Post			
		Six Months		Twelve Months	
	N	N	%	N	%
Hypertension	81	17	20.9	23	23.4
Diabetes	10	3	30.0	3	30.0
Cholesterol	44	3	6.8	8	18.2

Note: Completion of program was defined as attendance at six or more classes.

This table shows, for example, that 81 participants completed one session of WLM and were on hypertension medicine before the program began. Though the results

were not statistically significant, at six months after completing the program, approximately 21% of participants stopped taking their hypertension medications and at 12 months after completing the program, approximately 23% stopped taking their hypertension medications. Similar results were calculated for diabetes and cholesterol though the overall number of completers in these groups were lower.

Table 4.4

Completers compared to non-completers after one session for hypertension medications 6 and 12 months post

Session 1-6 months	Got off meds	Stayed on meds	Total
Non completers	14	71	85
Completers	17	64	81
Total	31	135	166
Session 1-12 months	Got off meds	Stayed on meds	Total
Non completers	16	69	85
Completers	23	58	81
Total	39	127	166

This table shows that 17 participants stopped taking their hypertension medications six months after completing one session of WLM compared to 14 who did not complete the program. At 12 months after, 23 participants stopped taking hypertension medications after completing one session of WLM compared to 16 non-completers.

Table 4.5

Completers compared to non-completers after one session for diabetes medications 6 and 12 months post

Session 1-6 months	Got off meds	Stayed on meds	Total
Non completers	2	16	18
Completers	3	7	10
Total	5	23	28
Session 1-12 months	Got off meds	Stayed on meds	Total
Non completers	2	16	18
Completers	3	7	10
Total	5	23	28

Like the previous table, Table 4.5 shows three participants completed one session of WLM and stopped taking diabetes medication six months after, compared to two who did not complete one session. At 12 months, there were three participants who stopped taking diabetes medication after completing one session compared to two participants who did not complete the program. Table 4.6 shows similar results, only for cholesterol medication and those who completed and stopped taking medication compared to those who did not complete the program.

Table 4.6

Completers compared to non-completers after one session for cholesterol medications 6 and 12 months post

Session 1-6 months	Got off meds	Stayed on meds	Total
Non completers	7	40	47
Completers	3	41	44
Total	10	81	91
Session 1-12 months	Got off meds	Stayed on meds	Total
Non completers	10	37	47
Completers	8	36	44
Total	18	73	91

There was no statistical significance between UK employees who completed one session of WLM and ceased their blood pressure, diabetes, or cholesterol medications six months or 12 months after WLM. This led to further investigation to see if two sessions of WLM would be impactful.

Because there were no statistically significant associations between UK employees who completed one session of WLM and cease taking their medications for hypertension, cholesterol, or diabetes, the analyses were repeated to test whether there was a significant association between UK employees who completed more sessions of WLM and cease taking their medications. Therefore, Chi Square and Fisher's Exact tests were performed again after two sessions of WLM were completed. These results were significant for hypertension drugs six months post-WLM and 12 months post-WLM for completers. The number of observations past two completed sessions was too small to conduct data analysis (see Table 4.7).

There was a statistically significant association between UK employees who completed two sessions of WLM and ceased taking their blood pressure medications six months after WLM $\chi^{2.}$ (1) = 5.5547, $p < 0.0184$ compared to those who did not complete two sessions. There was a statistically significant association between UK employees who completed two sessions of WLM and cease taking their blood pressure medications twelve months after WLM $\chi^{2.}$ (1) = 11.0929, $p < 0.0009$ compared to those who did not complete two sessions. For those who completed two sessions, 32% came off their hypertension medications six months after WLM. For those who completed two sessions, 50% came off their hypertension medications 12 months after WLM. Statistically, participants were more likely to cease taking their medications after completing two sessions of WLM than non-completers.

Table 4.7

Completers (after completing two session) on medications

	Completers	Drug Free Post			
		Six Months		Twelve Months	
	N	N	%	N	%
Hypertension	28	9	32.1*	14	50.0**
Diabetes	4	0	0.0	1	25.0
Cholesterol	14	1	7.1	3	21.4

Note: Completion of program was defined as attendance at six or more classes.

*p = <0.05, **p = <0.001

Table 4.7 shows the number of completers who were on medications and stopped taking medication at six and 12 months after completing two sessions of WLM. For example, there were 28 participants who completed two session of WLM and were on hypertension medications prior to starting. After completing two sessions, 32% stopped taking medication and after 12 months, 50% stopped taking hypertension medications. Similar results are shown for diabetes and cholesterol medications for those who completed two sessions.

Table 4.8

Completers compared to non-completers after two sessions for hypertension medications 6 and 12 months post

Session 2-6 months	Got off meds	Stayed on meds	Total
Non completers	5	43	48
Completers	9	19	28
Total	14	62	76
Session 2-12 months	Got off meds	Stayed on meds	Total
Non completers	7	41	48
Completers	14	14	28
Total	21	55	76

Table 4.8 displays the two by two contingency tables for completers compared to non-completers who stopped taking hypertension medications at six and 12 months post WLM. For example, nine completers stopped taking medications six months after two sessions of WLM compared to five non-completers. These results were statistically significant.

Table 4.9

Completers compared to non-completers after two sessions for diabetes medications 6 and 12 months post

Session 2-6 months	Got off meds	Stayed on meds	Total
Non completers	4	5	9
Completers	0	4	4
Total	4	9	13
Session 2-12 months	Got off meds	Stayed on meds	Total
Non completers	3	6	9
Completers	1	3	4
Total	4	9	13

Table 4.9 displays the results of the two by two contingency tables for completers compared to non-completers at six and 12 months after completing two sessions of WLM who stopped taking diabetes medication. Table 4.10 displays similar results, only for cholesterol medication

Table 4.10

Completers compared to non-completers after two sessions for cholesterol medications 6 and 12 months post

Session 2-6 months	Got off meds	Stayed on meds	Total
Non completers	3	23	26
Completers	3	11	14
Total	6	34	40
Session 2-12 months	Got off meds	Stayed on meds	Total
Non completers	4	22	26
Completers	1	13	14

Table 4.10 (continued)

Total	5	35	40

There was not a statistically significant association between UK employees who completed two sessions of WLM and cease taking their diabetes (n = 4) or cholesterol (n = 14) medications six months or 12 months after WLM compared to those who did not complete two sessions. Twelve months after two sessions, 25% of completers ceased taking diabetes medications and 21.42% ceased taking cholesterol medications.

For those who completed one session of WLM, a sub-sample of low BMI (below 30) and high BMI (30 and above) was tested via Chi Square analysis. Because there were only 18 participants in the normal category, a different stop point had to be determined. Therefore, below 30 BMI were compared to above 30. There was no significant difference between groups for those who ceased taking hypertension (n = 81), cholesterol (n = 44), or diabetes (n = 14) medications 12 months after one session of WLM (see Table 4.11). On average, the low BMI group lost 2.18% body weight and the high BMI group lost 3.52% body weight in one session of WLM. This might be due to the low BMI group having such a small n. There were even fewer participants on medications after two sessions, which made analysis unwarranted.

Table 4.11

12 months after completing one session by BMI group

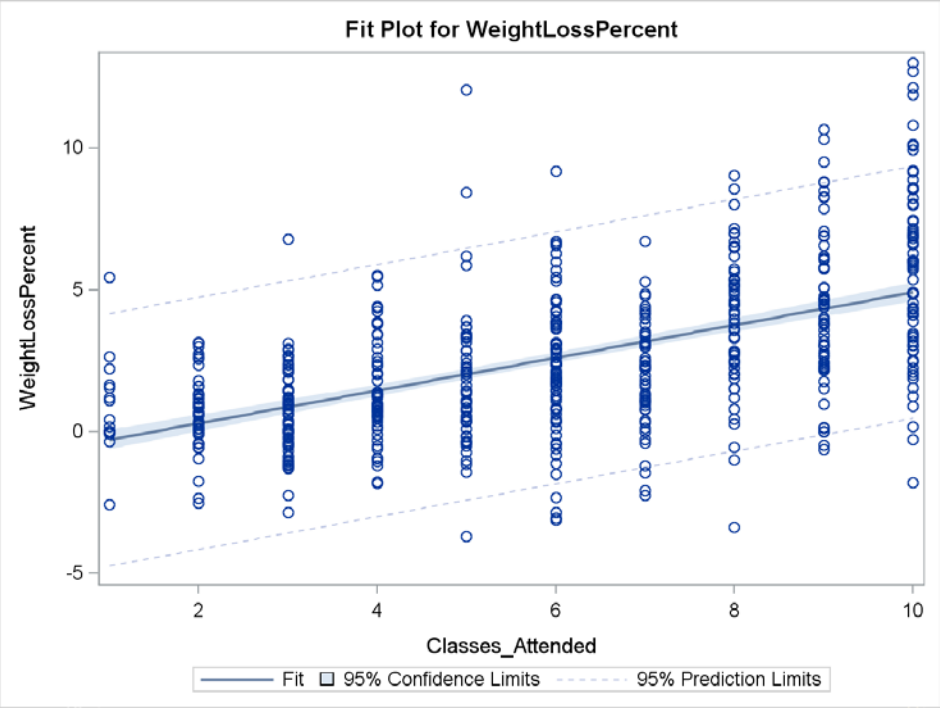
	Hypertension		Cholesterol		Diabetes	
	On	Off	On	Off	On	Off
Low BMI	18	7	8	2	1	0
High BMI	40	16	28	6	9	4

Attendance and percent body weight lost

Hypothesis 7: The higher the attendance rate (attendance of WLM classes), the more weight lost in UK employees at the end of one WLM session. For the seventh hypothesis, a linear regression analysis was chosen to test if the predictor variable (classes attended) accurately predicted the dependent variable (percent weight loss). Using classes attended as a continuous variable, the results showed the variable of classes attended was significant, $F(1,587) = 318.60$, $p = < 0.0001$ for percent weight lost. The more classes attended, the more weight lost in one session. This can be seen in the fit plot in Figure 4.2 and the equation: Y = a + bX where Y is percent weight lost, a is intercept, b is the slope of the line and X is classes attended.

