A SOCIAL ECOLOGICAL APPROACH TO INCREASE WALKING AMONG
SEDENTARY WOMEN

DISSEPTION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Amy Elizabeth Speed-Andrews, MS

*****
The Ohio State University

2008

Dissertation Committee:

Dr. Janet Buckworth, Advisor
Dr. Randi Love
Dr. Rick Petosa

Approved By:

Advisor,
College of Education
ABSTRACT

Less than half of American women are sufficiently active to reduce their risk for chronic disease (BRFSS, 2005). Current evidence emphasizes the importance of creating programs to increase physical activity that encompass multiple levels of the social environment. The primary purpose of the study was to evaluate the efficacy of a social ecological intervention to increase walking among sedentary women. The intervention was delivered at the organizational level (church), and walking was operationalized as average steps/day measured by the New-Lifestyles Digi-Walker SW 200 pedometer. A convenience sample of $N = 7$ Christian churches in the Greater Columbus area participated in the study, and women were recruited from the cooperating churches into the social ecological intervention group (SE: $n = 20$) or a self-monitoring only comparison group (SM: $n = 18$). Both groups monitored their steps/day over the 10 week study. In addition, women in the SE group attended four sessions designed to target intrapersonal (self-efficacy, and self-regulation), and interpersonal (social network and group cohesion) levels of the social environment.

Both groups significantly increased their steps/day from pretest to follow up ($p < .001$). This increase was significantly greater among women in the SE intervention group compared to women in the SM comparison group ($+2660 \pm 1969$ steps/day vs. $+1316 \pm 1925$, $p < .05$). The intervention had a significant impact on self-regulatory self-efficacy
and the social network index church among SE women only. Self-regulation and social support for physical activity significantly increased over time \((p < .001)\), but the difference between the groups was not significant. Associations in the SE intervention group between change in steps/day and self-regulatory self-efficacy \((r = .309)\), and the social network index church \((r = .305)\) suggest these variables were possible mediators of the intervention on steps/day. Associations between change in steps/day with BMI \((r = -.435, p < .001)\), age \((r = .453, p < .01)\) and education \((r = .391, p < .05)\) imply their role as moderators of the intervention on steps/day. The findings support including multiple levels of the social environment when designing interventions to increase physical activity among sedentary women.
ACKNOWLEDGMENTS

Thank you to my dissertation committee Dr. Janet Buckworth, Dr. Randi Love and Dr. Rick Petosa for all your guidance and support throughout this process, especially Dr. Buckworth for your unlimited patience, guidance and support. I have the greatest respect for you not only as my academic adviser but also as a friend.

Thank you to Ya-Ting Hsu and Jennifer Lutmer for your help with data collection and implementation. Thank you to Julie Wallis and Christie Talbott for kindly volunteering your churches for my pilot study. And, thank you to Dr. Brian Hertz and Dr. Elizabeth Eakin for your expert measurement advice.

Thank you to my family and friends at home for all your support and encouragement, and for being there for me regardless of time, distance or country. In particular, my lifelong friends, Sandie Casey, Jeanne Dick, Fiona Dyer, Caroline Lee, Sam McLaren, Marlene Morton, Lynne Moores and Emma Wiseman. To my brother in law Ian and my two beautiful nieces Rachel and Bethany McBride, for making me laugh. To Nigel, for your encouragement and helpful tips, and for being an example of someone who lived to tell the tale. To my Dad, thank you for dragging us up all those mountains and instilling in me the value of an active lifestyle at an early age. And above all my Mum and Sister who without your support I would not be who I am or where I am today.
Thank you to my US family who have lived through the “drama” and shared the misery in close proximity and still want to know me, Stephanie Drotos, Maria Rozorea, Angela Miller-Barton, Yuka Jonen & Kyoko Wardwell, Ulises Picon, Bev Kuder and new addition to the family Lisa Vardar. And particular thanks to Jennifer Hardes my US sister and fellow compatriot for all the fun and laughter through stressful times and endless cups of milky tea.

Thank you to all the instructors and fellow teacher trainees, yogis and yoginis at Balanced Yoga. Thank you for challenging me physically and mentally, reminding me to breathe and for bringing some balance into my life.

And last but by no means least, the greatest appreciation to all the churches and ladies that took part in my study whose hard work, motivation and perseverance enabled me to complete my doctoral dissertation.
VITA

June 2nd, 1976 ...........................................Born – Alexandria, Scotland UK

1999..........................................................MA, the University of Glasgow

2004..........................................................MS, Western Illinois University

2004-2005...................................................Graduate Research Associate
                                    The Ohio State University
                                    College of Education

2005-2007...................................................Graduate Teaching Associate
                                    The Ohio State University
                                    College of Education

2007-present..............................................Graduate Research Associate
                                    The Ohio State University
                                    Institute of Behavioral Medicine

FIELD OF STUDY

Major Field: Education
# TABLE OF CONTENTS

ABSTRACT ....................................................................................................................ii

ACKNOWLEDGMENTS ..............................................................................................iv

VITA ............................................................................................................................vi

LIST OF TABLES ........................................................................................................x

LIST OF FIGURES ......................................................................................................xii

Chapters:

1. Introduction
   - Background ........................................................................................................1
   - Physical Activity Research ..................................................................................2
   - A Social Ecological Model ..................................................................................3
   - The Church ..........................................................................................................4
   - Walking ...............................................................................................................5
   - Evaluation ..........................................................................................................8
   - Stages of Research ............................................................................................14
   - Purpose ..............................................................................................................16
   - Research Questions ...........................................................................................17
   - Definition and Terms .........................................................................................19

2. Literature Review
   - Introduction ......................................................................................................28
   PART I
     - The Environment ..........................................................................................30
     - The Social Ecological Model .........................................................................31
     - Intrapersonal ..................................................................................................37
     - Interpersonal ..................................................................................................42
     - Organizations .................................................................................................57
     - Group Cohesion ..............................................................................................80
   PART II
     - Physical Activity ..........................................................................................83
     - Walking ..........................................................................................................87
     - Pedometers ....................................................................................................90
3. Method

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Design</td>
<td>118</td>
</tr>
<tr>
<td>Sample</td>
<td>127</td>
</tr>
<tr>
<td>Setting and Recruitment</td>
<td>130</td>
</tr>
<tr>
<td>Participant Recruitment</td>
<td>132</td>
</tr>
<tr>
<td>Measures</td>
<td>136</td>
</tr>
<tr>
<td>Pilot Test</td>
<td>150</td>
</tr>
<tr>
<td>Content Validity</td>
<td>150</td>
</tr>
<tr>
<td>Field Test</td>
<td>152</td>
</tr>
<tr>
<td>Reliability</td>
<td>163</td>
</tr>
<tr>
<td>Procedure</td>
<td>168</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>176</td>
</tr>
<tr>
<td>Process Evaluation</td>
<td>177</td>
</tr>
<tr>
<td>Impact Evaluation</td>
<td>180</td>
</tr>
<tr>
<td>Research Questions and Statistical Hypotheses</td>
<td>185</td>
</tr>
<tr>
<td>Assumptions of the ANOVA model</td>
<td>189</td>
</tr>
<tr>
<td>Considerations for Correlational Analysis</td>
<td>191</td>
</tr>
<tr>
<td>Data and Coding</td>
<td>192</td>
</tr>
</tbody>
</table>

4. Results

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART I</td>
<td>196</td>
</tr>
<tr>
<td>Description of Recruited Churches, Final Sample</td>
<td>200</td>
</tr>
<tr>
<td>Subject Mortality and Description of Final Sample</td>
<td>202</td>
</tr>
<tr>
<td>PART II</td>
<td></td>
</tr>
<tr>
<td>Impact Evaluation Results</td>
<td></td>
</tr>
<tr>
<td>Steps/day</td>
<td>214</td>
</tr>
<tr>
<td>Social Ecological Model Variables</td>
<td>225</td>
</tr>
<tr>
<td>Correlations</td>
<td>240</td>
</tr>
<tr>
<td>Change in Steps/day and Change in Social Ecological Variables</td>
<td>241</td>
</tr>
<tr>
<td>Change in Steps/day and Participant Demographic Characteristics</td>
<td>246</td>
</tr>
<tr>
<td>PART III</td>
<td></td>
</tr>
<tr>
<td>Process Evaluation Results</td>
<td>248</td>
</tr>
<tr>
<td>Implementation</td>
<td>249</td>
</tr>
<tr>
<td>Group Cohesion</td>
<td>250</td>
</tr>
<tr>
<td>Participant Satisfaction</td>
<td>252</td>
</tr>
</tbody>
</table>

5. Discussion

<table>
<thead>
<tr>
<th>PART I</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Evaluation Steps/day</td>
<td>257</td>
</tr>
<tr>
<td>Walking Logs</td>
<td>260</td>
</tr>
<tr>
<td>PART II</td>
<td>266</td>
</tr>
<tr>
<td>Impact Evaluation of Social Ecological Variables</td>
<td>271</td>
</tr>
<tr>
<td>PART III</td>
<td></td>
</tr>
<tr>
<td>Associations between Steps/day and Social Ecological Variables</td>
<td>285</td>
</tr>
<tr>
<td>Participant Demographics and Change in Steps/day</td>
<td>295</td>
</tr>
<tr>
<td>PART IV</td>
<td></td>
</tr>
<tr>
<td>Process Evaluation</td>
<td>299</td>
</tr>
<tr>
<td>Participant Satisfaction</td>
<td>304</td>
</tr>
<tr>
<td>PART V</td>
<td></td>
</tr>
<tr>
<td>Limitations</td>
<td>309</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1 Church based physical activity interventions</td>
<td>109</td>
</tr>
<tr>
<td>Table 2.2: Church based pedometer interventions</td>
<td>113</td>
</tr>
<tr>
<td>Table 3.1: Studies used for effect size estimation</td>
<td>129</td>
</tr>
<tr>
<td>Table 3.2: Description of pilot churches</td>
<td>156</td>
</tr>
<tr>
<td>Table 3.3: Descriptive Statistics for age and BMI, pilot sample</td>
<td>157</td>
</tr>
<tr>
<td>Table 3.4: Demographic distribution of pilot sample</td>
<td>159</td>
</tr>
<tr>
<td>Table 3.5: Descriptive statistics for weekly minutes of physical activity, pilot sample</td>
<td>161</td>
</tr>
<tr>
<td>Table 3.6: Descriptive statistics for dependent variables, first administration, pilot sample</td>
<td>163</td>
</tr>
<tr>
<td>Table 3.7: Univariate repeated measures ANOVA’s for instruments, pilot study</td>
<td>167</td>
</tr>
<tr>
<td>Table 3.8: Intervention lesson plans</td>
<td>174</td>
</tr>
<tr>
<td>Table 3.9: Interpretation of the correlation coefficient, Cohen (1988)</td>
<td>184</td>
</tr>
<tr>
<td>Table 4.1: Description of churches, final sample</td>
<td>202</td>
</tr>
<tr>
<td>Table 4.2: Descriptive statistics for age and BMI, final sample</td>
<td>206</td>
</tr>
<tr>
<td>Table 4.3: Descriptive statistics for total weekly minutes of physical activity, final sample</td>
<td>207</td>
</tr>
<tr>
<td>Table 4.4: Demographic characteristics, final sample</td>
<td>212</td>
</tr>
<tr>
<td>Table 4.5: Descriptive statistics for dependent variables by group, final sample</td>
<td>213</td>
</tr>
<tr>
<td>Table 4.6: subject mortality</td>
<td>372</td>
</tr>
<tr>
<td>Table 4.7: differential mortality</td>
<td>373</td>
</tr>
<tr>
<td>Table 4.8: Mixed ANOVA’s for dependent variables, final sample</td>
<td>216</td>
</tr>
<tr>
<td>Table 4.9: Descriptive statistics for average steps/day by group over time</td>
<td>217</td>
</tr>
</tbody>
</table>
Table 4.10: Cohen’s $d$ for change in steps over time for group……………………………………………...220
Table 4.11: Descriptive statistics for steps/day by group, final sample Appendix T………………………..410
Table 4.12: Descriptive statistics for days the pedometer was worn by group, Appendix U…………………412
Table 4.13: Summary of enablers and barriers to increasing steps/day, final sample…………………..222
Table 4.14: Summary of enablers and barriers to pedometer use, final sample …………………………224
Table 4.15: Descriptive statistics for SRSE by group over time, final sample……………………………225
Table 4.16: Cohen’s $d$ for SRSE for each group over time, final sample…………………………………228
Table 4.17: Descriptive statistics for TSKSE by group over time, final sample…………………………..229
Table 4.18: Descriptive statistics for SRWLK by group over time, final sample…………………………230
Table 4.19: Cohen’s $d$ for SRWLK by group, final sample………………………………………………..232
Table 4.20: Descriptive statistics for SSPA over time, final sample……………………………………..232
Table 4.21: Cohen’s $d$ for SSPA by group, final sample………………………………………………….234
Table 4.22: Descriptive statistics for SNFF over time, final sample………………………………………..234
Table 4.23: Descriptive statistics for SNCH by group over time, final sample…………………………..236
Table 4.24: Cohen’s $d$ for SNCH by group, final sample……………………………………………………239
Table 4.25: Bivariate correlation matrix for change in steps/day with change in social ecological variables from pretest to posttest, final sample ……………………………………………………………………….241
Table 4.26: Bivariate correlation matrix for change in steps/day with change in social ecological variables from pretest to follow up, final sample ……………………………………………………………………………………243
Table 4.27: Bivariate correlation matrix for change in steps/day with change in social ecological variables from posttest to follow up, final sample……………………………………………………………………………245
Table 4.28: Bivariate correlation matrix for change in steps/day with participant characteristics, final sample ………………………………………………………………………………………………………247
Table 4.29: Descriptive statistics for change in steps/day and participant attendance…………………...249
Table 4.30: Bivariate correlation matrix for process variables, group cohesion and attendance with change in steps/day.251
Table 4.31: Participant satisfaction, process evaluation, social ecological intervention group…………253
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1: Mediation (Barron &amp; Kenny, 1986).</td>
<td>11</td>
</tr>
<tr>
<td>Figure 3.1: Quasi-experimental non-equivalent control group design with follow up</td>
<td>119</td>
</tr>
<tr>
<td>Figure 3.2: Cohen’s d</td>
<td>128</td>
</tr>
<tr>
<td>Figure 3.3: Formula for calculating Stability Reliability Coefficients</td>
<td>166</td>
</tr>
<tr>
<td>Figure 3.4: Time line for the intervention group</td>
<td>171</td>
</tr>
<tr>
<td>Figure 3.5: Conceptual model of the social-ecological church based intervention</td>
<td>173</td>
</tr>
<tr>
<td>Figure 4.1: Flow diagram of participant recruitment, retention and attrition.</td>
<td>204</td>
</tr>
<tr>
<td>Figure 4.2: Change in steps/day for time by group</td>
<td>218</td>
</tr>
<tr>
<td>Figure 4.3: Descriptive statistics for change per week in steps/day, final sample</td>
<td>410</td>
</tr>
<tr>
<td>Figure 4.4: Change in SRSE over time by group</td>
<td>226</td>
</tr>
<tr>
<td>Figure 4.5: Change in TSKSE by group over time</td>
<td>229</td>
</tr>
<tr>
<td>Figure 4.6: Change in SRWLK over time by group</td>
<td>231</td>
</tr>
<tr>
<td>Figure 4.7: Change in SSPA over time by group</td>
<td>233</td>
</tr>
<tr>
<td>Figure 4.8: Change in SNFF over time by group</td>
<td>235</td>
</tr>
<tr>
<td>Figure 4.9: Change in SNCH over time by group</td>
<td>237</td>
</tr>
</tbody>
</table>
CHAPTER 1
Introduction