Figure 4.2

Fit Plot of classes attended and percent weight loss



There were 589 participants who enrolled in one session of WLM with records for classes attended. The fit plot shows classes attended (β = 0.577) is positively associated with percent weight lost $R^2 = 0.35$, Pr > [t] of < 0.0001. As the number of classes attended increased, the probability of weight loss increased.

The weight loss percent mean is 2.38; meaning people lost an average of approximately 2.4% (SE = 0.032) body weight in one 10-week session. For a 200-pound person, this would equal 4.8 pounds per 10-week session.

Linear regression was repeated investigating each level of classes attended (i.e., 2-10). Linear regression modeling indicates that attending four classes or more had a statistically significant association with percent weight lost compared to those who only attended one class $F(9,589) = 39.92$, $p < 0.001$. The mean percent weight lost per classes attended within a 10-week session are shown in Table 4.12. For a 200-pound person, at four weeks, they would have lost 1.4 pounds on average. This is not as meaningful, though it is statistically significant. For a 200-pound person, at six weeks, they would have lost 3 pounds on average. See table 4.12 for mean percent weight lost per number of classes attended and Table 4.13 for estimates.

Table 4.12

Percent weight loss per class attended for one session (N=589)

Classes attended	Mean (SD)
1	0.12 (1.05)
2	0.3 (1.52)
3	0.35 (1.63)
4	0.67 (1.84)
5	1.0 (2.27)

Table 4.12 (continued)

6	1.48 (2.38)
7	1.48 (2.0)
8	2.36 (2.55)
9	2.79 (3.11)
10	4.69 (3.34)

Table 4.13

Multiple regression modeling the association of percent body weight lost with number of classes attended as predictor variables (n=589)

Predictor Variable	Estimate (SE)
Intercept	20.88 (2.57)
2 classes attended	-0.46 (0.44)
3 classes attended	-0.39 (0.40)
4 classes attended	-1.24 (0.43)*
5 classes attended	-1.53 (0.43)**
6 classes attended	-2.06 (0.40)**
7 classes attended	-1.80 (0.43)**
8 classes attended	-3.67 (0.43)**
9 classes attended	-4.08 (0.42)**
10 classes attended	-5.42 (0.40)**

Note: * p = 0.0004, ** p = <0.001

Attendance and percent body weight lost-Sex

Hypothesis 8: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase at the end of the first WLM session compared to starting weight when controlled for sex. To test the eighth

hypothesis, an analysis of co-variance was used on 586 records of those who enrolled in one session of WLM who had sex recorded. An ANCOVA was chosen because the predictor variable (attendance) was categorical. The dependent variable was percent weight lost. Sex was the co-variant. The main effect of sex yielded an *F* ratio of $F(2,583) = 1.05$, $p = 0.31$, indicating that sex was not significant. The equation used was: $Y = b_0 + b_1X_1 + b_2X_2$ where Y is percent weight lost, X_1 is female, X_2 is classes attended and b is the change in Y relative to the change in X. Table 4.14 displays the results of this analysis.

Table 4.14

Analysis of Co-variance for sex on weight loss

	Estimate (SE)	Pr > [t]
Intercept	-0.592 (0.339)	0.082
Female	-0.303 (0.295)	0.305
Male	0.000	

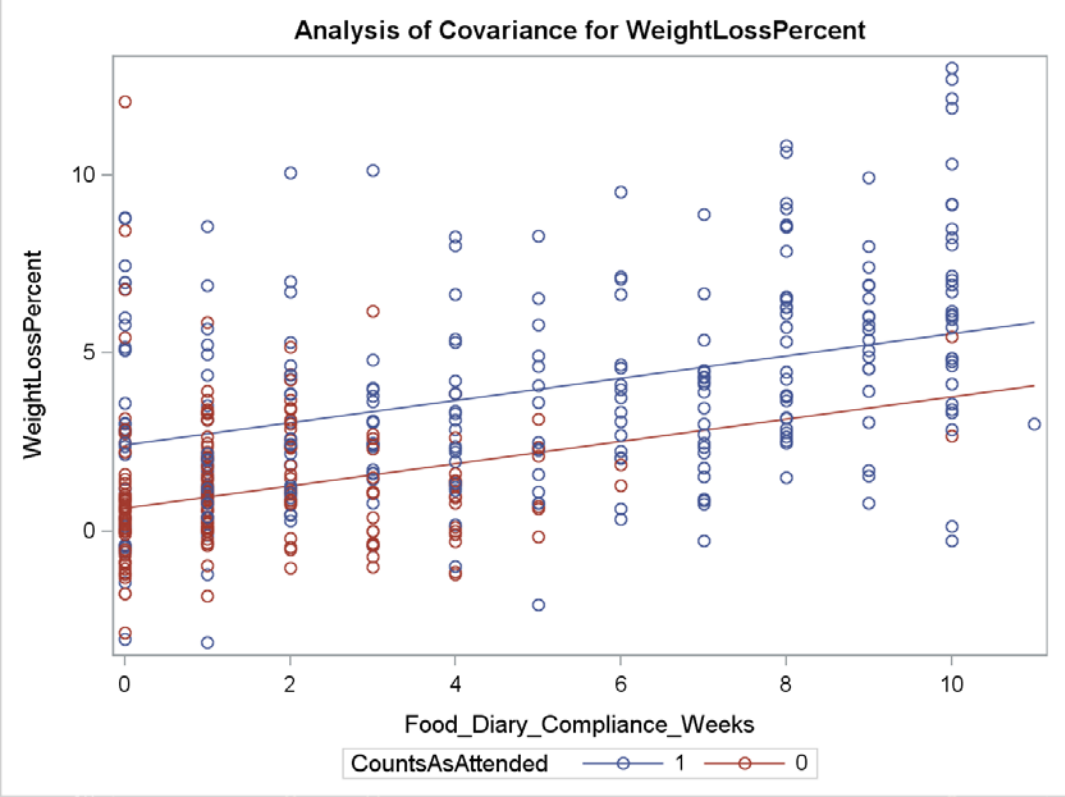
Food diaries and percent body weight lost

Hypothesis 9: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase with increased food diary compliance. An analysis of covariance for the ninth hypothesis used 454 records as this was the number who enrolled in one session and had data for food diaries. An ANCOVA was chosen to determine if a statistically significant difference between food diary compliance and the dependent variable (percent weight loss) were present for those who completed one session compared to those who did not complete one session. The covariate is attendance; whether participants completed six or more classes (compliant)

or less than six classes (non-compliant). The model showed the effect of food diaries completed was significant $F(2,451) = 116.85$, $p = <0.0001$ for those who attended six or more classes. The more food diaries completed the more percent body weight lost. This can be seen in the fit plot in Figure 4.3 and the equation: $Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3$ where Y is percent weight lost, b_0 is the slope of the line and X_1 is food diary compliance, X_2 is attended, and X_3 is not attended.

Figure 4.3

Fit plot of food diary compliance and percent weight loss for compliers and non-compliers



To test the hypothesis another way, two linear regressions were conducted. The food diary compliance variable was divided into three variables: compliance (6 or more food diaries), non-compliance (0-5 food diaries), and non-reporting (missing data). The

non-reporting variable could be between 0 and 10 food diaries, just not reported. The first linear regression included food diary compliant (six or more diaries completed) compared to non-compliant (N = 586). The second linear regression included non-reporting participants compared to reporting (N = 586). The first model indicates compliance was statistically significantly associated with weight loss $F(2,585) = 179.43$, $p = <0.001$ compared to non-compliance. The second model shows reporting was statistically significantly associated with weight loss $F(2, 585) = 184.02$, $p = <0.001$ compared to non-reporting. Together these results mean reporting any food diaries is better than not-reporting and reporting six or more food diaries was associated with better weight loss than reporting five or less. Table 4.15 displays both model's estimates and *p* values.

Table 4.15

Two regressions modeling food diaries and weight loss

Model 1	Estimate (SE)	Pr > [t]
Compliant compared to non-compliant	0.82 (0.37)	0.026
Model 2		
Reporting compared to non-reporting	0.49 (0.20)	0.013

Percent body weight lost and sex, PA, food diaries, and goal

Hypothesis 10: A composite of variables: physical activity, sex, food diary compliance, and weight loss goal will significantly predict a change in percent body weight. A multiple regression was performed utilizing weight loss percent as the dependent variable and sex, physical activity (dichotomous), food diary compliance

(continuous), and goal (categorical) as the predictor variables in 152 observations using the equation: $Y = b_0 + b_1X_1 + b_2X_2 + b_3X_{3..}$. where Y is the dependent variable (weight loss percent), b is the slope, and $X_{2,}$ X_3… represents each predictor variable. Table 4.16 displays the number of participants in each goal category. The analysis found that physical activity ($p = 0.01$) and food diary compliance ($p < 0.0001$) were significant predictors, but not sex or goal $R^2 = .27$, $F(4,147) = 13.41$, $p < 0.0001$.

Table 4.16

Number participants in each goal category

Goal 0-Weight Loss	351
Goal 1- Maintain	1
Goal 2-Feel better/look better	21
Goal 3- Doctor's suggestion/medical reason	1
Goal 4- 0+1	1
Goal 5- 0+2	40
Goal 6- 1+2	0
Goal 7 - 0+3	1

Multiple regression was repeated for one session enrollees another way. The second linear regression compared those who attended (six or more classes) and dummy variable, who were food diary compliant (six or more diaries) and dummy variable, food diary reporting and dummy variable, physical activity reported and dummy variable, and each of seven goals with corresponding dummy variables. The model was significant F (10, 350) = <.001 and when physical activity was not reported, these cases were not included. Attending six or more classes and having a goal of "doctor's

suggestion/medical condition" were both significant for percent weight lost in the second model. Physical activity was not significant in this model, though it was in the first model (p = 0.10). Table 4.17 shows which variables significantly predicted weight loss percent for this second model.

Table 4.17

Multiple regression modeling the association of percent body weight lost with potential predictor variables (N=350)

Predictor Variable	Model 2 Estimate (SE)
Intercept	4.55 (7.93)
Physical activity reported	-0.34 (0.20)
Attended six or more	0.88 (0.24)**
Food Diary compliant	0.43 (0.56)
Food diary Reporting	0.30 (0.21)
Goal 0 "Weight loss"	-1.79 (1.81)
Goal 1 "maintain"	N/A
Goal 2 "Feel better/look better"	-1.37 (1.86)
Goal 3 "Doctors suggestion/medical reason"	9.80 (2.55) ***
Goal 4 = 0+1	-3.54 (2.56)
Goal 5 = 0+2	-1.69 (1.83)
Goal 6 = 1+2	-2.26 (2.55)
Goal 7 = 0+3	0

Note: * = $p < .05$, ** = $p < .001$, *** = $p \leq .0001$

Table 4.17 indicates the estimate (SE) for each predictor variable on weight loss. The goal of "doctor's suggestion/medical reason" was statistically significant though there was only one participant in this model with this goal.

Hypertension

Hypothesis 11: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in blood pressure prescription claims.

The first logistic regression analysis of 88 observations was conducted with the dependent variable being presence of hypertension medications *six* month post-WLM (dichotomous). Sex, physical activity, classes attended (continuous), food diary compliance (continuous), goal, age, and percent body weight lost were predictor variables. The number of participants used in this analysis was 88 because this was the number of participants who reported hypertension medication use data at twelve months prior to WLM. Logistic regression was chosen because the dependent variable (presence of medication six months post-WLM) was dichotomous and this analysis was chosen to determine the relationship of the six variables to the dependent variable. The model was not significant, indicating the variables did not have a statistically significant relationship $Pr > \chi^2 = 0.083$. The equation for the model is $p = \exp(b_0=b_1X_1+b_2X_2\ldots)/1+ \exp(b_0=b_1X_1+b_2X_2\ldots)$ where the p is the expected probability that the outcome is present, the X represents the predictor variables, and the b represents the coefficients.

The model was repeated with the dependent variable being presence of hypertension medications *12* month post-WLM and sex, presence of physical activity, classes attended (continuous), food diary compliance (continuous), goal, age, and percent

body weight lost as predictor variables. The model was not significant, indicating the variables did not have a statistically significant relationship Pr > χ^2 = 0.23.

A second regression analyses of 88 observations was conducted using sex, physical activity reported or not, *goal one through seven and corresponding dummy variables* for each as predictor variables and getting off hypertension medications *six* months after one session of WLM. This model was repeated using sex, physical activity reported or not, *goal one through seven and corresponding dummy variables* for each as predictor variables and getting off hypertension medications *12* months after one session of WLM. Classes attended was a continuous variable for both models. Neither model was statistically significant as shown in table 4.18.

Table 4.18

Logistic regression modeling each predictor variables effect on stopping hypertension medication six and 12 months post WLM

	6 Months Post	**12 Months Post**
Predictor variable	**Estimate(SE)**	**Estimate(SE)**
Intercept	7.09 (405.3)	1.11(1.75)
Sex-male	0.25 (0.43)	0.64 (0.42)
PA Start	0.47 (0.37)	-0.13 (0.28)
Classes _attended	-0.18 (0.19)	0.07 (0.16)
Food diary compliance	-0.15 (0.15)	-0.02 (0.11)
Goal 0	5.07 (63.24)	-0.43 (0.92)
Goal 1	0	0
Goal 2	0.26 (147.2)	-12.17 (379.6)
Goal 3	10.75 (382.9)	14.22 (690.6)

Table 4.18 (continued)

Goal 4	0	0
Goal 5 0	0	0
Goal 6	0	0
Goal 7	0	0
Age	0.06 (0.03)	-0.05 (0.03)
Weight Loss Percent	0.29 (0.17)	-0.01 (0.13)

A final regression was conducted with the same variables as the previous analyses for those who completed two sessions (n = 45) of WLM. The two sessions model had the best fit (AIC = 37.34, SC = 39.15), though none of the variables were statistically significant for ceasing medication likely due to the low n.

Cholesterol

Hypothesis 12: A composite of variables including food diary compliance, physical activity, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in cholesterol prescription claims. A logistic regression was completed using 48 records with the dependent variable being presence of cholesterol medications *six* months post-WLM and sex, presence of physical activity, classes attended (continuous), food diary compliance (continuous), goal, age, and percent body weight lost as predictor variables. Forty-eight records were used as this was the number of participants who were on cholesterol medications and had data recorded at twelve months prior to WLM. The model was used again at *12* months post-WLM. The models were not statistically significant Pr> χ^2 = 0.44 and Pr> χ^2 = 0.64, respectively.

This is likely due to the low n. This model was considered again after two session of WLM, however the n was too low to complete the analysis.

Diabetes

Hypothesis 13: A composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in diabetes prescription claims. A logistic regression analysis of 12 observations was conducted with the dependent variable being presence of diabetes medications *six* month post-WLM and sex, presence of physical activity, classes attended (continuous), food diary compliance (continuous), goal, age, and percent body weight lost as predictor variables. Twelve observations were used as this was the number of participants who were on diabetes medication and had values recorded twelve months prior to WLM. The same model was used for a second analysis after *12* months. Neither model was statistically significant, likely due to the low N $Pr > \chi^2 = 0.15$ and $Pr > \chi^2 = 0.44$. This model was also considered again after two sessions, but not able to be completed due to the low n.

Discussion

There was a large difference between the number of men (66) and women (525) included in the data set. Research has indicated women are greater users of healthcare systems (Kramer, H.U., et al. 2012; Shalve, V., Chodick, G., and Kokia, E., 2005; Roy, K. and Chaudhuri, A. 2008). This may account for the disproportionate number of males verses females. Out of the total sample of 591 only 42.4% of participants were on any of the three categories of medication at all. Only 10 participants had co-morbidities or were on more than one category of medication. The average age of those on medications was 50.2 years and those not on medications was 41.7 years. This is in line with national

trends. According to Gallup, 52% of Americans report taking prescription medication while 48% report taking no prescription medications (http://www.gallup.com/poll/20365/Half-Americans-Currently-Taking-Prescription-Medication.aspx). For those 30-49, 40% report taking prescription medications while for those 50-64, that number increases to 61%. In the 65 and over group, it rises to 88% on medications.

For each of the 13 research questions, each question was asked after one session of WLM and after finding no statistical significance the hypotheses were tested again after two sessions of WLM. For some analyses, two sessions of WLM were found to be adequate to find significant changes.

The first two research questions were similar, the only difference being whether the analysis was conducted at six months or 12 months post-WLM. Hypothesis 1: UK employees will cease taking blood pressure medications six months after completing one session of WLM. There was no statistical significance six months after one session, therefore the researcher asked the same question after two sessions and found a statistically significant correlation between those UK employees who completed two sessions of WLM and ceased taking their blood pressure medications six months post-WLM and 12 months post-WLM. Though there was no statistically significant association after one session, 21% of participants ceased taking their medications after six months and 28% ceased taking them after 12 months. A study by Miller et al (2002) demonstrated a large reduction of blood pressure lifestyle modifications, results similar to medication therapy, for reducing blood pressure. Though their study was short (only 9 weeks), the significantly lower blood pressure was extrapolated to assume stopping medications if continued long term. The results of the current study demonstrated

subjects stopping blood pressure medications with weight loss after two sessions. Hughes, Girolami, Cheadle, Harris, and Patrick (2007) found after 26 or 52 weeks in a worksite wellness weight loss intervention, prescription claims decreased 44% in a subgroup of 61, similar to the current study. Though the current study measured data for five years, the number of participants who stayed in WLM for two sessions was 155 and of those only 76 were taking blood pressure medications. While the other studies lacked longitudinal data, the current study demonstrated participants ceased taking their blood pressure medications six and 12 months after 20 weeks of a weight loss program. These 20 weeks may or may not have been continuous as previously described. One session was 10 weeks and a participant may have waited any amount of time before starting again or their enrollment may have been continuous without gaps. Regarding the Transtheoretical Model, the participants who only stayed in one session (10 weeks), might have been relapsing from action or they may have achieved their goal and moved on to termination or maintenance. On the other hand, it is possible that those who stayed in for two sessions or more might have relapsed and come back to action or stayed in action throughout the whole 20 weeks.

In the same way, the third and fourth research questions were similar to one another, conducting analysis at six months and 12 months post-WLM. Hypothesis: UK employees will cease taking diabetes medications six months after completing one session of WLM. Again, there was no statistical significance six months or 12 months after WLM and the researcher tested again after two sessions of WLM. There was still no statistically significant association. In a systematic review by Aucott (2008) and another by Fujioka (2010), they highlighted several studies that showed a reduction in blood glucose levels is highly associated with weight loss. None of these studies showed

a complete removal of medications and suggested longer termed studies to see if there were any effects on medication use. This current research has five years' worth of data, but the actual number of participants who stayed in WLM for more than two sessions (20 weeks) was 155 and of those, only 13 were on diabetes medication. In addition, the current study only measured whether participants ceased taking their diabetes medicine, not a reduction in medicine as previous studies had measured.