Background

Cardiovascular disease (CVD) is the leading cause of death and disability among women in the USA (AHA, 2006). The Task Force for the National Institutes of Health has recognized CVD prevention and treatment in women as a research priority (NIHS, 1999). Research indicates that physically active women have a 60 to 75% lower risk of CVD than inactive women (Blair et al., 1995). Moreover, the annual per capita medical expense for inactive women with CVD is $4391 compared to only $1810 for active women without CVD (Wang et al., 2004). A reduction in risk for CVD and other chronic disease can be achieved with 30 minutes of accumulated moderate intensity physical activity (PA) on five or more days of the week, which is equivalent to a brisk two mile walk for most healthy adults (Pate et al., 1995, Haskell et al., 2007). Despite the known health benefits associated with regular physical activity (PA), less than half of American women (47.9%) across all race and ethnic groups engage in a sufficient amount to reduce their risk for chronic disease (BRFSS, 2005). Moreover, physical activity rates have remained relatively unchanged over the last two decades (Dishman, 2001). The continuing prevalence of physical inactivity suggests that interventions have had little
impact on consistently increasing and sustaining physical activity levels (Dishman & Buckworth, 1996).

Physical Activity Research

In comparison to other domains of health, physical activity intervention studies comprise a relatively new field of inquiry (Dunn & Blair, 2002). Findings from a literature review conducted by Kahn et al. (2002) indicated a two fold growth in published results of physical activity intervention research since the 1980’s. Thus far the literature has been dominated by individual approaches to behavior change (Sallis & Owen, 1996). Moreover, most of the dominant theories are intrapersonal focusing on the individual as the main mechanism for change. Common themes among such theories are that personal factors such as knowledge, attitude or motivation regulate human activity, and therefore behavior change is sought through the alteration of these processes. In health education such individually oriented behavior change strategies have been accused of a “victim blaming ideology” in that they place the onus of responsibility on the individual and minimize the importance of the social and physical environment to health (p. 256, Crawford, 1979). There is emerging consensus that multi-level approaches may be essential to bring about population improvements in health. Green & Kreuter (1991) stressed the importance of multi-level strategies that target the individual and strengthen environmental supports conducive to health and well-being, and the Healthy People Report 2010 (USDHHS, 2000) likewise acknowledged the need for multilevel interventions.
The failure of current empirical research to address social and contextual variables in the physical activity field has been suggested by some authors to contribute to the lack of success in changing or sustaining physical activity behavior (Sallis & Owen, 1999). Sommer & Wicker (1991) stated that the individual approach tends to neglect the natural context in which physical activity behavior occurs. In addition, correlational research suggests the need for a broader perspective to understand PA behavior that not only includes individual level variables, but also contextual variables (Sallis & Owen, 1999). Recently calls have been made for the consideration and integration of multilevel, ecological approaches to PA promotion (Spence & Lee, 2003). According to Sallis & Owen (2002) the challenge now is how to operationalize and apply ecological frameworks specifically to physical activity behavior change and evaluate their effectiveness.

A Social Ecological Model

McLeroy et al. (1988) proposed a social ecological model for health promotion encompassing intrapersonal, interpersonal, organizational, community and public policy factors that are hypothesized to support and sustain healthy behaviors. The main mechanism of change within this model is the social environment; in particular behavior change is sought by enhancing cohesion and support from each level of the model (McLeroy et al., 1988). The intrapersonal level includes characteristics of the individual such as knowledge, attitudes, self-efficacy, and/or behavioral skills. Interpersonal refers to transactions between the individual and formal and informal social networks such as
family, or work networks. Organizational refers to support stemming from social institutions with organizational characteristics such as worksites, schools and churches. Community is defined in terms of the relationships between organizations, and public policy is concerned with the influence on behavior from local, state, and national laws and policies. The different levels are not considered to be all inclusive, but rather reflect the range of strategies that researchers can select from for intervention and analysis (McLeroy et al., 1988).

The Church

In this study, churches were selected as the organizational setting through which participants were recruited and the intervention was conducted. The utility of churches as an attractive setting to conduct health promotion programs has been recognized by several authors (Thrasher et al., 2004; Campbell et al., 2004; Wells, et al., 1990; DeHaven et al., 2004, Peterson et al., 2005). Thrasher et al. (2004) stated that the social integration of church congregations makes them powerful units for intervention that can be used to target multiple levels of the social environment. Moreover, the availability of churches in almost every community suggests that church based health programs have the ability to reach large numbers of people, and in particular have the potential to succeed in reaching underserved populations (Campbell et al., 2004). Research has also reported that women are more likely to value and participate in church activities and therefore may be more likely to attend health promotion programs in churches (Wells et al., 1990). Importantly, the literature suggests that health promotion programs conducted within
churches have a positive impact on health (DeHaven et al., 2004). However, few church
based health promotion programs have specifically targeted increasing physical activity
(Bopp et al., 2007). In addition, almost all church based studies target African American
congregations, and few studies publish outcome measures relating to successful program
components. Further research is needed to examine the role of the church in promoting
PA, and there is a need to determine the feasibility and efficacy of church based
interventions to increase PA among more diverse populations. Furthermore, DeHaven et
al. (2004) stated that only by increasing the evaluation components of church based
programs will it be possible to determine how the programs exert their impact. This
information can then be used to design effective interventions and ultimately improve
women’s health.

Walking

The prevalence of physical inactivity has been attributed to the general conception
that vigorous activity is the only alternative to gain sufficient health benefits from PA and
to the continuing promotion of structured and or planned physical activities as the main
method to improve health (Porter, 2003). As stated by Swartz (2003) individuals often
find it difficult to incorporate structured exercise into their previously sedentary lives.
Moreover, evidence suggests that about 50% of individuals who adopt a fitness program
will abandon it within 3 to 6 months (Franklin, 1988). As stated by Dishman &
Buckworth (1996) there is a need to find novel ways to increase physical activity in a
largely sedentary US population, who in general find vigorous physical activity aversive and who frequently cite inconvenience and lack of time as barriers.

One way to overcome barriers to participation in physical activity that has been increasing in popularity over recent years is the promotion of Lifestyle Physical Activity (Dunn, Anderson, & Jakicic, 1998). Lifestyle physical activity is defined as the daily accumulation of at least 30 minutes of self-selected activities, which include all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and can be planned or unplanned activities that are part of everyday life (Dunn, Anderson, & Jakicic, 1998). Lifestyle physical activity represents an alternative method to meeting recommendations for PA \(^1\) \(^2\) (Dunn et al., 1998).

Walking is a mode of Lifestyle Physical Activity (LPA) and provides a viable alternative for meeting the current recommendations for PA. Walking can be planned or unplanned, accumulated and/or continuous, and therefore easily integrated into everyday life (Ziegel, Brackbill & Heath, 1995). As noted by Siegel et al. (1995) walking is especially promising as a focus of intervention because of its accessibility and acceptability, particularly among populations with a low prevalence of PA. Walking is the most common form of PA among the general population and among major subpopulations such as older persons and ethnic minorities (Siegel et al., 1995). It is

---

1 In 1995, the Centers for Disease Control and Prevention, and the American College of Sports Medicine recommended that all US adults should participate in 30 minutes or more of accumulated moderate intensity physical activity on five or more days of the week (Pate et al., 1995).

2 In February 2003, an expert panel updated the original CDC/ACSM recommendations to state that all healthy adults aged 18 to 65 years old need a minimum of 30 minutes of moderate intensity aerobic (endurance) PA on five days each week. Moderate intensity PA, generally equivalent to a brisk walk can be accumulated towards 30 minutes by performing bouts lasting 10 or more minutes (Haskell et al., 2007).
estimated that nearly 4 out of 10 US adults walk for exercise, and for most walkers (56.7%) walking is their only form of leisure time physical activity (Rafferty et al., 2002). Vigorous activity on the other hand, has been noted to be more infrequent and intermittent (Masse et al., 1998). Finally, walking has also been found to confer many health and economic benefits (Hu et al., 2000; Manson et al., 2002). A review by Mokdad et al. (2000) indicated that combined, poor diet and physical inactivity amount to the second leading cause of death in the US, with nearly 400,000 deaths attributed to this combination of factors. This increase from 300,000 deaths reported in 1993 occurred in spite of an abundance of evidence linking health benefits to regular exercise (McGinnis, 1993; USDHHS, 1996). Moreover, a study conducted by Jones and Eaton (1994) suggested if 10% of US adults began a regular walking program, $5.6 billion could have been saved from coronary heart disease costs alone in 1994. Despite its wide appeal, the prevalence of sufficient walking to gain health benefits is low (8% to 15%; Merom et al., 2006). Therefore, effective strategies to increase walking are warranted.

Pedometers have been used as both an objective measure of PA and more recently as a method to increase lifestyle PA in intervention studies, in particular walking (Tudor-Locke et al., 2004). Wearing a pedometer provides not only a cue to being more active but can assist with goal setting and attainment as they provide social ecological feedback about activity levels (Heesch et al., 2005). According to King (1997), an effective method to improve health is through promotion of simple, realistic, attainable lifestyle physical activity through the use of behavior strategies such as self-monitoring, feedback and goal setting. Pedometers are simple to use, inexpensive, and measure walking with
acceptable accuracy (Tudor-Locke et al., 2002, 2004). Moreover, pedometers are relatively easy to disseminate and therefore have the potential to reach individuals who might not otherwise participate in structured exercise programs (Merom et al., 2007).

Similar to the church studies, a limitation with pedometer intervention research thus far is a failure to conduct and report evaluations of successful program components. Moreover, interventions often lack a control or comparison group, and few studies have examined the efficacy of pedometer interventions with non clinical populations.

Current evidence emphasizes the importance of creating programs to increase the adoption and maintenance of physical activity that are feasible, effective for individuals and encompass multiple levels of the social environment. What is more, a fundamental question in health promotion is establishing how interventions produce behavior change (Flay, 1986).

Evaluation

The word value, is embedded within evaluation, therefore in health behavior terms, evaluation is the systematic process of deciding the value or worth of a given health behavior program (Worthern, Sanders & Fitzpatrick, 1997). A comprehensive evaluation incorporates process, impact and outcome evaluation, all of which are functionally related to one another.

Working backwards, the purpose of the outcome evaluation is to determine whether the long term objective of the program is attained. In terms of physical activity promotion the long term objective of a given program is generally defined in terms of a
change in health status\(^3\). It would be difficult to justify both to participants and funding agencies why an intervention is important unless we can provide evidence for the value of a program. A change in health status is of value to participants in that it can improve quality of life and to the larger population by increasing productivity and reducing the economic burden of chronic disease.

The purpose of an impact evaluation is to determine the short term social ecological impact of a health program. Behavior is a central tenet of health education; all health education programs attempt to bring about a change in health through change in behavior, such as change in physical activity behavior (Glanz, Lewis, & Rimer, 2001). Impact evaluation, therefore, can be used to determine the impact of the intervention on behavior, for example, physical activity behavior.

Impact evaluation also provides a systematic way of considering the role of theory in intervention by identifying what components of the intervention are successful and why (Baranowski, Anderson & Carmack, 1998). Ideally, interventions are grounded in theory and program components are designed to influence the theoretical constructs that are thought to influence behavior change. Theories specify the relationships between constructs, which are then used to predict or explain changes in behavior (Kerlinger, 1986). For instance, an assumption within Social Cognitive Theory (SCT; Bandura, 1986) is that change in the theoretical construct self-efficacy results in behavior change.

---

\(^3\) As the link between health and physical activity is well established, the current study utilized only impact and process evaluation and not outcome evaluation methods.
Therefore, a physical activity intervention grounded in SCT would attempt to change self-efficacy as a method to change physical activity behavior.

Few church-based physical activity studies or pedometer studies report outcomes relating to the theoretical constructs on which they are based. Without reporting change in these constructs, it is not possible to determine why or why not the intervention was successful (Hallum & Petosa, 1998). Is the intervention ineffective because the program components did not change the theoretical constructs? Or because change in the theoretical constructs was insufficient to change behavior? Investment in the construct validity of the treatment enables researchers to begin to answer this question. Construct validity involves using impact evaluation methods to determine the ability of the intervention to change the constructs on which it is based, and the importance of those constructs in supporting behavior change (Hallum & Petosa, 1998), thus providing an investment in theory testing (Green & Lewis, 1986).

A second step that can be taken in the construct validation of a study is to examine whether change in the theoretical constructs account for a significant proportion of the variance in the outcome variable (physical activity) over and above the intervention itself. If this latter finding is reported the theoretical construct is said to mediate the impact of the intervention on the outcome or dependent variable (DV). A mediator has been described as an “intervening causal variable” that is on the pathway between the intervention and behavior (Bauman et al., 2002, p.7). According to the framework outlined by Baron and Kenny (1986) a variable functions as a mediator when it meets the following three criteria: 1) Variation in levels of the independent variable
(IV), in this instance the intervention, significantly account for variation in the hypothesized mediator (social environment variables), 2) Variation in the mediator significantly accounts for variation in the dependent variable (DV: physical activity) 3) When both the IV and mediator are regressed on the DV, a previously significant relationship between the IV (intervention) and DV (physical activity) no longer exists.

True mediation is purported to occur if when the mediator is controlled, the intervention has no effect on behavior (Baranowski, Anderson & Carmack, 1998). As it is unlikely that one variable fully explains behavior change, it has been suggested that attenuation may be a more likely goal (Baron & Kenny, 1986).

a. Partial Mediation

b. True Mediation

*Figure 1.1: Mediation (Barron & Kenny, 1986). Where: A = Health Intervention, B = Hypothesized Mediator, and C = Behavior*

Understanding the factors that influence physical activity behavior is a basic research concern and crucial to developing and evaluating strategies to increase adoption and maintenance of physical activity (Bauman et al., 2002). Factors that demonstrate reproducible associations with physical activity or are able to predict behavior are known as correlates (Bauman et al., 2002). Correlation is a statistical technique that is used to measure and describe a relationship between two variables, X and Y. If the relationship is positive, both variables change in the same direction. If the relationship is negative,
they change in opposite directions i.e. every time X increases, there is a corresponding
decrease in Y. If two variables are known to be related in some systematic way, it is
possible to use one variable to make predictions about another. Correlational research
has both theoretical and practical uses (Bauman, et al., 2002). Theoretically, hypotheses
derived from a given theory can be tested by examining the correlation between two
variables. Practically, correlational studies generate hypotheses about possible causal
relationships and about potential mediators that can be targeted in intervention studies
(Bauman et al., 2002). However, it should be noted that correlation simply describes a
relationship between two variables it does not explain why the variables are related. A
correlation should not and cannot be interpreted as proof of a cause and effect
relationship between variables (Bauman et al., 2002). The main value of correlational
research comes from its ability to identify possible mediators of physical activity
behavior change. Although, not all correlates are necessarily mediators, all mediators are
correlates (Kraemer, et al., 2001). Correlates that are consistently identified to be
associated with physical activity should be examined as possible mediators of behavior
change and thus future targets for intervention. On the other hand, correlates that show
an inconsistent or inexistent relationship with physical activity would not be a sensible
choice to target in physical activity interventions. Therefore, it is first necessary to
examine correlations among theoretical variables and behavior, prior to testing for
mediation.

Correlation research can help to identify not only potential mediators, but also
moderating variables. A moderator is equivalent to a statistical interaction, and can
affect the direction and strength of the relation between the intervention (IV) and DV (Baron & Kenny, 1986). A moderator can be qualitative (race), or quantitative (level of education). Demographic correlates are important to examine as they can provide insight into characteristics of the population that may moderate the impact of the intervention. Within the PA field, it is becoming more apparent that one intervention does not fit all (Mihalko et al., 2004). A key issue therefore is to find what types of interventions work for different groups. Identification of moderators can aid in this process.

Process evaluation is concerned with the fidelity of the intervention’s implementation, appropriateness, and site or recipient response to the program (Green & Lewis, 1986). Implementation is concerned with whether or not the program is being delivered as intended. Type III errors can occur when program failure is attributed to inadequacies in the program itself, when in fact the program was not delivered as intended (Basch et al., 1985). Process evaluation can be used to determine whether all parts of the program are being implemented, whether all parts of the program are reaching the intended population, and how much of the program is necessary to change theoretical constructs and thus change behavior. Bauman et al. (2002) described process variables as subsets of mediators that describe the extent to which the program was actually implemented.

Process evaluation is also concerned with the appropriateness of the intervention. Process measures can be used to determine whether the program components and materials are appropriate for the target population, and qualitative methods such as interviews, focus groups or open ended questions can provide a measure of satisfaction of
the recipients of the program. Without process evaluation, it is not possible to determine whether lack of impact on the primary outcome variables is due to the program itself being irrelevant or inappropriate for the target population, or whether program components were not delivered as intended.

Only by fully understanding the cause of an intervention’s success or failure, can we modify and improve theory, and thus design effective interventions to ultimately change physical activity behavior and impact public health.

**Stages of Research**

In 1986, Flay outlined a series of eight stages that research should progress ranging from basic research to demonstration studies. The first five stages are concerned with determining program efficacy, which measures whether the intervention does more harm than good when delivered under optimal conditions and is related to the internal validity of the intervention⁴.

The first stage, *Basic Research* involves examining the epidemiological evidence to identify the relationship between risk factors, in this instance physical activity and chronic disease. The second stage, *Hypothesis Development* involves identifying descriptive and cross-sectional studies to examine personal and environmental variables that are associated with physical activity and are amenable to change through intervention. Resultant from this stage, relevant theories are selected and hypotheses

---

⁴ Internal validity is the assurance or certainty that the results you obtained were due to the study itself and not due to other factors.
formulated relating to the identified variables and physical activity. The third stage is *Pilot Applied Research*, or pilot studies. As outlined by Flay, pilot studies should be employed for the preliminary testing of new approaches to achieve social ecological effects relating to specific health promotion goals. Pilot tests involve using pre or quasi-experimental designs on a small scale with few units per condition. The fourth stage, *Prototype Studies* is concerned with small scale tests of programs refined through the previous stage.

The latter three stages; *Effectiveness Trials, Implementation Effectiveness*, and *Demonstration Studies* are concerned with examining the effectiveness of a given program. Effectiveness trials examine whether the intervention does more harm than good when delivered under real-world conditions, and is related to external validity\(^5\).

The relationship between physical activity and chronic disease has been well established. Likewise, cross-sectional research has demonstrated consistent positive associations between physical activity, intrapersonal, interpersonal and organizational variables (Trost et al., 2002; Bauman et al., 2002) supporting the selection of a social ecological model to target multiple levels of support for physical activity. Owing to the dearth of church based physical activity studies reporting outcomes relating to theoretical constructs, little is known about the efficacious components of church based programs. Therefore, the current study targeted the third stage of research put forth by Flay (1986) and is an exploratory pilot test of the efficacy of a social ecological intervention

\(^5\) External validity is concerned with the extent to which your results can be generalized when delivered under typical conditions.
implemented through churches, to increase physical activity. According to Flay (1986), it would be unwise to plan an effectiveness trial of a program of unknown efficacy. Likewise, little is known about the correlates of steps/day measured by pedometers. In the dietary area, there is some suggestion that behavior is more predictable if one focuses on limited classes of behavior. Baranowski, Anderson & Carmack (1998) suggested that PA does the same by developing separate models for walking, gardening, jogging and so forth. Therefore, in the present study associations between steps/day, social ecological variables and participant demographics were examined to identify possible mediators and moderators of change in steps/day.

**PURPOSE**

The primary purpose of the study was to evaluate the efficacy of a social ecological intervention to increase daily walking among sedentary females compared to a self-monitoring only condition. The study was based on the social-ecological model proposed by McLeroy et al. (1988), and targeted intrapersonal (self-efficacy and self-regulation), and interpersonal variables (social network and group cohesion) and was delivered at the organizational level (church). There were four secondary purposes to this study. First, we sought to evaluate the utility of the intervention to change the intrapersonal and interpersonal variables on which the study was based. Impact evaluation methods were used to examine the impact of the intervention on changing daily walking and the social environmental variables. The second purpose was to
examine associations between changes in these variables with change in daily walking to identify potential mediators of behavior change. Associations between change in daily walking and participant characteristics were also examined to identify potential moderators of behavior change. Thirdly, process evaluation methods were used to examine the relationship between fidelity of program implementation, and group cohesion to daily walking. Finally, process evaluation methods were used to determine appropriateness of program content, and overall participant satisfaction.

RESEARCH QUESTIONS

The current study was designed to answer the following research questions:

*Primary Research Question:*

1. Did the social-ecological intervention increase steps/day over time?
2. Did the social-ecological intervention increase steps/day over and above the self-monitoring only comparison group?