Research questions five and six were also similar. Hypothesis 5: UK employees will cease taking cholesterol medications six months after completing one session of WLM. Neither at six months or 12 months after one session of WLM, was there any statistically significant association, therefore, the researcher tested the hypothesis again six and 12 months after two sessions of WLM and still found no significance. After six months, seven percent who completed two sessions ceased taking medication. After 12 months, 21% who completed two sessions ceased taking medication. The literature supports HDL cholesterol improvement after maintaining weight loss for two years (Matsuo, 2010). The current data set had only 40 participants using cholesterol medications and staying in the program for two sessions (20 weeks).

Finkelstein, Linnan, Tate, and Leese (2009) looked at cost savings from all medical claims (prescription and otherwise) in a sample of employees from 17 colleges across North Carolina, but did not find significant effects for all claims. They did not find significant cost savings for those who lost weight, except for pharmacy claims. This current study partially supports those findings as hypertension medications were stopped after two sessions. Though these numbers are small, these costs can add up over time.

Regarding diabetes and dyslipidemia, genetics might have influenced the results. The average age of the participants was 45 years. There is potential that medications for

these two conditions are not prescribed until later in life. In this sample, the average age of those on medications was 50.2 years while the average age of those not on medication was 41.7 which could be why there were no significant findings for diabetes or cholesterol medication cessation. There were relatively few people on medications (42.4% on medication). From a larger perspective, health promotion is often about keeping the well well and working to move the higher risk participants along the scale toward well. This is a demonstration of that idea.

The seventh analysis tested the hypothesis: The higher the attendance rate (attendance of WLM classes), the more weight lost in UK employees at the end of the first WLM session. The results showed the more classes attended, the more weight lost with the weight loss percent mean of 2.4%. For example, for a 200-pound person, this would equal 4.8 pounds lost in one session. From the descriptive statistics, the average attendance for one session was 5.6 classes meaning participants, on average, lost about a pound per week per class attended. Further investigation revealed attending four classes was significantly associated with percent weight lost. This could have been due to the participants' readiness to change per the Transtheoretical model (TTM). After registering and paying the fee, the participants were likely in the preparation stage, which is 'ready to take action in the next 30 days', moving into action 'overtly making changes in behavior'. However, because stage of readiness was not measured, this assumption may not be valid.

Johnson and colleagues (2008) and Logue et al. (2004) also found that staying in the action stage or maintenance stage of the TTM had significant effects on long term weight loss. Two sessions of WLM is 20 weeks, which could be action or maintenance, but also might mean there is a relapse. Like the previously mentioned studies, this study

also found that the longer a person attended, the more weight lost. Staying in WLM for two or more sessions had significant effects on long term weight loss.

The eighth question was the same as number seven only controlling for sex. There were no sex differences when comparing classes attended to percent body weight lost. From the sample of 591, 11% were male, 89% female.

Hypothesis nine: Percent of body weight lost (weight lost/starting body weight) for UK employees who completed one session of WLM will increase with increased food diary compliance. There was a significant direct relationship in food diary compliance and weight loss. Food diary compliance together with attendance completion have the best case scenario for predicting percent weight loss. Food diary compliance is a form of self-monitoring. In a systematic review of 22 studies regarding self-monitoring by Burke, Wang, and Sevick (2011), 15 studies reported significant associations between self-monitoring and weight loss. The current research supports this same finding.

The tenth research analysis utilized all the variables into a regression model and was computed two ways. The hypothesis was: A composite of variables: physical activity level, sex, food diary compliance, attendance, and weight loss goal will significantly predict a change in percent body weight. Though the instrument to collect physical activity information was not robust, the variable was included as part of the intake and therefore included in the model, though it may affect the results. The results reinforced the finding that attendance and food diaries have a statistically significant relationship on weight loss. One goal had a statistically significant relationship to weight loss; having a goal of doctor's suggestion/medical reason increased the likelihood of losing weight. Dixon and his colleagues (2009) conducted a study to uncover motivation to lose weight with bariatric surgery. Their categories for motivation coincided with this research's

variable of goal. They found 69% choose "to improve a medical condition" or "to improve health". This is similar to this study's option of "doctor's suggestion/medical reason".

Hypotheses 11-13 were similar in that each tested for a change (off or on) in prescription claims for each condition (hypertension, diabetes, and cholesterol) at six months and 12-months post with all possible predictor variables using logistic regression modeling. None of the results were statistically significant. However, since results from hypotheses one and two showed two sessions were required for participants to cease taking medications for hypertension, these hypotheses were tested again after two sessions of WLM.

The 11th hypothesis was a composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in blood pressure prescription claims six months (and 12 months) post one session of WLM. There were no significant results after one session. With two sessions, the N = 45, thus making analysis unsubstantiated as there were 14 variables in the model.

The 12th hypothesis was a composite of variables including food diary compliance, physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in cholesterol prescription claims six months (and 12 months) post one session of WLM. There were no significant results after one session. After two sessions, the N = 44 which was too small to analyze.

The 13th question was will food diary compliance, physical activity level, sex, age, weight loss goal, and weight change predict a change in diabetes prescription claims? The hypothesis was a composite of variables including food diary compliance,

physical activity level, sex, age, weight loss goal, and percent body weight lost will significantly predict a change in diabetes prescription claims six months (and 12 months) post one session of WLM. There were no significant results after one session. After two sessions, there were only 11 observations, which was too few on which to conduct analysis.

The key idea of the socio-economic model that framed this study is that the three levels (microsystem, mesosystem, and exosystem) all interact with each other. The variables at the microsystem level that were statistically significant were weight loss, hypertension medication cessation, and food diary reporting. The significant amount of percent body weight lost by participants found by this research could also be an effect of the mesosystem level. At the mesosystem level, the weekly WLM group dynamics might have affected the percent weight lost, food diary compliance, and attendance, though this variable was not measured. Also, if participants signed up with a co-worker or friend, this would be at the mesosystem level. Group dynamics or a "buddy system" was not a measured variable, but could affect the results. Future programming could include incentivizing signing up with an accountability partner or buddy. The reduction in hypertension medications after two sessions of WLM affects the exosystem level in that stopping medications means fewer pharmaceutical claims to the health plan. Because UK has a self-funded health plan, cost savings to the health plan would get passed on to the individual employee, affecting the microsystem again. The fact that higher attendance and food diary reporting can affect weight loss demonstrates the interaction between all three levels in that better attendance (microsystem) might be a result of who is in the group or the supportive environment of the group (mesosystem). Increased attendance (microsystem) could lead to increased weight loss for several or all of the

group (mesosystem) and medication cessation which would affect the health plan costs (exosystem).

Limitations

One limitation of this study was the lack of measurements, both biometric and behavioral. The biometric measurement of blood pressure, blood glucose/AIC, or blood cholesterol levels would provide a more precise determination of changes occurring in the participant rather than relying on measuring medication cessation only. Behaviorally, the lack of records for food diaries and physical activity reports were two measures that were collected, but limited the study. Food diaries were not mandatory. Physical activity was only self-reported at enrollment of each session and not throughout.

Another limitation was the advanced knowledge of pharmaceuticals needed to determine if participants were reducing their medications instead of stopping their medications. Reduction in medication could be via dosage, method of delivery, how often it is taken, or the type of medication. The scope of this study was to determine if participants ceased taking medications.

Finally, having low numbers of participants who were on medications for diabetes and cholesterol limited the analysis. This is especially true regarding longitudinal analysis or testing more than one 10-week session. Fewer and fewer participants enrolled in subsequent sessions, lowering the total number available to test.

Chapter 5

Summary, Conclusions, and Implications

This chapter will summarize the study, present conclusions, and discuss implications for research and practice. Though culture is unique to each company or organization, there are some ideas that apply to more general worksite wellness programs.

Summary

The purpose of this study was to determine the effectiveness of the worksite wellness weight loss program called Weight Loss Matters (WLM) for employees at the University of Kentucky. The three main objectives were to measure the effect of Weight Loss Matters on employees from June 2006 to December 2011 in the areas of (1) prescription claims for hypertension, diabetes, and dyslipidemia, (2) weight loss, and (3) food diary compliance.

Records were collected from paper files of WLM and from the UK Health Plan claims database. These were merged into a single database for a final sample of 591 participants. Descriptive statistics were computed for those who completed one, two, three, four, and five sessions. Most participants (all but 18) had a BMI in the overweight or obese categories with most (n = 452) between 25.78 and 40.17. Chi Square, ANCOVA and multiple and logistic regression were used to test the 13 hypotheses. The results showed the more classes attended in a session, the greater the percent body weight lost, regardless of sex. Also, results indicated that the more food diaries completed in a session, the greater the percent body weight lost. Additional analysis indicated that after two sessions of WLM, a significant number of participants were likely to cease taking

their blood pressure medication, but no change was found for diabetes or cholesterol medication users.

Conclusions

1. There were no statistically significant results for cessation of any medications after one session of WLM in the whole sample.
2. After completing two sessions of WLM, there were statistically significant changes in hypertension medication cessation at six and 12 months post-WLM.
3. The participants demonstrated a statistically significant weight loss after one session (10 weeks). Those who continued attendance (multiple sessions), continued to have weight losses. For one session, attending four classes was statistically significantly associated with weight loss.
4. There was a statistically significant positive association between food diary compliance and weight loss. Both class attendance and completion of food diaries were the strongest predictors of weight loss.
5. Having a goal of "doctor's suggestion/medical reason" statistically significantly predicted weight loss for those who enrolled in one session, though only one person listed this as a goal.