*Secondary Research Questions:*

1. Did the social-ecological intervention increase self-efficacy over time?
2. Did the social-ecological intervention increase self-efficacy over and above the self-monitoring only comparison group?
3. Did the social-ecological intervention increase self-regulation of walking over time?
4. Did the social-ecological intervention increase self-regulation of walking over and above the self-monitoring only comparison group?

5. Did the social-ecological intervention increase social support for physical activity over time?

6. Did the social-ecological intervention increase social support for physical activity over and above the self-monitoring only comparison group?

7. Did the social-ecological intervention increase social network support for physical activity over time?

8. Did the social-ecological intervention increase social network support for physical activity over and above the self-monitoring only comparison group?

9. Was change in social ecological variables associated with change in steps/day?

10. Were participant demographic characteristics associated with change in steps/day?

11. Was group cohesion in participants of the social-ecological intervention condition associated with change in steps/day?

12. Was program dose of participants of the social-ecological intervention condition associated with change in steps/day?
DEFINITION AND TERMS

The following definitions and terms were adopted for the current research:

Body Mass Index (BMI)

BMI is defined as the individual's body weight divided by the square of his or her height.

Operational Definition:

BMI was operationally defined as self-reported weight in kilograms divided by self-reported height in meters squared.

*Normal weight:* Normal weight was operationally defined as individuals with a BMI \( \geq 18.5 \) to \( \leq 24.9 \) (ACSM, 2000)

*Overweight:* Overweight was operationally defined as individuals with a BMI \( \geq 25 \) to \( \leq 29.9 \) (ACSM, 2000)

*Obese:* Obese was operationally defined as individuals with a BMI \( \geq 30 \) (ACSM, 2000).

Group Cohesion

Group cohesion is defined as a “a dynamic process which is reflected in the tendency of a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs” (Carron, Brawley, & Widmeyer, 1998, p. 213). The construct is viewed as multi-dimensional with four
dimensions, which are group integration – social (closeness and bonding within the group related to social aspects of the group) group integration – task (closeness and bonding within the group related to group goals and objectives), individual attraction to the group – social (individual feelings about the group pertaining to aspects of social relationships), and individual attraction to the group – task (individual’s feelings about the group pertaining to matters of group goals and objectives).

Operational Definition:

Group cohesion was operationally defined as the tendency of the walking group to stick together and remain united in the pursuit of walking goals and objectives. Group Cohesion was measured using the Physical Activity Group Environment Questionnaire (PAGEQ; Estabrooks & Carron, 2000). The PAGEQ consists of 21 items with four subscales measuring each dimension of cohesion: group integration – social, group integration – task, individual attraction to the group – social, and individual attraction to the group task. Total mean score for the instrument was used to form a single measure of group cohesion.

Group: Group was operationally defined as individuals who were also participating in the church based walking program, and who attended the same educational sessions in terms of time and place. Cohesion is considered by social scientists as an important variable for small groups (Spink & Carron, 1994). Therefore, group was defined as a minimum of two women and a maximum of 12 women to enhance cohesion and interaction through a small and manageable size.
Lifestyle Physical Activity

Dunn et al. (1998) defined lifestyle physical activity as the accumulation of at least 30 minutes of self-selected activities, which include all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and can be planned or unplanned activities that are part of every day life.

*Operational Definition:*

For the purpose of the study, lifestyle physical activity was operationally defined as walking. Walking was measured by a Yamax 200 DigiWalker pedometer and operationalized as average steps per day. Average steps per day were calculated by summing total steps per week, and dividing total steps by the number of days over which they were taken.

Organization

Organization is defined as support stemming from social institutions with organizational characteristics such as worksites, schools and churches (McLeroy et al., 1988).

*Operational Definition:*

Organization was operationally defined as the church to which the individual belongs or attends.
Physical Activity

Physical activity (PA) is defined as any bodily movement produced by skeletal muscles that results in energy expenditure (EE), and is defined as closely related to but distinct from exercise and physical fitness (Blair et al., 1992). Exercise is a sub-component of PA and involves planned, structured, repetitive bodily movement with the purpose of improving health, or one or more components of physical fitness (Casperson, Powell & Christenson, 1985). Physical activity can be further subdivided into aerobic, and anaerobic, and different domains of physical activity. Leisure Time Physical Activity (LTPA), and occupational physical activity (OPA) are the two principal domains of physical activity that have been examined most often in relation to health (Howley, 2001). Occupational physical activity is usually referenced as work related activity within an 8-hour day, whereas the duration of LTPA is more variable, and includes all forms of aerobic activities, structured endurance exercise programs, resistance-training programs, and sports (Howley, 2001). Physical activity can be quantified in a variety of ways, most often by frequency, intensity, duration and/or physical activity energy expenditure (PAEE; Welk, 2002).

Operational Definition:

For the purpose of the study, physical activity was defined as moderate and/or vigorous physical activity that was planned or unplanned, and continuous for 10 minutes or longer. Total weekly minutes of participation in moderate or vigorous, planned or unplanned physical activity was determined using the 7-day Recall of Exercise Questionnaire (7DRE-Q; Petosa, 1995).
Moderate intensity PA: Moderate intensity physical activity was defined as any form of physical activity that was continuous for 10 minutes or longer that mildly elevated heart rate, and mildly elevated breathing yet it was still possible to hold a conversation during the physical activity.

Vigorous intensity PA: Vigorous intensity physical activity was defined as physical activity that was continuous for 10 minutes or more, rapidly elevated heart rate, and breathing was rapid and deep, and was not possible to hold a conversation during the physical activity.

Self-Efficacy

Self-efficacy is defined as beliefs regarding an individual’s capabilities to produce performances that will lead to anticipated outcomes (Bandura, 1997). McAuley & Milhalko (1998) distinguished between task self-efficacy, where motor skills and capabilities are assessed (e.g., walking a certain distance), and self-regulatory or coping efficacy, where efficacy is assessed relative to impediments or challenges to successful behavioral performance (e.g., carrying out a walking regime in the presence of foul weather).

Operational Definitions:

Self-regulatory self-efficacy: Self-regulatory self-efficacy was operationally defined as an individual’s confidence that she can be physically active in the face of personal, social and environmental barriers. Self-regulatory self-efficacy for physical activity was measured using the self-efficacy scale.
developed by Garcia & King (1991) and adapted in the present study to be specific to walking. The instrument consists of items that assess the respondent’s ability to be physically active when faced with certain social, personal and environmental barriers to PA, such as time, weather, and family demands.

*Task self-efficacy:* Task self-efficacy was operationally defined as one’s belief in their capability to complete gradations of walking (McAuley & Mihalko, 1998). Task Self-Efficacy was assessed using items developed by McAuley & Mihalko (1998), and adapted specifically for walking. Respondents were asked to rate their confidence for five statements relating to their belief they can participate in moderate intensity physical activity on a scale of 0 to 100% (0 = I cannot do it at all to 100% = I am certain that I can do it). The first statement measured the respondent’s ability to participate in 5 minutes of moderate intensity physical activity without stopping, the next statement 10 minutes, and so forth up until duration of 30 minutes without stopping in statement five. Total mean scale scores were used to calculate task self-efficacy for walking.

**Social Ecological Model**

The Social Ecological Model is defined as a framework with one or more levels to explain and describe behavior, including intrapersonal variables, and extra personal environmental variables (Spence & Lee, 2003).
**Operational Definition:**

The social ecological model was defined as a framework that incorporates intrapersonal (self-efficacy and self-regulation), interpersonal (social support and social network, and group cohesion), and organizational levels (church), and defines the social environment as the main mechanism for change.

**Self-Monitoring**

Self-monitoring typically refers to keeping written records of physical activity behavior (USDHHS, 1996).

**Operational definition:**

Self-monitoring was operationally defined as the recording of total steps/day counted by the pedometer and the recording of total daily steps/day in walking logs.

**Social Network**

Social network refers to the collective structure of social relationships that surround an individual, and provides information on how an individual is integrated with others (Institute of Medicine, 2001), including structural (e.g., number, type, density, proximity) and interactional (frequency, durability, and intensity) aspects of social relations. Social network is distinguished from social support in that the former refers only to the linkages between people that may or may not provide social support.
Operational Definition:

Social network was operationally defined as the interaction (frequency of contact and degree of support received and provided to each of the social network members) between the respondent and her social network. In the present study two types of social network members were examined, which were friends/family/partner and church.

Support Network was measured using a shortened version of the University of California Social Support Inventory (UCLA-SSI: Dunkel-Schetter, Feinstein & Call, 1986) adapted specifically to measure desire for support and amount of support received and provided from social network members, specifically friends/family/partner, and church. Total mean scale scores were calculated to measure support from each social network source.

Family: Family was operationalized as a relative (not including spouse).

Friend: Friend was operationally defined as an individual with whom the participant has a close interpersonal relationship, but not including a romantic partner, or family member.

Partner: Partner was defined as an individual with whom the participant has a close romantic relationship (including spouse).

Church: Church was operationally defined as members or attenders of the church in which women were participating in the study.
Self-Regulation

Self-regulation refers to setting goals, evaluating one’s performance and adjusting one’s behavior to achieve these goals in the context of ongoing feedback (Bandura, 1986).

Operational Definition:

Self-regulation for walking was operationally defined as the use of methods to overcome barriers to walking and regulate walking behavior, including scheduling time for walking, monitoring walking, goal setting and planning for relapse. Self-regulation was measured using an instrument developed by Anderson et al. (2006) for a church based intervention with African American congregations. The instrument was adapted for the current study to be specific to walking.

Social Support

Social support is the function of interpersonal relationships, and has been defined as “the aid and assistance exchanged through social relationships and interpersonal transactions” (Heaney & Israel, 1997 p.181).

Operational Definition:

In the present study, social support was operationally defined as the function of the individual’s support network according to the six functions outlined by Weiss (1974). These functions are guidance (advice or information), reliable alliance (assurance that others can be counted on for tangible assistance), reassurance of worth (recognition of one’s competence, skills, and value by others), opportunity of nurturance (sense that others rely on one for their well being), attachment (emotional closeness from which one...
derives a sense of security), and *social integration* (sense of belonging to a group that shares similar interests, concerns and recreational activities). Social support was measured using the Social Provisions Scale for Physical Activity (Duncan & McAuley, 1993) that is based on the functional model proposed by Weiss. The total mean scale score was determined to provide a single measure of social support.
CHAPTER 2

Literature Review

Introduction

A comprehensive review was conducted to examine literature relevant to the purpose of the study. Medline and Psychinfo databases were searched entering key words in different combinations such as “Women,” “Social Ecological Model,” “Social Environment,” “Church,” “Physical Activity,” “Walking,” “Pedometer,” “Step Counter,” and “Intervention/Behavior change.” The literature review spans relevant research published up until February 2008.

The first section of the review presents findings from the literature, which support the utilization of a social ecological model as a framework for interventions to increase physical activity among women, in particular the implementation of interventions through churches (see Table 2.1). The second section reviews the literature pertaining to the feasibility of promoting walking to reduce the prevalence of physical inactivity among women with particular attention given to pedometer based studies (see Table 2.2).
Awareness of the influence of the social and physical environment on health and disease is not a new concept. In 1847, Rudolf Virchow stated that social, economical, and political factors were as influential in the typhoid epidemic as biological and physical factors. In the 1950’s Lewin proposed the concept of *lifespace* in that behavior is a function of the person and his or her environment (Moos, 1979). In 1973 Lipowski called for a combined ecological and psychosomatic approach that views people as psychobiological entities in dynamic interaction with the environment, and in 1976 Cassel purported that “disease with rare exception has not been prevented by treating sick individuals but rather by modifying environmental factors facilitating its occurrence” (In Stone et al., 1979., pp. 524).

As noted by Breslow (1998), in the last few decades health education in general has witnessed a shift from individually focused behavior change methods to an ecological approach. Stokols (1996) illustrated this shift by the broadening of health education in the 1970’s and 1980’s to encompass health promotion. Green (1980) defined health education as “any combination of learning experiences designed to facilitate voluntary adaptations of behavior” (In Glanz, Rimer & Lewis, 2002, pp. 8), thus focusing on the individual as the main mechanism for change. Health promotion, however, places a greater emphasis on the role of persons, groups, and organizations as active agents in
shaping health practices to optimize both individual and collective well-being (USDHEW, 1979).

Green & Kreuter (1991) defined health promotion as “any combination of health education and related organizational, economic, and environmental supports for behavior of the individual, or communities conducive to health” (In Glanz, Rimer & Lewis, 2002, pp. 9). Green & Kreuter (1991) emphasized that the two concepts of health education and health promotion are overlapping and intertwined, in that health promotion does not replace health education, but rather health promotion is a critical adjunct to health education. Green & Kreuter (1991) argued that health promotion without health education may be perceived as a socially engineered manipulated enterprise, but on the other hand efforts to change a person’s behavior may go unheeded if the person is not ready or is unmotivated to change (Stokols, 1996).

The Social Ecological Model

The term ecology refers to the study of relationships between organisms and their environments (Hawley, 1950). In ecological models, the term environment simply refers to the space outside of the person (Stokols, 1992). Whereas environmental psychologists are primarily concerned with the influence of the physical environment on behavior, the ecological approach construes the environment as multi-dimensional with influence derived from both the physical and social environment (Stokols, 1996; & Moos, 1979).

According to Moos (1979), developments in ecological psychology emerged out of work by both Kurt Lewin and Rodger Barker, as eco- behavioral science founded by
Barker (1968) shifted the focus from the individual to behavioral settings, such as the classroom, school or place of worship. And Lewin who was influenced by the Gestalt tradition\(^6\) coined the phrase *ecological psychology* for the study of the influences on the person from the perceived social and physical environment (Cartwright, 1951).

The suffix *model* emphasizes that the social ecological perspective refers to a framework rather than a theory (Moos, 1979). An advantage therefore is that relevant theories or theoretical constructs can be integrated into each level of the model to target behavior change (Smedley & Syme, 2000). The prefix *social* emphasizes that although the social ecological perspective considers the influence of both the social and physical environment, the mechanism for behavior change is considered within a social context, including friends, family, work, church and neighborhood associates, and formal and informal health organizations (Fleury & Lee, 2006). The social environment is more malleable to change than the physical environment, and it is thought that by changing the social climate, particularly through increasing cohesion and support for behavior change, collective action can be taken to change the physical environment (Cohen, Glass, & Phillip, 1977).

The social-ecological perspective focuses on the nature of peoples’ transactions with their environment (Stokols, 1992). Within this framework, transactions are mutual; the environment can directly influence a person’s health and behavior, and individuals can modify the healthfulness of their environment through individual and collective

---

\(^6\) The Gestalt tradition was concerned with studying mental and behavioral processes as a whole in their naturally occurring contexts (Dzewaltowski, 1997).
action (Pervin, 1968). Moreover, it is thought that the social and physical environment have a direct as well as an indirect impact on health through health behavior (Moos, 1979) and/or perception (Sallis & Owen, 2002). Gibson (1979) defined perception as an act of attention, in which the active individual extracts information from the environment. Within his perspective, the objective component of perception is the information available in the environment (direct), and the subjective component is the individual’s perception of the information (indirect). In support of this distinction, Sallis et al. (1990) found that objective measures of convenience to exercise facilities versus perceived convenience to exercise facilities were predictive of exercise status.

Consideration of the direct influence of the environment on health, and indeed on health behavior is a defining feature of the social ecological framework, distinguishing it from interpersonal theories of behavior (Dzewaltowski, 1997). Interpersonal theories hypothesize that environmental influences are mediated through psychological processes. For instance, in Social Cognitive Theory (Bandura, 1986) cognitions such as self-efficacy and outcome expectancies play a major role in influencing people’s interaction with the environment and behavior, however the theory does not consider the possibility of external influences having a direct impact on behavior (Spence & Lee, 2003). Dzewaltowski (1997) noted that in Social Cognitive Theory (SCT), emphasis is placed on the self-regulation of behavior rather than the environmental regulation of behavior. Sallis & Owen (1996) noted that a main challenge in determining a direct effect of the environment on behavior is that few measurement tools exist that enable both objective and subjective assessment of the physical and social environment.
A further defining feature of social ecological models is their incorporation of two or more analytic levels that include intrapersonal factors relating to the individual and extra-individual levels of the environment (Spence & Lee, 2003). Intrapersonal influences include individual attitudes such as beliefs and behaviors, while extra individual influences can include interpersonal relationships, organization, policies and/or environmental topography (Spence & Lee, 2003). One of the earliest social-ecological frameworks proposed is that by Brofenbrenner (1979). Brofenbrenner (1979) viewed behavior as being affected by and affecting multiple levels of influence, which are micro, meso, exo systems and macro system levels. The micro system refers to the face-to-face interactions in specific behavioral settings and their influence on behavior (e.g., interactions within family or church groups). The meso system refers to the interrelations among various behavior settings in which the individual is involved, such as family and church. The exosystem refers to forces within the larger social system in which the individual is situated, for example policies for PA in the worksite. Finally, the macro system refers to cultural beliefs and values that can influence both the microsystem and the macrosystem (Spence & Lee, 2003).

Cross-sectional data from the physical activity literature suggest that multiple levels should be studied to understand physical activity behavior, including individual, social and physical factors. Reviews by Trost et al. (2002) and Bauman et al. (2002) present evidence relating to a positive association between PA and intrapersonal variables, the social environment and to a lesser extent the physical environment. Likewise, Sallis et al. (2006) recommended specifically the integration of models
incorporating environmental/ecological and psychosocial variables to understand PA behavior and bring about population change.

*The Social Ecological Model Proposed by Mc Leroy, Bibeau, Steckler & Glanz (1988)*

Based on the work by Broffenbrenner, Mc Leroy, Bibeau, Steckler and Glanz (1988) proposed a social ecological model for health promotion encompassing both the individual and multiple levels of the social environment. The model incorporates intrapersonal, interpersonal, organizational, community and public policy factors that are hypothesized by the authors to support and sustain healthy behaviors. In this model the intrapersonal level includes characteristics of the individual, such as knowledge, attitudes, behavior, self-concept, and/or behavioral skills. Interpersonal refers to transactions between the individual and formal and informal social network support systems such as family, work group and friendship networks. Institutional refers to support stemming from social institutions with organizational characteristics, and their formal (and informal) rules and regulations for operation (organizational level). Within this model, the fourth level (i.e., community) has three distinct meanings. Firstly, community refers to the mediating structures to which the individual belongs. Mediating structures can be family, informal social networks, or organizations such as worksites and churches (Berger & Neuhaus, 1977). Secondly, community is relationships between organizations and groups within a defined area, such as local schools, and/or health providers. Thirdly, community is defined in terms of geographical and political boundaries. Mc Leroy et al. (1988) emphasized that the latter definition neglects the
relationship component of a community; their social ecological framework emphasizes
relationship and considers not only relationships within single settings but also the
relationships between multiple behavior settings within the broader community and their
combined influence on health (Stokols, 1996). The final level, public policy, is
concerned with the influence of regulatory policies, procedures and local, state and
national laws to protect the health of the community (Runyan, et al., 1982). Policies have
been developed to facilitate change in the individual through environmental change, such
as public campaigns to increase awareness of a health issues or prohibiting smoking in
public places. McLeroy et al. (1988) contend that although policies provide an
opportunity to influence large scale health behavior change, change and sustainability
will depend on change at each level.

Working within an ecological model requires that measurement take place at
more than one of these levels. An advantage of this feature is that there are multiple
levels for intervention, and researchers can examine both individual level and aggregate
level influences on health behavior (Stokols, 1996). In the McLeroy et al. (1988) model,
the different levels are not considered to be all inclusive, but rather reflect the range of
strategies that researchers can select from for intervention and analysis. Stokols (1996)
suggested that two or more levels relevant to the study should be selected. As the present
study was an exploratory pilot test of the efficacy of a social ecological intervention to
change physical activity, the levels of intervention selected for the study were
intrapersonal and interpersonal, and the intervention was delivered at the institutional
(organizational, i.e., church) level. Justification for the inclusion of these levels and variables within each level is presented below.

Intrapersonal

The social ecological model does not diminish the important role of the individual, but rather shifts our focus to consider, as well, environmental variables that support the behavior change process (McLeroy et al., 1988). A number of intrapersonal processes have been found to have a consistent positive association with PA. Gender and age are two of the most consistent correlates of PA. Men are more active than women, and there is an inverse association between activity levels and age (Trost, et al., 2002). Likewise, research has consistently found a positive relationship between PA, level of income, education and occupational status (Bauman et al., 2002). Such variables would be considered moderators of behavior change, and therefore provide important insights into characteristics of the individual or population for which interventions are more or less effective (e.g., men versus women, and/or older versus younger populations), however such characteristics are not subject to experimental manipulation (Buckworth & Dishman, 2007). Rather, cognitive and psychological processes that are subject to change tend to be the focus for intervention in PA research.
Self-Efficacy and Self-Regulation

Two intrapersonal psychological constructs that have received consistent support for their association with physical activity are self-efficacy and self-regulation. Self-efficacy is a person’s confidence in his or her ability to perform a specific behavior and overcome barriers to performing that behavior (Bandura, 1986). Self-efficacy has been found to be important in the early stages of exercise adoption, and individuals with greater self-efficacy have been found to be more likely to adhere to an exercise program (McAuley, 1992). Self-efficacy is one of the most consistent correlates of PA across race, gender and age (Trost et al., 2002; Sherwood & Jeffrey, 2000). Sternfeld et al. (1999) found a positive association between self-efficacy and leisure time physical activity (LTPA) in a large sample of ethnic minority women. Likewise, a study conducted by Sanderson et al. (2003) found that self-efficacy was five times higher among active women, in comparison to a less active group.

Self-efficacy has also received support from intervention studies as a mediator of PA behavior change. A study by Miller & Trost (2002) found self-efficacy to partially mediate change in PA among mothers with young children. Likewise, a study by Dishman et al. (2004) confirmed that an experimental manipulation to increase self-efficacy mediated an increase in PA in a sample of young adolescent girls.

Self-regulation of PA is the use of methods to overcome barriers to physical activity and regulate physical activity behavior, including scheduling time for physical activity, goal setting, monitoring physical activity and planning for relapse (Hallum & Petosa, 1998). Lack of time is one of the most common barriers reported for physical
activity (Berg & Cromwell, 2002). With a diverse sample of women, Heesch & Masse (2004) found that participants’ perceptions about their lack of time for PA was not influenced by the number of minutes that they spent in occupational, household or recreational activities; women on average had approximately 28 hours of leisure time available to them per week, which they spent mainly in sedentary activities. The study implicates that providing women with the skills to plan accumulated PA into their day may improve participation in physical activity. Skills for coping with barriers to being physically active has likewise been found to have a consistent positive association with PA in cross-sectional studies (Trost et al., 2002; Bauman et al., 2002).

The positive role of self-regulation has also been supported in PA interventions. A worksite study conducted by Hallum & Petosa (1998) found that a brief four session educational intervention significantly increased self-regulation relative to a comparison group at 6 weeks, and at 6 and 12 month follow up. Moreover, self-regulation was found to mediate change in days of exercise behavior at posttest.

**Relationship to the Social Environment**

Within SCT, Bandura (1997) emphasizes the importance of both self-efficacy and self-regulation as key variables in PA behavior change. And, according to Bandura (1997), the influence of social support on exercise adherence is largely indirect through
self-efficacy beliefs\(^7\). In support, Duncan & McAuley (1993) found that self-efficacy mediated the relationship between social support and exercise adherence in middle aged adults. Cross-sectional studies and structural equation analyses have likewise provided support for the relationship between social support, self-regulation and self-efficacy.

Blanchard et al. (2005) examined whether weight status moderated intrapersonal and environmental correlates of PA in a random sample of adults. Intrapersonal variables included demographics, co-morbidities of obesity (e.g., hypertension, hypercholesterolemia), and self-efficacy. The interpersonal variable examined was social support. For the purpose of comparison, individuals were divided into tertiles by body mass index (normal weight, overweight and obese).