Overall, the Weight Loss Matters program at the University of Kentucky has achieved moderate gains for participants. Gains were seen in weight loss and stopping hypertension medications after two sessions. Direct measurements of blood pressure, blood glucose/A1C, and blood lipids might yield more positive results from the program. In addition, modifications in the program (see implications section) could also yield more effects.

Implications

These results show value of the program on an individual level and a University-wide level. Weight loss and medication cessation are important to people. As a result of participation in a wellness program, people might feel better, look better, have better health, have decreased medication costs, or decreased healthcare costs in general. This is also of value on a greater scale. Happier and healthier employees have better morale, less absenteeism, and less presenteeism. Fewer medication claims against the health plan could cause the total cost of the health plan to the University to decrease. Since Weight Loss Matters has achieved moderate gains for participants, it should be continued. Attempts to improve the program should be undertaken and data should be collected to determine if the changes are impactful.

After two sessions (20 weeks) of completing WLM, participants were significantly more likely to cease taking their blood pressure medications. What is not known is if the two sessions of WLM were back to back or had a time lapse. Since changes were seen over time, the program facilitators might consider extending the sessions from 10 weeks (current length) to 12-15 weeks. Since completion of one session was considered six or more classes and people averaged 5.6 classes, two completed sessions would mean approximately12 classes. While some have perfect attendance and some only completed six classes, extending the program to 15 weeks would allow the participants more time to address and implement the recommended behaviors and still account for the average attendance of approximately half of the classes. Another option would be to inform participants they are likely to achieve more weight loss and cease taking their medications if they attend more classes. Knowledge alone can be a motivator for behavior change, but as already demonstrated in the Transtheoretical Model, there are

several constructs that can affect actions toward behavior change. According to the WHO (2003), there are five dimensions of adherence to both drugs and lifestyle modifications: social/economic factors, therapy-related factors, patient-related factors, condition-related factors, and health system/HCT-factors. Though WLM cannot affect all of these dimensions, at least extending the program as an option can affect patient-related and social/economic factors. Additionally, incentives or challenges for attendance might yield higher attendance and greater effects.

The WLM program should consider measuring blood pressure, blood glucose/AIC, and blood cholesterol levels prior to the program and after the program to more directly document possible reduction in these values that could lead to the stopping of medications. Therefore, there is an opportunity for future research to examine other data that could indicate success in the program

Because there was a significant relationship between food diaries completed and percent body weight lost; the program should consider incenting the use of food diaries instead of making it optional. For some participants, simply knowing that more food diaries equal more weight lost might be incentive enough to complete them. For others, added incentives for food diary completion could be a simple solution and added layer of support for weight loss. The reason food diary completion was associated with increased weight loss might be because the food diaries or that self-monitoring makes the behavior more salient. Food diaries are not just about self-monitoring, but also for reflection and insight about food choices. Another option for increasing food diary compliance is the use of technology (i.e. a smart phone application), which is more readily available.

Physical activity was self-reported and not found to be a statistically significant predictor of weight loss, consistently. Perhaps incorporating physical activity more

fundamentally into the program and following up after one session would underline the importance of physical activity to the participants. Once participants begin to lose weight, exercise habits might change.

Because the goal of 'doctor's suggestion/medical condition' was a significant predictor of weight loss, the program could consider strengthening the referral process between the WLM program and health care providers to gain more participants with this goal. The current (to the time) system in places involved a full time Health and Wellness staff person assigned to build relationships with the health care providers within the University clinics with the hope of receiving more referrals from providers to Health and Wellness professionals. However, only participant has this goal listed and therefore these implications are speculative. The implications for increasing provider referrals could lead to more weight loss for those who become enrolled, further reduction of medications, and greater cost savings across the individual level and University wide.

No statistical significance was found for stopping diabetes or cholesterol medications after one or two sessions of WLM. This was likely due to the low number of participants who were taking these types of medications. Targeted marketing by WLM staff to those with diabetes or dyslipidemia could result in greater numbers enrolled; then more research could be completed. Other reasons for no significant changes for these two conditions might also be the conditions themselves are related more to genetics when compared to hypertension and less affected by food choices and activity habits (behaviors). Considering the goal of "doctor's suggestion/medical reason" was a significant predictor of weight loss and there were no significant results for medication cessations for cholesterol or diabetes, perhaps focusing on educating older persons to get the appropriate checkups so the health care providers can then refer or suggest they lose

weight because of a medical reason, this could have a positive effect on increasing enrollment into the program.

There was a larger number of participants on hypertension medications with only ten participants on multiple medications. In a study by Nguyen, Varela, Sabio, Naim, Stamos, and Wilson (2006), for obese patients on multiple medications after bariatric surgery the participants reduced the number of medications they were taking from 2.4 to 0.2. This research is informative in showing a reduction of medications, but does not speak to which medications are stopped first. After searching current literature, there is an apparent lack of research in finding which medications are stopped when comorbidities are present.

Additionally, research to detect the time it takes for medications to be reduced or stopped is also lacking. Though this current research demonstrated hypertension medication cessation after 20 weeks for completers versus non-completers, there seems to be mixed results in a research review. Aldana et al. (2005) demonstrated an improvement in diabetes risk after six months of a Diabetes Prevention Program held within the worksite. Fielding (1984) found hypertension improvements after one year. Finkelstein, Linnan, Tate, and Leese (2009) found no medical cost savings at 12 months or the subsequent two years after losing 5% body weight in a worksite wellness weight loss program. However, Trogdon, Finkelstein, Reyes, and Dietz were able to demonstrate a 5% weight reduction resulted in a $90 per person savings in medical costs plus absenteeism at one year. These varied results indicate a need for further research regarding the time it takes to reduce or stop medication after weight loss.

This research has demonstrated positive effects for the employees at the University of Kentucky. The research fits into the Strategic plan, as previously

mentioned. It has potential to impact cost savings for the individual and also for the University, also as previously mentioned. However, WLM could be used as a template for other health promotion programs targeting weight loss and its effects in other worksite wellness programs, but also in general. Community groups, health departments, and civil organizations could use the WLM template to impact a greater number of people. There are also possibilities for future research opportunities with the Health and Wellness program working in close proximity with the faculty of the Kinesiology and Health Promotion Department.

More broadly, this research has not only demonstrated its efficacy for health promotion programming within worksite wellness programs, but could have greater impacts on health promotion policy. The 1986 Ottawa Charter adopted by the WHO at the first Global Conference on Health Promotion put health promotion on the global radar. The charter has been updated, changed, and globalized even mores since then. Specifically, in 2005, the 6th Annual Global Conference on Health Promotion which was held in Bangkok, laid out four key action areas: "to make the promotion of health central to the global development agenda, a core responsibility for all of government, a key focus of communities and civil society, and a requirement for good corporate practices" (http://www.who.int/healthpromotion/conferences/6gchp/bangkok_charter/en/). This research fits into the fourth area of making health promotion a requirement for good corporate practice. This includes promoting health and well-being to employees and their families.

Appendix A

Weight Loss Matters Registration Form

Please check which class you are registering for:

- ☐ Tuesdays Noon-1 Mining & Minerals Bldg
- ☐ Tuesdays 5:15-6:15 Nursing Bldg.
- ☐ Thursdays 11-Noon Wethington Bldg

Name: _____ Date: _____

Gender: ___ Male ___ Female D.O.B: _____ Last four digits SSN: _____

Choose one: _____ Employee _____ Retiree _____ Spouse _____ Sponsored dependent

If a spouse or sponsored dependent, UK employee's name: _____

Department: _____ E-Mail: _____

Room & building/ Home address: _____
(if spouse , retiree, or sponsored dependent please provide home address and phone)

Speed sort/Zip code: _____ Work/Home phone: _____

How did you hear about Weight Loss Matters? __ Website __ UK News __ Departmental flyer __ In the Loop __ Other _____
(specify)

Have you participated in Weight Loss Matters before? ___ Yes ___ No

Current weight _____ lbs Height _____ Age _____

YOUR 10-WEEK WEIGHT LOSS GOAL: _____ lbs. (Not to exceed 10 pounds)

Have you attempted to lose weight in the past? ___ Yes ___ No

If yes, how have you tried to lose weight? _____

What are the major obstacles to your weight loss? _____

Why do you want to lose weight now? _____

Please list your current medical conditions _____

Please list all medications and/or supplements that you take (both prescription and non-prescription)
_____

Are you physically active? ___ No ___ Yes (if yes, please tell us):

Number of days per week you are active _____ Duration of activity _____

Type of activity (i.e. walking, aerobics, biking, weight training, etc.) _____

UK UNIVERSITY OF KENTUCKY
Health & Wellness Program
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Appendix B

Session start wt. lbs. Session wt. loss goal Dat Weigh Total _____ Goal _____ Met goal __ yes__	Session start wt. lbs. Session wt. loss goal lbs. Date Weight Total loss _____ Goal weight _____ Met goal __yes __no
Session start wt. lbs. Session wt. loss goal Dat Weigh Total _____ Goal _____ Met goal __ yes__	Session start wt. lbs. Session wt. loss goal lbs. Date Weight Total loss _____ Goal weight _____ Met goal __yes __no

Name:_____ Meal Plan: _____ kcal at _____ activity level

Appendix C

NAME: _____

DIRECTIONS: Write the date in the space provided (each box represents one day). On the left of each box, record what you eat each day. On the right of each box, check the boxes as you eat foods from each food group. At the end of the day, you should have checked the number of boxes in each food group as indicated by your meal plan.