The study indicated that self-efficacy was significantly lower in obese individuals compared to the other weight groups, and the relationship between self-efficacy and PA was significantly weaker for obese individuals compared to the other two groups. On the other hand, social support predicted PA in all weight groups and the strength of the association was similar across groups. The results indicated an interaction between self-efficacy and social support for both the overweight and normal weight groups. As the level of social support increased, the number of days individuals were physically active increased, and the relationship was greater for those who had higher compared to lower self-efficacy. As suggested by Blanchard et al. (2005), the findings implicate that when developing a PA intervention it may be more optimal to manipulate both social support

---

\(^7\) The direct effect of a given variable is the portion of a variable’s total effect on physical activity that is independent of other variables, and the indirect effect is the proportion of the total effect that is dependent on other variables (Anderson et al., 2006).
and self-efficacy to increase PA, rather than social support or self-efficacy alone. This suggestion warrants future investigation.

Using structural equation modeling, Rovniak (2002) found that SCT accounted for 55% of the variance in PA among college students and consistent with Bandura (1997), social support influenced PA indirectly through self-efficacy. Moreover, in this study, self-efficacy influenced PA both directly and indirectly through self-regulation.

In a different study, McNeill et al. (2006) used structural equation modeling to examine the potential pathways through which social cognitive and ecological variables influence physical activity in a large community based sample. The researchers developed separate models to examine the relationship between self-efficacy, intrinsic and extrinsic motivation, social support from friends and family, neighborhood quality and availability of facilities for physical activity with walking, and moderate and vigorous intensity physical activity. In all models, the social environment (social support from friends and family) and motivation accounted for 42% of the variance in self-efficacy, and self-efficacy accounted for 15% of the variance in walking, 18% of the variance for moderate intensity PA and 21% for vigorous intensity PA.

Similarly, Anderson et al. (2006) tested a social cognitive model of physical activity with data from 14 churches in Southwest Virginia. The Social Cognitive model explained 46% of the variance in PA. In this study, self-regulation exerted the strongest total effect on PA accounting for 36% of the variance, with women being more likely to use SR skills than men. The more self-regulation participants reported the greater the level of PA ($\beta = .36$). The effect of social support from friends and family on PA was
largely indirect ($\beta = .20$) through self-efficacy ($\beta = .35$) and self-regulation ($\beta = .54$). The effect of self-efficacy on PA was largely direct (total $\beta = .12$, direct $\beta = .80$). The total effect of SR in the model exceeded SE, and interestingly, although self-efficacy was an important contributor to self-regulation, social support was more important. Social support increased self-regulation both directly and indirectly through self-efficacy. Anderson et al. (2006) suggested that PA interventions targeting the behavioral norms and modeling of family members may be an effective method to increase self-efficacy and self-regulation for PA, which in turn may then increase the likelihood of behavior change.

Of consideration, structural equation modeling and cross-sectional research suffer from the same limitation in that it is not possible to infer causal relationships. However, the findings do suggest that when presenting evidence related to the important role of the social environment on PA behavior, the discussion would be incomplete without also examining the role of intrapersonal variables such as self-efficacy and self-regulation. Moreover, in support of McLeroy et al. (1988) the findings suggest that although the ultimate target of intervention strategies is change in the individual, the proximal targets of intervention should perhaps be social influences.

Interpersonal

Compared to intrapersonal level variables we known less about the potentially modifiable social environment correlates of PA and how they are influenced by
intervention (King et al., 2002). In the model by McLeary et al. (1988) interpersonal represents relationships between the individual and his or her friends, family, work colleagues or any other formal or informal social groups, and the influence of transactions within these relationships on health behavior. During the mid 70’s to early 80’s social support was used to define the transactions or interactions within a given relationship (Veiel & Baumann, 1992), yet the exact nature of such transactions has not been clearly defined.

In a review of the literature, Hupcey (1998) concluded that there is no current universal agreement concerning either the theoretical and/or operational definition of the social support concept. Definitions adopted for social support include type of support provided (Cohen et al., 1985), perceptions of support received, satisfaction with support received (Procidano & Heller, 1983), intentions of the provider (Shumaker & Brownell, 1984), and reciprocal support (Antonucci, 1985). Hupcey’s (1998) findings suggested that the majority of the definitions imply a positive interaction or helpful behavior provided to another person (Rook & Dooley, 1985), but when operationalized for research, only a small facet of the social support concept is measured. He recommended that a more inclusive model would help researchers better understand how social support works and can be strengthened to produce positive health outcomes. Similarly, Vaux (1988) argued that social support is a metaconstruct and that a single universal definition of social support is inappropriate.

Cohen & Syme (1985) proposed that a simple distinction between functional and structural support captures most of the definitions and measures in the field. Structure
refers to the existence and types of connections within a social network and the extensiveness of a person’s social ties, such as marital status, network size and community membership (DiMatteo, 2004). Individuals generally belong to one or more social networks. Connections between these networks can be relatively *homogenous* (the same), or *heterogeneous* (diverse) (Cohen et al., 1997). Likewise, connections can be dense (all network members are linked) or sparse (individuals are loosely connected). McLeroy et al. (1988) purported that individuals who have primary membership in a dense, homogenous network are more likely to be influenced by the norms and values of that group compared to individuals who belong to multiple, less dense and heterogeneous groups. Network members may also serve different functions on account of the type of the support they provide. Support for health behavior has been assessed from a variety of sources including spouses, family, friends, and neighbors, co-workers and supervisors however, most physical activity studies examine only a single source of support, most commonly from friends and family and/or health care providers (Glasgow et al., 2000).

The functional aspect of interpersonal relationships refers to the type of support provided and perceptions of that support including appraisal of support availability and or perceived adequacy of support provided (Cohen, 1988). In general, types or domains of support include informational, emotional, and tangible/instrumental (DiMatteo, 2004). In relation to PA, support would be instrumental through giving a non-driver a lift to an exercise class, informational by telling a neighbor about a physical activity program, and emotional by calling a friend to see how she is getting on with her exercise program or to provide encouragement or reinforcement for learning a new activity or skill.
A number of investigators have also emphasized the transactional as opposed to uni-dimensional nature of social support (Hupcey, 1998; Rook, 1984). Reciprocal support is the exchange of resources between two or more individuals. Rook (1984) suggested that support, which is not reciprocated, might be perceived as negative. Non-reciprocity can occur if individuals perceive that they are providing more support than they receive, or if they receive more support than they can provide (Rook, 1984). Most existing tools used to assess social support do not consider the transactional nature of the concept (Vaux, 1997).

In 1974 Weiss proposed that theoretically social support consists of six relational provisions incorporating reciprocal support and the structural and functional aspects of support. The relational provisions within this model have been described with respect to physical activity by Motl et al. (2004), and include obtaining guidance (advice or information), reliable alliance (assurance that others can be counted on for tangible assistance), reassurance of worth (recognition of one’s competence, skills, and value by others), opportunity for nurturance (sense that others rely on one for their well being), attachment (emotional closeness from which one derives a sense of security), and social integration (sense of belonging to a group that shares similar interests, concerns and recreational activities). On account of the inclusiveness of this model and evidence to suggest its validity within the PA domain (Duncan & McAuley, 1993; Motl et al., 2004), Weiss’s conceptualization of social support as described by Motl et al. (2004) was adopted and examined in relation to PA in the present study.
**Interpersonal Relations and Health**

In spite of diverse research methodologies and disparities between definitions and measures of support, there is consistent evidence to suggest that higher levels of social support are related to improved health outcomes (Uchino et al., 1996). Significant relationships have been found between support and immunity (Cohen et al., 1997), mortality (House et al., 1988), and with health status and health behaviors (Glasgow et al., 1989). Prospective population based studies have illustrated a strong association between lower levels of social support and mortality, especially among women (Shumaker & Hill, 1991). The Alameda County study (Berkman et al., 1985) found that a decrease in the frequency of contact with network members, including friends, family, church membership and group affiliation was associated with increased mortality. The overall age adjusted *relative risk*\(^8\) (RR) was 2.3 for men, and 2.8 for women. Similarly, preliminary epidemiological evidence suggests that individuals who participate in diverse social networks (e.g., are married, interact with family members, friends, neighbors, and fellow workers, religious groups and so forth) have a longer life than individuals with fewer types of relationships (quality versus quantity: Vogt et al., 1992). As reported by House et al. (1988) the relative risk of mortality among those with less diverse networks is comparable to the relative risk between smoking and mortality from all causes. More recently, Cohen et al. (1997) found that individuals with more types of social ties (e.g.,

---

\(^8\) Relative risk (RR) is the ratio of the probability of an event (disease) occurring in an exposed group versus a non-exposed group. If the probability of developing CVD among sedentary females was 20% and 1% among active women, then the relative risk of CVD associated with inactivity would be 20.
friends, family, workmates, and groups) were less susceptible to developing a cold. This relationship remained significant after controlling for virus specific anti-body, age, sex, season, BMI, education and race and remained even after controlling for the number of people in the social network. The findings implicate that diversity rather than quantity of ties was the more important factor for immunity from a cold (Cohen et al., 1997). Moreover, susceptibility to colds decreased in a dose response manner with increased diversity of social network. Of relevance to the current study, Cohen et al. (1997) reported that lower levels of network diversity were associated with being a smoker and with insufficient exercise, suggesting that the findings may also be applicable to health behaviors and supporting the inclusion of two or more network members when examining the relationship between social networks and health.

Cohen et al. (1988) suggested several possible mechanisms that could account for the relation between social support and health including suppression of negative affect, enhanced immune system functioning, and/or the promotion of healthful lifestyles including increased PA.

*Social Support and Physical Activity*

Physical activity is a behavior inherently shaped by the social environment in that most activity occurs within behavioral settings with differing norms and values (Li et al., 2005). Social network membership provides access to support resources that can promote PA participation such as access to childcare or assistance with starting a PA program, and the provision of informational, tangible and emotional support can serve to
enable PA behavior. Cross-sectional studies have provided strong evidence for a consistent positive association between PA and social support, especially among women. Reviews by Trost et al. (2002), Bauman et al. (2002), and Sherwood & Jeffrey (2000) document social support from friends/peers and from family to have a strong positive association with PA. A longitudinal study of men and women found that women were more likely to adopt and maintain physical activity if recommended by family members, especially children (Eaton et al., 1993). Friend support also seems to play an important role in PA participation (King et al., 1990). A study by Gillette (1988) found that social interaction during exercise was an important determinant for exercise in women. Likewise, Mayo (1992) found that an exercise partner was the most predictive factor in maintaining a structured exercise program among African America women. And, a cross-sectional study by Eyler et al. (1999) found that regardless of ethnic group, women classified into medium or high support tertiles were much less likely to be sedentary than those with low or no support. The findings remained significant even when marital status, age, income, and education were considered. No differences were found between support from friends or family for any measure of PA, which was suggested by Eyler et al. (1999) to mean that the fact that some support exists is more important than the source of support.

With regards to different types of social support and their relationship with PA, a study by Thrasher et al. (2004) examined the relative importance of different types of social support, informational, emotional and tangible, in regards to diet, PA, and colorectal cancer (CRC) screening behavior. The study was based on Optimal Matching
Theory (OMT; Curtrona, 1990), which hypothesizes that the relative importance of type of support depends on the controllability of a behavior or event. The theory suggests that if an individual experiences an uncontrollable event such as death of a loved one or personal illness, emotional support is more important, whereas for events that are relatively controllable including health behaviors such as smoking or physical activity, informational and instrumental supports are more important. Optimal Matching Theory further suggests that social network members can be differentiated in terms of the different types of support they provide.

Findings from the study indicated that both emotional and tangible support were significantly related to PA, informational and tangible support were related to diet behaviors, and all three types of support were related to CRC screening. Subsequent regression models indicated a positive association between emotional support for women, though not for men, and the findings suggested that the influence of tangible support on physical activity was partially mediated by self-efficacy. With regards to the lack of association between PA and informational support, Thrasher et al. (2004) suggested that participants may already be aware of the benefits of physical activity and therefore may perceive this type of support to be irrelevant. Overall, the authors reported a relatively low level of agreement for support providers across the different behaviors suggesting that participants turn to different people for support depending on the health behavior.
Social Support Interventions

Both the structure and function of social support has received little empirical attention in their contribution to PA within the intervention literature (Eyler et al., 1999). There are few published accounts of interventions that are specifically designed to provide adults, especially women, with the skills to obtain social support for PA from different network members. Intervention research is important in order to allow tests of models or theoretical mechanisms and at the same time to examine the efficacy of these models or theories to improve PA outcomes and health (Barrera et al., 2006). A review of PA interventions by the Task Force on Community Preventive Service led to recommendations for social support interventions to increase PA levels, which include “buddy systems” walking groups, and exercise contracts with another person (Kahn et al., 2002).

In another review, Hogan et al. (2002) synthesized the findings from 100 studies that examined the effectiveness of social support interventions on disease and health behavior in general. He reported that although the majority of studies reported some beneficial effects of social support, researchers consistently failed to either include a measure of social support or report whether or not the intervention was successful in changing social support dimensions. Likewise, within the PA field few experimental studies have documented whether social support is sensitive to change through intervention, and whether social support in turn accounts for change in PA. Nevertheless, a number of studies were identified that targeted social support in PA interventions and
provide some evidence that social support based interventions can improve PA in midlife and older women (Kriska et al., 1986; Dunn et al., 1999).

An early intervention study by Kriska et al. (1986) provided postmenopausal women with information on walking, finding a walking partner, and support for walking over a 2-year period. Their findings indicated a 79% increase in the reported number of blocks walked in the intervention group, compared to a 16% increase in the control group. Project Active compared the impact of a lifestyle intervention emphasizing the accumulation of moderate intensity self-selected physical activities with a structured exercise group (Dunn et al., 1999). The structured group received an exercise prescription tailored to meet recommendations for vigorous intensity PA and received support from personal trainers, whereas participants in the lifestyle group received informational support and were encouraged to enlist support for PA from their own social network. Over a two-year period men and women in the lifestyle group increased support for PA, which in turn resulted in improvements in PA, energy expenditure (EE), and physiological parameters including reduced body fat and improved cardiorespiratory fitness. Moreover, change in PA and fitness values were similar to the results obtained by participants in the structured exercise group.

Findings from the above studies indicate that it is possible to increase social support with intervention and in turn PA, and provide preliminary evidence for social support as a mediator of PA behavior change.

A limitation of research in the PA domain is that studies most often examine support provided from one source, most commonly health care workers or friends and
family. Peterson et al. (2002) suggested that examining support from multiple sources enables investigators to determine the specific sources of support that are relevant to increasing PA among women. Similarly, Glasgow et al. (2000) contend that distal sources of support including the workplace, media, public policy, and other neighborhood and community factors also influence individual’s behavior. They recommended that intervention and assessment of multiple support dimensions is necessary as different network members, and/or behavioral settings influence people simultaneously.

Glasgow et al. (2000) developed a multi-level pyramid model of social environmental support related to disease self-management permitting study of the comparative and combined influences of different levels of support on health behavior. The model is based on the assumption that a wide array of organizations, activities and resources in most communities can be used to support efforts to maintain healthy behaviors. To test this model, the Chronic Illness Resource Survey (CIRS)\(^9\) was designed to measure multiple levels of support that influence self-management of chronic conditions. Seven sub-scales reflect seven levels of social environmental support, including 1) personal actions (disease management and all other), 2) family and friends, 3) health care team, 4) neighborhood and physical environment, 5) work and organizations, 6) community and region, and 7) media and policy. Items in the instrument are included to measure informational, emotional, instrumental and tangible support resources.

---

\(^9\) The 64 item CIRS and a brief (22-item) scale have been validated with patients who have heart disease, arthritis, diabetes and chronic obstructive pulmonary disease (COPD) among other chronic conditions.
Several intervention studies have provided support for the social ecological model proposed by Glasgow et al. (2000). Riley et al. (2001) conducted a pilot study with low-income clients with chronic illness, in an attempt to improve their use of socio-ecological resources supportive of disease self-management and self-management behaviors, including physical activity, dietary patterns and smoking. The conceptual framework for the intervention drew on constructs from SCT including self-efficacy and self-regulation strategies (Bandura, 1986).

Participants attending a community health centre were randomized to a treatment or a control condition to evaluate the intervention outcomes at one and three months follow up. At one month, participants in the intervention condition increased their use of social environmental resources significantly more than those in the control group, and, the use of support resources was evenly distributed across the CIRS categories, verifying the use of multiple sources of support for disease self-management. Of relevance to the present study, minutes of PA increased significantly more for participants randomized to the CIRS support condition in contrast to the comparison group (Cohen’s $d = .40$), providing preliminary support for a social ecological based conceptualization of disease self-management, including increasing physical activity behavior.

Similarly, Bull, Eakin, Reeves & Riley (2006) evaluated the influence of interpersonal and community level supports for physical activity and dietary behaviors among a sedentary low-income Latino population with multiple chronic conditions. Participants were enrolled in Resources for Health, a randomized control trial to promote
multi-level support for chronic illness self-management, and completed the CIRS, which has been validated with low-income Spanish speaking populations (Eakin et al., 2007). The findings indicated that Latinas with greater social support were more likely to meet guidelines for PA. Overall score on the CIRS as opposed to scores for support from independent sources was the only variable to remain a statistically significant predictor of meeting recommendations for PA. Bull et al. (2006) suggested that the finding implicates that overall support rather than support from a particular source may be a greater predictor of an active lifestyle. Nevertheless, the authors recommended further examination of the relative importance of each level of support for promoting health behavior change.

The Mediterranean Lifestyle intervention (MLT) is a six-month comprehensive lifestyle management intervention designed to target behavioral risk factors for coronary heart disease (CHD) for women (Toobert et al., 2005). The mechanism for change in this intervention is based on a combination of constructs from SCT (Bandura, 1986), goal systems (Karoly, 1993) and social ecological theory (Glasgow et al., 2000). Participants are taught self-regulation skills for the target behaviors, including goal setting, overcoming barriers and increasing supportive resources (Glasgow et al., 2000). A study by Barrera et al. (2006) examined the impact of the MLT on diet, PA, and stress management among postmenopausal women with type II diabetes. The authors administered the CIRS (Glasgow et al., 1998) along with the Social Network Index (Cohen et al., 1997) to measure social integration and diversity, and the Medical Outcomes Study (MOS) Social Support Survey to measure perceived support.
Findings from the study indicated that changes in social ecological resources measured by the CIRS mediated the intervention’s effect on fat consumption, physical activity and glycemic control. The Social Network Index significantly mediated the intervention’s effect on PA change only. Interestingly, the intervention did not have an effect on participant’s perceived support. Barrera et al. (2006) suggested that that as the MOS was not designed as an outcome measure it may not be sensitive to intervention.

It should be noted that MLT is an intensive six-month intervention. Although, the literature suggests that intensive interventions produce better outcomes, they consequently have lower participation rates, especially for women (Haskell, et al., 1994). Therefore, it is not clear whether such a program would be feasible for most women to maintain in the long term. Regardless, the study provides support for a social ecological approach to increasing PA among post-menopausal women with type II diabetes.

A limitation of the intervention studies discussed thus far is that the social-ecological model developed by Glasgow et al. (2000) is specific to disease self-management and to individuals with chronic disease. It is not clear to what extent the results are generalizable to other non-disease populations. However, a study by Miller et al. (2002) was identified that examined the influence of multiple support sources on PA among a non-clinical population. The study examined the efficacy of two strategies, print material only versus print and community development to increase the proportion of women with young children meeting guidelines for PA.

Child care centers (CCS) in Sydney, Australia, were stratified by social economic status (SES), and randomized to a true control group, a print only condition, or a print
and community intervention. Participants in the print only condition received a booklet containing information about overcoming barriers and the benefits of regular PA. The community engagement group received the same print material and additionally participated in discussion groups to explore perceived barriers to regular PA. On the basis of these discussions, the intervention strategies for the community condition focused on ways to increase self-efficacy and to increase partner and community support.

At baseline, less than half of the women in each group were meeting recommendations for PA. At 8 weeks posttest, 46.3% of the control group, 50.4% of the print only group, and 59.9% of the print and community group were meeting recommendations for PA. The difference between the print plus community group and the other two groups was significant, whereas the difference in PA was not significant between the control group and print only condition. Overall, the authors reported that the multiple level intervention resulted in significant short-term (8-week) increases in the proportion of mothers categorized as sufficiently active for health benefits. Moreover, changes in partner support and self-efficacy among participants in the print plus condition significantly predicted meeting guidelines for PA at post-test.

The lack of effect of the print intervention in changing PA levels compared with the more intense intervention (print and community development) suggests that intervention at the individual level (e.g., education) may not be as effective as interventions that target multiple levels of influence (Miller et al., 2002). It should be noted that although the intervention changed PA, partner support, and self-efficacy at eight weeks posttest, the effect was not sustained at long term follow up. The authors
recommended that more research is needed to understand the various time lines of change for specific mediating variables and to explore how the short-term effects of interventions such as this can be translated into more sustainable changes in PA behavior (Miller et al., 2002).

The preceding review of the multi-level interventions provides support for the utilization of a social ecological model to increase PA among women. A major strength of most of the studies reviewed was the use of existing organizational and community resources as a method of reaching hard to reach populations and increasing support for physical activity. Even though the majority of studies were conducted with individuals with chronic disease, the literature suggests that we could benefit from a greater understanding of the nature of the relationship between intrapersonal, interpersonal, organizational and community level supports for PA not only for women with chronic disease, but also as possible targets for the primary prevention of chronic disease.

Organizations

Churches

Most people spend one third to one-half of their lives in organizational settings (McLeroy et al., 1988), and therefore the use of organizations such as schools, churches and worksites as intervention settings has the potential to reach a large number of people. Moreover, most organizations have an existing support structure. In particular, the utility of churches as an effective setting to conduct health promotion programs has been
recognized by several authors. Resnicow et al. (2002) noted that churches provide a major social link to the community and have a mission of care and service to others. Likewise, Thrasher et al. (2004) stated that the social integration of church congregations makes them powerful units of intervention, particularly for interventions that capitalize on existing support networks.

A literature review by Peterson et al. (2002) concluded that there are seven key elements of churches that can be beneficial for establishing evidence based health promotion programs. These elements are 1) partnership, 2) positive health values, 3) availability of services, 4) access to church facilities, 5) community focused interventions, 6) health behavior change, and 7) supportive social relationships. Peterson et al. (2002) defined partnership as the partnership between churches and outside health agencies or research institutes. The Congregational Health Ministry Survey, conducted by the National Council of Churches USA (2007) reported that 70% of responding churches provide direct health care services, while 65% offer health education programs within their community. Similarly, a review by DeHaven et al. (2004) reported that Faith Based Organizations have a long history of independently and collaboratively hosting health promotion programs in areas such as health education, management of blood pressure (BP), diabetes, weight loss, smoking cessation, cancer prevention and awareness, geriatric care, nutritional guidance, and mental health care. With regards to positive health values, Peterson et al. (2002) reported that historically, the church has served as an enabler of actions for the advancement of health in the community (Hatch, Cunningham, Woods & Snipes, 1986). The church is well respected by its congregation
and also in most communities, and can therefore be an important asset to instill not only positive moral values, but also positive health values among its members (Tuggle, 1995). Moreover, pastors can serve as credible role models by encouraging healthy behavior in sermons and providing opportunities for healthy behavior through church resources (Eng et al. 1985). A study by Thomas et al. (1994) with African American churches reported that commitment of the church leaders to promoting healthy lifestyles was an important indicator for the success of church based health promotion programs.

The third important element of church based health promotion programs reported by Peterson et al. (2002) is availability of services. The National Council of Churches reported that in 2000 there were 320,827 congregations in the US, with churches being available in almost all communities (Yearbook of American and Canadian Churches, 2000). The availability of churches in almost every community suggests that church based health programs have the ability to reach large numbers of people. Moreover, a Gallop survey conducted in 2003 reported that 83% of US citizens stated that religious worship is important in their lives and 38% attended church within the last week. Furthermore, the Public Health Service (1989) suggested that church based health promotion programs may succeed in reaching underserved populations.