MY MEAL PLAN:

Starch ____ exchanges Meat ____ exchanges

Fruit ____ exchanges Milk ____ exchanges

Vegetable ____ exchanges Fat ____ exchanges

Breakfast Date _____

Lunch

Dinner

Starch	□□□□□□□□□
Fruit	□□□□□
Veggie	□□□□□□
Meat	□□□□□□□
Milk	□□□
Fat	□□□□□□
Water	□□□□□□□□

Breakfast Date _____

Lunch

Dinner

Starch	□□□□□□□□□
Fruit	□□□□□
Veggie	□□□□□□
Meat	□□□□□□□
Milk	□□□
Fat	□□□□□□
Water	□□□□□□□□

Appendix D

Drug	alt name	uses	explanation	side effects	Source
Vytorin	ezetimibe/simvastatin	cholesterol	blocks the absorption of cholesterol from food AND reduces cholesterol the body makes naturally	loss of appetite, upper belly pain, dark urine, yellowing of skin or whites of eyes, feel tired/weak; headache, increased liver enzyme levels, muscle pain, upper respiratory infection, diarrhea; allergic reactions, joint pain, inflammation of pancreas, nausea, dizziness, tingling sensation, depression, gallstones, trouble sleeping, poor memory, confusion, ED, breathing problems/cough/SOB	http://www.vytorin.com/ezetimibe_simvastatin/vytorin/consumer/about_vytorin/index.jsp?WT.mc_id=Y03R1&utm_source=google&utm_medium=cpc&utm_term=vytorin&utm_campaign=Branded_2013&utm_content=swVnTtv9v|dc_pcrid_18912150850
Simvastatin	see above	cholesterol			
Simvastatin	Zocor	cholesterol	HMG-CoA reductase inhibitor (statin)	Headache, nausea, vomiting, diarrhea, abdominal pain, muscle pain, abnormal liver tests; liver damage, muscle inflammation or breakdown; rhabdomyolysis.	http://www.medicinenet.com/simvastatin/page2.htm
Zocor	see above	cholesterol			
Crestor	rosuvastatin calcium	cholesterol	blocks enzyme in liver causing liver to make less chol and increases uptake and breakdown by liver of chol already in blood	muscle problems, liver problems, headache, muscle aches, abdominal pain, weakness, nausea, high blood sugar, memory loss/confusion	http://www.crestor.com/c/about-crestor/crestor-side-effects.aspx

Zetia	ezetimibe	cholesterol	works in digestive tract to block absorption of chol from food you eat reversible inhibitor of the enzyme that catalyzes the	diarrhea, joint pain, feeling tired; muscle problems, allergic reactions, rash, joint pain, muscle pain, alterations in lab tests, liver problems, stomach pain, inflammation of pancreas, nausea, dizziness, tingling, depression, headache, gallstones, inflammation of gallbladder	http://www.zetia.com/ezetimibe/zetia/consumer/about-zetia/faqs.jsp
Pravastatin Sodium	Prevachol	cholesterol	conversion of HMG-CoA to mevalonate, early and rate limiting step in biosynthetic pathway for chol. Reduces VLDL and TG and increases HDL-C.	cardio angina pectoris, rash, nausea/vomiting, diarrhea, flatulence; dyspepsia/heartburn, abdominal distension; fatigue, chest pain, influenza, muscle pain, myalgia, headache, dizziness, pharyngitis, upper respiratory infection, rhinitis, cough	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=dcf45e4f-b46e-6fbb-b67a-2ff619ab1780 and http://www.drugs.com/pravastatin.html
Atorvastatin Calcium	Lipitor	cholesterol	Inhibitor of HMG-CoA reductase. This enzyme catalyzes the conversion of HMG-CoA to mevalonate, an early and rate limiting step in cholesterol biosynthesis	nasopharyngitis, arthralgia, diarrhea, pain in extremity, UTI, dyspepsia, nausea, musculoskeletal pain, muscle spasms, myalgia, insomnia, pharynogolaryngeal pain	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=d385e07a-c16f-4aef-8e55-af95bd1c7526
Lipitor	see above	cholesterol			

Fenofibrate	Antara, Fenoglide, Lipidil, Lipofen, TriCor, Triglide, Trilipix	cholesterol	antillipemic agents, speeds up natural processes that remove chol from body	constipation, diarrhea, heartburn, pain in back/arm/legs, headache	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a601052.html
Trilipix	Fibricor	cholesterol			
TriCor	Fenoglide, Tricor, Lipofen, Antara, Triglide, Lofibra	cholesterol			
Fenofibrate Micronized		cholesterol			
Gemfibrozil	Lopid	cholesterol	class: fibrates, reduces the production of triglycerides in the liver	stomach pain, heartburn, muscle pain/tenderness/weakness, blurred vision	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a686002.html
GlyBURIDE-Metformin	Glucovance	Diabetes	glyburide/metformin hydrocholoride	Lactic acidosis (can be fatal), muscle pain/weakness, numb or cold feeling in arms/legs, trouble breathing, stomach pain, nausea w/ vomiting, slow/uneven HR, dizziness, feeling weak/tired.	http://www.rxlist.com/glucovance-drug.htm
Janumet	sitagliptin and metformin HCI	Diabetes	helps pancreas make more insulin, helps body more effectively use the insulin, and decreases excess sugar that your liver makes	Lactic acidosis (can be fatal),pancreatitis (also fatal), kidney problems, stuffy/runny nose, sore throat, upper respiratory infection, diarrhea, nausea, vomiting, gas, upset stomach, indigestion, weakness, headache, low blood sugar	http://www.janumetxr.com/sitagliptin_metformin_HCL/janumetxr/consumer/what-is-janumet/index.xhtml

Metformin Hydrochloride	actoplus met, Actoplus Met XR, Avandamet, Fortamet, Glucophage, Glucophage XR, Glucovance, Glumetza, Janumet, Metaglip, Prandimet, Riomet	Diabetes	antihyperglycemic agent, lowers basal and postprandial plasma glucose. Decreases hepatic glucose production, decreases intestinal absorption of glucose, and improves insulin sensitivity by increasing peripheral glucose uptake and utilization.	lactic acidosis, diarrhea, nausea/vomiting, flatulence, asthenia, indigestion, abdominal discomfort, headache	http://www.fda.gov/ohrms/dockets/dailys/02/May02/053102/800471e6.pdf and http://www.drugs.com/monograph/metformin-hydrochloride.html
Acarbose	Prandase or Precose	Diabetes	Works by slowing the action of certain chemicals that break down food to release glucose into your blood.	shakiness, dizziness/lightheadedness, sweating, nervousness/irritability, sudden changes in behavior or mood, headache, numbness or tingling around mouth, weakness, pale skin, hunger, clumsy or jerky movements	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a696015.html
Actos	pioglitazone	Diabetes	Thiazolidinedione that depends on presence of insulin for action. Decreases insulin resistance in periphery and liver, resulting in increased insulin dependent glucose disposal and decreased hepatic glucose output.	low blood sugar, liver problems, bladder cancer, broken bones, macular edema, ovulation, cold-like symptoms, headache, sinus infection, muscle pain, sore throat	http://www.fda.gov/downloads/Drugs/DrugSafety/UCM183833.pdf and http://www.drugs.com/pro/actos.html

Avandia	rosiglitazone maleate	Diabetes	Increasing insulin sensitivity, improves glycemic control while reducing circulating insulin levels. Improves sensitivity to insulin in muscle an adipose tissue and inhibits hepatic gluconeogenesis.	heart failure, swelling, low blood sugar, fractures, weight gain, anemia, ovulation, liver problems	http://www.fda.gov/downloads/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/UCM143413.pdf
Byetta	Exenatide	Diabetes	Helps pancreas make more insulin more efficiently.	low blood sugar, kidney problems, severe allergic reactions, nausea, vomiting, diarrhea, feeling jittery, dizziness, headache, acid stomach, constipation, weakness	http://www.fda.gov/downloads/Drugs/DrugSafety/UCM191084.pdf and http://www.drugs.com/byetta.html
Glimepiride	Amaryl	Diabetes	causes pancreas to produce insulin helps body use insulin efficiently	dizziness, nausea, yellowing of skin or eyes, light colored stools, dark urine, pain in upper right stomach, unusual bleeding/bruising, diarrhea, fever, sore throat	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a696016.html
GlipiZIDE	Glucotrol	Diabetes	causes pancreas to produce insulin helps body use insulin efficiently	diarrhea, gas, feeling jittery, dizziness, uncontrollable shaking of a part of the body, red or itchy skin, rash, hives, blisters, yellowing of skin or eyes, light colored stools, dark urine, pain in upper right stomach, unusual bleeding/bruising, diarrhea, fever, sore throat	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a684060.html
GlipiZIDE Extended Release		Diabetes			
GlipiZIDE XL		Diabetes			

GlyBURIDE	Micronase, DiaBeta, Glynase, glibenclamide	Diabetes	causes pancreas to produce insulin helps body use insulin efficiently	nausea, upper abdominal fullness, heartburn, rash, yellowing of skin or eyes, light colored stools, dark urine, pain in upper right stomach, unusual bleeding/bruising, diarrhea, fever, sore throat	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a684058.html
GlyBURIDE-Metformin		Diabetes			
Humalog	insulin lispro	Diabetes	regulation of glucose, Is a form of insulin	hypoglycemia, renal impairment, hepatic impairment, allergy	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=b34cd3ff-d0af-4852-b4ef-2a8b4a93aeae#s20
Humalog Cartridge		Diabetes			
Humalog Pen		Diabetes			
Lantus	insulin glargine	Diabetes	long acting human insulin analogues to improve glycemic control	headache, flu like symptoms, dyspepsia, diarrhea, back pain, pharyngitis, lipodystrophy, lipohypertrophy, pallor, palpitation, tachycardia, local allergic reaction, hypokalemia, peripheral edema	http://reference.medscape.com/drug/lantus-toujeo-insulin-glargine-999003#4
Lantus OptiClik Cartridge	see above	Diabetes			
Lantus Solostar Pen	see above	Diabetes			
Novolin R		Diabetes	insulin-controls the storage and metabolism of carbohydrates, proteins, and fats	skin rash, SOB, fast HR, sweating, drop in BP	http://dailymed.nlm.nih.gov/dailymed/archives/fdaDrugInfo.cfm?archiveid=10574

NovoLog		Diabetes	insulin	hypoglycemia, headache, injury accidental, nausea, diarrhea	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=3a1e73a2-3009-40d0-876c-b4cb2be56fc5
NovoLog FlexPen	see above	Diabetes			
NovoLog Mix 70/30 FlexPen		Diabetes	rapid acting and long acting insulin mix	hypoglycemia, headache, flue like symptoms, dyspepsia, back pain, diarrhea, pharyngitis, rhinitis, skeletal pain, upper respiratory tract infection	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=973a9333-fec7-46dd-8eb5-25738f06ee54
Prandin	repaglinide	Diabetes	lowers blood glucose by stimulating the release of insulin from pancreas	hypoglycemia, respiratory infection, nausea, diarrhea, constipation, vomiting, dyspepsia, back pain, arthralgia, headache, paresthesia, chest pain, UTI, tooth disorder, allergy	http://www.accessdata.fda.gov/drugsatfda_docs/label/2009/020741s035lbl.pdf
Hydrochlorothiazide-Lisinopril	Prinzide or Zestoretic	HTN	Lisinopril is ace inhibitor, relaxes blood vessels. Hydrochlorothiazide is diuretic,	blurred vision, body aches or pain, chills, confusion, cough, diarrhea, difficulty breathing, dizziness, faintness, lightheadedness, ear congestion, fever, headache, loss of voice, nasal congestion, nausea, runny nose, sneezing, sore throat, sweating, unusual tiredness or weakness, vomiting; acid/sour stomach, belching, burning/crawling/tingling, decreased libido, heartburn, inability to have or keep erection, indigestion, lack/loss of strength, loss of sexual performance, muscle cramps, rash, stomach discomfort/pain;	http://www.mayoclinic.org/drugs-supplements/lisinopril-and-hydrochlorothiazide-oral-route/description/drg-20069073

Hydrochlorothiazide-Losartan		HTN			
Hydrochlorothiazide-Triamterene	Maxide-25	HTN			
Hydrochlorothiazide-Valsartan		HTN			
Avalide/Avapro	irbesartan, hydrochlorothiazide	HTN	see above	see above	http://www.fda.gov/Drugs/ResourcesForYou/SpecialFeatures/ucm298226.htm
Irbesartan		HTN	see above		
Hydrochlorothiazide		HTN	see above		
Metoprolol Succinate ER	Toprol	HTN	Beta blocker	drowsiness, dizziness, tiredness, diarrhea, slow HR, decreased sexual ability, cold feelings in hands/feet; mood changes, SOB, sudden wt gain; rash,	http://www.webmd.com/drugs/drug-8814-Metoprolol+Succinate+Oral.aspx?drugid=8814
Toprol XL	see above	HTN	see above	see above	
Clonidine Hydrochloride	Clorpres	HTN	antihypertensive agent and diuretic	dry mouth, increased thirst, drowsiness, feeling restless, nausea, vomiting, increased urination, muscle pain/weakness, fast HR, lightheaded, fainting, seizure, easy bruising/bleeding, red or purple spots on skin, confusion, hallucinations, urinating more or less than usual, SOB, swelling, rapid wt gain, numbness/tingly, nausea, stomach pain, low fever, loss of appetite, dark urine, clay colored stools, jaundice; dry mouth, loss of appetite, diarrhea, constipation,	http://www.rxlist.com/clorpres-drug/patient-images-side-effects.htm

				upset stomach, dizziness, drowsiness, headache, feeling restless or nervous, sleep problems, nightmares or unusual dreams, breast swelling or tenderness, mild itching or skin rash, impotence or loss of interest in sex	
Catapres-TTS-1	clonidine, transdermal patch	HTN	stimulates alpha-adrenoceptors in brain stem, resulting in reduced outflow from central nervous system and decrease in peripheral resistance, renal vascular resistance, HR, and BP	dry mouth, drowsiness, fatigue, headache, lethargy and sedation, insomnia, dizziness, impotence/sexual dysfunction, dry throat, constipation, nausea, change in taste, and nervousness	http://dailymed.nlm.nih.gov/dailymed/archives/fdaDrugInfo.cfm?archiveid=13567
Lisinopril	Prinivil or Zestril	HTN		cough, dizziness, headache, excessive tiredness, nausea, diarrhea, weakness, sneezing, runny nose, decrease in sexual ability; swelling of face/throat/tongue/lips/eyes/hands /feet, hoarseness, difficulty breathing/swallowing, fever, sore throat, chills, signs of infection, yellowing of skin or eyes, lightheadedness, fainting, chest pain	

Diovan HCT	valsartan and hydrocholrothiazide usp	HTN	valsartan is angiotensin II receptor blocker and hydrochlorothiazide is diuretic	Allergic reaction, breakdown of skeletal muscle resulting in kidney failure, eye pain/vision problems, light headed or fainting, swelling rapid weight gain, fast or pounding HR, urinating less than usual, jaundice, dry mouth/increased thirst, drowsiness, restless feeling, confusion	http://www.rxlist.com/diovan-hct-drug/patient-images-side-effects.htm
Benicar	Olmesartan, hydrochlorothiazide, Atacand, Avapro, Cozaar, Diovan, Micardis, Teveten	HTN	angiotensin II receptor blocker,	see above	http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm215245.htm
Nadolol	Corgard	HTN	beta-adrenergic receptor blocker	Dizziness or lightheadedness, excessive tiredness, SOB, swelling in hands, feet, ankles, lower legs; unusual wt gain, fainting,	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a682666.html and http://labeling.pfizer.com/ShowLabeling.aspx?id=708
Metoprolol Tartrate	Lopressor	HTN	beta-selective (cardioselective) adrenergic receptor blocker.	tiredness/dizziness, sob, bradycardia, cold extremities, arterial insufficiency, palpitations, CHF, peripheral edema, hypotension, wheezing, diarrhea, nausea, dry mouth , gastric pain, constipation. Flatulence, heartburn, vomiting, pruritus/rash, peyronies disease, pain. blurred vision, tinnitus	http://www.drugs.com/cdi/metoprolol-tartrate.html and http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=011ee828-5c2a-49b9-bf8e-07f5eb5fc635

Spironolactone	Aldactone	HTN	potassium-sparking diuretic that prevents the body from absorbing too much salt and keeps potassium levels from getting too low	vomiting, diarrhea, stomach pain/cramps, dry mouth, thirst, dizziness, unsteadiness, headache, enlarge/painful breasts, irregular menstrual periods, vaginal bleeding in post men, difficulty maintaining or achieving erection, deepening of voice, increased hair growth on body parts, drowsiness, tiredness, restlessness	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a682627.html and http://www.drugs.com/spironolactone.html
Amlodipine Besylate	Norvasc, Azor nifedipine, Adalat CC, Afeditab CR, Nifediac CC, Nifedical XL, Procardia,	HTN	besylate salt of amlodipine, a long acting calcium channel blocker, inhibits transmembrane influx of calcium ions into vascular smooth muscle and cardiac muscle. Amlodipine is peripheral arterial vasodilator causing reduction in peripheral vascular resistance and reduction in bp.	edema, dizziness, flushing, palpitation	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=2bac4ec4-9542-4927-8121-a7cd1858075b and http://www.webmd.com/drugs/2/drug-5891/amlodipine-oral/details
Afeditab CR		HTN	Calcium channel blocker, relaxes cardiac muscle and blood vessels	worsening angina, light headed, pounding heartbeat, chest pain, swelling in ankles or feet, stomach pain, dizziness, weakness, headache, mood changes, heartburn, nausea, tremors, muscle cramps, cough, wheezing, sore throat or stuffy nose	http://www.drugs.com/mtm/afeditab-cr.html

	Procardia XL				
Nifediac CC	see above	HTN			
Nifedical XL	see above	HTN			
Nifedipine ER	see above	HTN			
Nisoldipine	see above	HTN			
Sular	nisoldipine	HTN			
Amlodipine Besylate-Benazepril Hydrochloride	Lotrel	HTN	calcium channel blocker and ACE inhibitor, relaxes blood vessels to help flow	dizziness, cough, swelling hands/ankles/feet, fainting, irregular heartbeat, high potassium, weakness, sore throat, liver problems, chest pain or heart attack,	http://www.fda.gov/Safety/MedWatch/SafetyInformation/ucm262165.htm and http://www.webmd.com/drugs/2/drug-11524/amlodipine-benazepril-oral/details#side-effects
Lotensin	benazepril hydrochloride	HTN	non-sulfhydryl angiotensin-converting enzyme inhibitor	headache, dizziness, somnolence, postural dizziness	http://www.accessdata.fda.gov/drugsatfda_docs/label/2012/019851s042lbl.pdf
Atenolol	Tenormin	HTN	Beta blocker,	dizziness, lightheadedness, tiredness, drowsiness, depression, nausea, diarrhea, SOB, swelling of hands or feet, weight gain, fainting	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a684031.html
Bisoprolol Fumarate		HTN	Beta blocker-relaxes blood vessels and slows heart rate to improve and decrease BP.	excessive tiredness, vomiting, diarrhea, muscle aches, runny nose; SOB, swelling of hand/feet, unusual weight gain, fainting,	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a693024.html

Bystolic	nebivolol	HTN	beta blocker, relaxes blood vessels	headache, fatigue, dizziness, diarrhea, nausea, insomnia, chest pain, bradycardia, SOB, rash, peripheral edema	http://www.bystolic.com/
Cartia XT	diltiazem, Cardizem	HTN	calcium channel blocker, relaxes blood vessels so blood flows more easily, lowers HR	dizziness, lightheadedness, weakness, nausea, flushing, constipation, headache	https://healthy.kaiserpermanente.org/health/care/consumer/health-wellness/drugs-and-natural-medicines/drug-encyclopedia/medicine-information/!ut/p/a1/hc_BTsJAEAbgp-FIZ9qFdvG2gOK2ArU2UvdiSllbkmW3KQsNPr0U8WCMOreZfPMnPwjIQOj8uC1zuzU6V90u_NcU-XI8dhmiy4fI45AuppR6OCGwghBEqcz6gl8qa-ubHvZw0xxKqYtTvzaNVdL2EIQyRa4kZFL3D_t_dXfjU8i8URBQ_MYLo63UtpF6IxvZ_MxejUG02fumYt0f02tCSxCNfOu4U5m9haxtW6c0plTSKczuXET83RWv4C58-gTLwYgin0_uJ3wRIc6CK4gZcjrHoYuM-Mj9lETBfOHibHAFSPjjJWEW-3i2URo9jyKC6H2BX4Yh1Dt6Iur4IJO1n9wm7AM6_jt-/dl5/d5/L2dBISEvZ0FBIS9nQSEh/
Diltiazem Hydrochloride		HTN	calcium ion cellular influx inhibitor (slow channel	lower limb edema, sinus congestion, rash NOS	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=813eb1bb-1475-4958-821d-e97c5abb7462

			blocker or calcium antagonist)		
Carvedilol	Coreg	HTN	beta blocker, relaxes blood vessels	extreme thirst, frequent urination, extreme hunger, weakness, blurred vision; tiredness, weakness, lightheadedness, dizziness, headache, diarrhea, nausea, vomiting, vision changes, joint pain, difficulty falling or staying asleep, cough, dry eyes, numbness, burning, or tingling in the arms or legs	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a697042.html
Chlorthalidone	Hygroton, Thalitone	HTN	water pill-causes the kidneys to get rid of unneeded water and salt	muscle weakness, dizziness, cramps, thirst, stomach pain, upset stomach, vomiting, diarrhea, loss of appetite, headache, hair loss	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a682342.html
Cozaar	losartan potassium	HTN	Blocks the vasoconstrictor and aldosterone-secreting effects of angiotensin II by selectively blocking the binding of angiotensin II to the AT receptor found in many tissues.	abdominal or stomach pain, anxiety, bladder pain, bloody or cloudy urine, blurred vision, chills, cold sweats, coma, consution, cool pale skin, depression, difficult breathing, difficulty burning or painful urination, dizziness, fast heartbeat, frequent urge to urinate, headache, increased hunger, irregular heartbeat, lower back pain, nausea/vomiting, nightmares, numbness or tingling in hands feet or lips, pale skin, seizures, shakiness, SOB, slurred speech, trouble breathing w/ exertion, unusual bleeding or bruising, unusual	and https://www.merck.com/product/usa/pi_circulars/c/cozaar/cozaar_pi.pdf

				tiredness/weakness, weakness/heaviness of legs	
Doxazosin Mesylate		HTN	Selective inhibitor of alpha 1 subtype of adrenergic receptors. Results in systemic vascular resistance.	dizziness, fatigue, swelling of feet, SOB	http://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=345478a6-8389-4229-92b3-6e40da7b06fd
Enalapril Maleate		HTN	Maleate salt of enalapril, the ethyl ester of a long acting angiotensin converting enzyme inhibitor, enalaprilat. Enalapril, after hydrolysis to enalaprilat, inhibits angiotensin-converting enzyme (ACE) .	fatigue, orthostatic effects, asthenia, diarrhea, nausea, headache, dizziness, cough, rash	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=e31289f1-4b59-418a-a893-c748ce073f6c
Felodipine	Plendil, Lexxel (a combination drug)	HTN	calcium channel blocker, relaxes blood vessels so blood flows more easily, lowers HR	headache, flushing, dizziness or lightheadedness, weakness, fast heartbeat, heartburn, constipation, enlargement of gum tissue around teeth	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a692016.html

Fosinopril Sodium	Monopril	HTN	hydrolyzed by esterase to the pharmacologically active from, fosinoprilat, a specific competitive inhibitor of angiotensin converting enzyme (ACE)	cough, dizziness, nausea, vomiting, headache, diarrhea, fatigue, sexual dysfunction	http://dailymed.nlm.nih.gov/dailymed/archives/fdaDrugInfo.cfm?archiveid=4617
Guanfacine Hydrochloride	Intuniv, Tenex	HTN	alpha2A-adreneergic receipt agonists-decreases HR and relaxes blood vessels to blood can flow more easily	dry mouth, tiredness, weakness, headache, irritability, decreased sexual ability, decreased appetite, stomach pain, nausea, vomiting, constipation, fainting, blurred vision, rash, slow HR	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a601059.html
Hyzaar	Losartan potassium and hydrochlorothiazide	HTN	angiotensin II receptor antagonist and a diuretic	abdominal pain, edema/swelling, palpitation, dizziness, cough, sinusitis, URI, rash	https://www.merck.com/product/usa/pi_circulars/h/hyzaar/hyzaar_pi.pdf
Indapamide	Lozol	HTN	water pill-causes the kidneys to get rid of unneeded water and salt	muscle cramps, drowsiness, confusion, thirst, upset stomach, vomiting, stomach cramps, decreased sexual ability, blurred vision	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a684062.html
Labetalol Hydrochloride		HTN	adrenergic receptor blocking agent	postural hypotension, increased sweating, flushing	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=17bb21ce-9bb1-4603-b168-abea7fc85d17
Minoxidil	Loniten, Rogaine, Renewal	HTN	vasodilator-relaxes blood vessels so blood can flow more easily	increase in size or darkness of fine body hair, breast tenderness, headache, nausea, vomiting; rash, fast HR, swollen ankles/feet, unexplained weight gain,	https://www.nlm.nih.gov/medlineplus/druginfo/meds/a682608.html

				difficulty breathing, dizziness, fainting	
Propranolol Hydrochloride		HTN	synthetic beta-adrenergic receptor blocker	nausea, vomiting, epigastric distress, abdominal cramping, diarrhea, constipation, mesenteric arterial thrombosis, ischemic colitis, bronchospasm, Systemic lupus erythematosus, dry eyes, toxic epidermal necrolysis, urticaria, skin issues	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=46942e6e-73bb-4687-853a-e3ec2734cc70
Quinapril Hydrochloride	accupril, accuprin, acequin, korec	HTN	salt form of quinapril, a prodrug and non-sulfhydryl angiotensin converting enzyme (ACE) inhibitor with antihypertensive activity-leads to vasodilation	dizziness, lightheadedness, tiredness, cough, nausea, vomiting, fainting, muscle weakness, slow/irregular HR, change in amount of urine (http://www.webmd.com/drugs/2/drug-6254/quinapril-oral/details#)	http://pubchem.ncbi.nlm.nih.gov/compound/Accupril#section=Top
Sotalol Hydrochloride		HTN	antiarrhythmic drug with beta-adrenoceptor blocker and cardiac action potential duration prolongation properties	infection, fever, localized pain, cardiovascular symptoms, nervous system symptoms, digestive, respiratory, urogenital, metabolic, musculoskeletal, skin rash, bleeding, visual problems	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=576905b7-6e6d-4aa0-b690-24be26e70cd2
Verapamil Hydrochloride		HTN	calcium ion influx inhibitor (slow channel blocker) modulates the influx of ionic calcium across the cell membrane of	constipation, headache, dizziness, lethargy, dyspepsia, rash, ankle edema, sleep disturbance, myalgia	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=3bee2d26-138c-4641-a217-a38d3d657461

			arterial smooth muscle and conductile and contractile myocardial cells		
Verapamil Hydrochloride SR	see above	HTN			
Tamsulosin Hydrochloride	Flomax	not for use in HTN	alpha 1 adrenoceptor blocking agent-selective for prostrate	headache, infection, asthenia, back pain, chest pain, nervous system symptoms, respiratory, digestive, urogenital symptoms, blurred vision	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=d302b0fb-4f03-4106-b484-1e811f62c356
Flomax	tamsulosin hydrochloride	Not indicated for HTN	alpha adrenoceptor antagonist	fainting, dizziness, lightheadedness, rash, itching, hives, runny nose, decreased semen	http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=c00d5f7b-dad7-4479-aae2-fea7c0db40ed
Norvasc	see above				
Lotrel	see above				
Tiazac	diltiazem		see above		
Diltzac	diltiazem hydrochloride				
Losartan Potassium	see above				
				Each of these contains 100 units of insulin as part per mL: 10 mL vials, 3 mL Pen Fill cartridges, 3mL NovoLog FlexPen, 3 mL NovoLog FlexTouch	
Propranolol Hydrochloride LA	see above		long acting		

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