There are 43 million uninsured individuals in the United States (Institute of Medicine, 2004) and research has found that uninsured individuals are more likely to avoid seeking care, be hospitalized for preventable conditions, and be diagnosed at later stages of disease progression (Schroeder, 2001). Campbell et al. (2004) implicated that lack of access to traditional health services may account for a proportion of the
disproportionate rates of certain chronic diseases among underserved and minority populations. African Americans have a disproportionate amount of health problems, and church based interventions have been recommended as a promising approach to influence the health of this group, given the large role that church plays in most of their lives (Hatch & Derthick, 1992). In turn, research has also reported that women are more likely to value and participate in church experiences and therefore may be more likely to attend health promotion programs in churches (Wells et al., 1990; Gallop Survey, 2003).

Related to providing access to health services is the provision of access to facilities. Peterson et al. (2002) suggested that churches sometimes have facilities that are conducive to hosting health or physical activity related programs. With regards to community focused interventions, Lasater et al. (1997) proposed that health promotion can be effectively diffused in churches and therefore have the ability to attract individuals from the wider community, in addition to active church members. Peterson et al. (2002) also noted that churches value helping people and promote a spirit of volunteerism. Hodgkinson et al. (1996) reported that individuals who volunteer list religious activities as the most frequent volunteer pastime. Finally and importantly, there is some evidence to suggest that church based health promotion programs positively influence behavior change (Peterson et al., 2002; DeHaven et al., 2004).

DeHaven et al. (2004) conducted a systematic review of the literature that described health activities of Faith Based Organizations. DeHaven et al. (2004) distinguished between faith based, faith placed and collaborative programs. The authors noted that although most studies are referred to as faith based, health programs are faith
based only if the program was part of the church’s ministry. Health programs were designated as *faith placed* if health professionals used the church to test an intervention, and defined as *collaborative* if they combined faith placed and faith based features (DeHaven et al., 2004). Findings from the review indicated that faith placed programs comprise the largest percentage (43.4%) of health programs conducted in churches. The main health topics addressed in the programs reviewed included heart disease, weight/nutrition, breast cancer, and smoking. No studies were mentioned that examined PA as the primary outcome variable. The majority of studies were targeted towards African American populations, and almost all health programs were conducted in a Christian church. Similar to findings by Chaves et al. (1996), almost all programs were delivered in Christian settings.

DeHaven et al. (2004) reported that a major limitation of the literature reviewed was that few studies reported outcome variables; therefore there was little information on which to base assessment of whether programs were successful or not. Faith placed programs were more likely to report outcome data than either faith based or collaborative, yet even within faith placed programs, only 11 out of 18 reported the outcome of a program intervention. Nevertheless, when studies reported outcomes, positive results were indicated for reducing cholesterol, blood pressure, heart disease and weight, increasing fruit intake, screening, and health related knowledge, smoking cessation, and

---

10 The current study is an example of a church placed study. Churches were selected as the organizational setting through which participants were recruited and the intervention was conducted. There was no spiritual component to the intervention and churches participating in the study were not involved in the design or evaluation of the study. Nevertheless, the involvement of the church was fundamental to the success of the study, and it was hoped that if the program was successful it would then be incorporated into the churches ministry.
improved mental health. No outcomes were reported relating to successful (or unsuccessful) program components. DeHaven et al. (2004) contended that only by increasing the evaluation components of Faith Based programs will it be possible to determine how the programs exert their impact. Information from program evaluation can then be disseminated to aid in the design of more effective interventions. Furthermore, the authors recommended the inclusion of other racial and ethnic groups in faith based research.

Church and Physical Activity

Despite the lack of attention to PA within the church based literature, participation in organized religious services has been indicated by several authors to be a source of support for PA. Weaver & Gary (1996) found that older African American women who attended church and participated in social groups had higher levels of PA than those who did not. Concomitantly, findings from the Women’s Cardiovascular Health Network Project reported that African American women attending religious services were more likely to have higher PA levels (Ainsworth et al., 2003). However, it is not clear from these studies to what extent these findings were due to healthier lifestyles in general.

A cross-sectional telephone survey by Merrill & Thygerson (2001) conducted in Utah examined religious preference, frequency of church attendance, and current PA level. Physical activity was defined as exercise at a vigorous intensity for 20 or more minutes at least three times a week. For Latter Day Saints (LDS) 52% of weekly
attenders were classified as vigorously active compared to 44.5% of less frequent attenders. Likewise, for other religious affiliations, the percentage meeting guidelines for vigorous activity was 57.6% for frequent attenders and 54.3% for less frequent attenders. However, when adjustment was made for smoking, age, education, and general health, differences between frequency of attendance within religious groups disappeared, suggesting individuals who attend church more frequently have a better health profile in general, which in turn is associated with greater PA levels (Merrill & Thygerson, 2001).

In a different study, Gillum (2006) examined whether frequency of attendance at religious services among American adults was associated with prevalence of leisure time physical activity (LTPA) after accounting for socio-demographic variables and health status. With the exception of women over the age of 60, there was no consistent difference between frequent and non frequent attenders in the prevalence of participation in walking or moderate and vigorous LTPA. In older women, less than weakly attendance at religious services had a negative association with LTPA. Gillum (2006) suggested that the presence of an association between religious attendance and LTPA in older women and not men might be due to the greater intrinsic religiousness repeatedly observed in women than in men, and therefore older women might be more likely to participate in faith based PA programs offered in their church or community. Alternatively, Gillum (2006) suggested that lack of a consistent association between PA and religiosity may be due to the fact that in contrast to smoking and alcohol consumption, the advent of PA promotion in churches is a recent phenomenon.
Based on the current evidence the relationship between physical activity and religiosity is still equivocal. Still, it is possible that religion and/or frequency of attendance are less important than the support of the church towards PA.

*The Church and Physical Activity Interventions*

A number of intervention studies have implicated the importance of the church as a setting to conduct programs for increasing PA levels. Project Joy was designed to reduce risk for CVD in African American women by improving nutrition and PA (Yanek et al., 2001). Women were assigned to one of three conditions, which were 1) a behavioral model based on standard group methods with weekly sessions (SI), 2) the same behavioral group model supplemented with a spiritual and church component (SP), and 3) a control group who received a non spiritual, self-help intervention (SH). However, during program implementation, women in the SI intervention introduced spirituality into their sessions and operated almost identically to the spiritual condition. Therefore, Yanek et al. (2001) combined the two groups for analysis. Health educators implemented the first 20 weeks of intervention, after which lay health advisors led the sessions, who were African American female congregants. The intervention conditions were designed to increase self-efficacy and were implemented through group sessions in the churches to utilize existing support resources. Physical activity was operationally defined as energy expenditure (EE).

The results indicated that although EE increased in the intervention groups, the increase was not significantly different from EE gains in the self-help control group.
Nevertheless, eleven out of thirteen cardiovascular risk factors improved in the intervention group including significant improvements in body fat, waist girth, systolic blood pressure (SBP), caloric intake, dietary fat and sodium consumption. Moreover, the proportion of participants meeting the PA and dietary goals mirrored the proportion meeting the positive biological changes observed (Yanek et al., 2001). And, one year follow up indicated that 10% of participants in the intervention conditions maintained clinically significant improvements in CVD risk profiles. In the control group, only percent of energy from fat changed.

Process evaluation indicated that attendance was a significant independent predictor of increasing PA, and churches with the strongest support from the pastor’s wife had the best attendance, suggesting that pastoral commitment was an important factor in continued participation. An interesting finding was that attendance was consistently lower when lay health workers as opposed to health professionals implemented the weekly sessions. Yanek et al. (2001) reported that participants indicated that they did not believe that lay health workers were qualified to lead the intervention groups, contradicting previous work that emphasizes the value of lay health workers (DePue et al., 1990). The authors did not report outcomes for psychosocial measures, therefore it is not clear what aspect or aspects of the intervention contributed to behavior and health status change. Nevertheless, the study provides support for the feasibility and potential health promoting benefits of health programs conducted in churches.

The WATCH (Wellness for African Americans through Churches) project (Campbell et al., 2004) was a randomized control trial to evaluate the effectiveness of
two different interventions to improve nutrition, PA, and colorectal cancer screening (CRC). Twelve churches in rural North Carolina were randomized to receive a tailored print and video intervention (TPV), a lay health advisor intervention (LHA) or to a control group.

The TPV condition targeted the individual’s stage of change, beliefs, barriers, knowledge, and cultural and spiritual factors and consisted of four computer tailored newsletters and four videotapes delivered to participants at home at months two, four, six and nine. The LHA condition promoted interpersonal social support for behavior change by capitalizing on the existing social network of churches assigned to this condition. Lay Health Advisors (LHAs) were female church members. The information targeted the same constructs as the TPV condition, and support provided by the LHA’s included the organization of three church wide activities, such as walking and/or exercise groups.

The authors hypothesized that the LHA condition would be more effective than the TPV in changing behavior owing to the multiple levels of support provided for health behavior change (intra and interpersonal levels). In contrast, with respect to PA, the TPV intervention significantly increased recreational physical activity from 9.5 MET\textsuperscript{11} hrs/week at baseline to 10.9 MET hrs/week at follow up (Cohen’s $d = 1.97$), whereas the LHA intervention did not have an impact on any health behaviors.

\textsuperscript{11}The MET or \textit{metabolic equivalent} is a product of intensity, duration and frequency (Ainsworth et al., 2000). One MET represents an individual’s energy expenditure while sitting quietly. Moderate intensity physical activities are between 3 and 6 METS, and vigorous $\geq 6$.  

66
Process measures administered one year post data collection indicated that the majority of participants, who reported that they had heard of the program, were participants from the TPV condition. Only 10% of people in the LHA group reported talking to an LHA, and 32% reported participating in WATCH related activities at their church. Process measures indicated that all LHAs conducted three church wide activities. However, interviews conducted with a sample of LHAs indicated that although they had shared health information with church and community members, only a small portion of this information was related to PA behavior. The process measures suggest that lack of implementation of the LHA condition may account for the lack of change in health behavior. Similar to the previous study (Yanek et al., 2001), Campbell et al. (2004) proposed that participants may not have perceived the LHAs to have the same credibility as a professional source and therefore be less likely to follow their advice.

A major limitation of Campbell et al’s (2004) study was failure to include and report outcome measures relating to the intrapersonal and interpersonal variables on which the TPV and LHA conditions was based. Although process measures provided some indication, it is not possible to determine specifically why one intervention condition was successful and the other was not. A final limitation noted by Campbell et al. (2004) is that although the TPV intervention successfully increased multiple health behaviors, the cost of the intervention in terms of tailored materials may prohibit widespread dissemination.

The Healthy Body Healthy Spirit was an intervention conducted within African American churches to increase fruit and vegetable consumption, and PA (Resnicow et al.,
2005). The study emphasized walking as the core mode of PA. The researchers randomized churches to one of three conditions. Group 1 received standard educational materials, Group 2 received culturally relevant self-help materials for both nutrition and PA, including an exercise video incorporating well-known African American celebrities, and a documentary in which African Americans tried to change their PA behavior. Group 3 received the same intervention as Group 2 with the addition of four Motivational Interviewing\(^\text{12}\) (MI) telephone counseling sessions conducted throughout the one year study period. The control group (Group 1) was equivalent to Group 2 in terms of format and dose, however the content of the material was generic as opposed to tailored.

At one year follow up, both Groups 2 and 3 significantly increased fruit and vegetable intake and PA above the control group. Resnicow et al. (2005) reported large effect sizes for change in total weekly minutes of PA (Cohen’s \(d = 1.98\)), change in PA > 3 METS (Cohen’s \(d = 3.2\)), and change in intentional activities (Cohen’s \(d = 2.3\)) relative to controls. The MI condition did not have any additional influence on PA over and above the self-help condition.

Again, a major limitation with the Healthy Body Healthy Spirit study was failure to report any outcome measures relating to the constructs targeted in the study. Moreover, even though the study was conducted in a church setting, the intervention was targeted towards the individual and did not capitalize on existing church support resources. Nevertheless, the intervention successfully changed diet and PA among

\(^{12}\) MI is a client-centered counseling approach purported to increase intrinsic motivation for behavior change by encouraging individuals to think about and verbalize their personal barriers to change, and how health behavior may conflict with their goals and values (Miller & Rollnick, 2002).
African American congregations, and the authors noted a high retention rate at one year follow up (86%), again providing support for the feasibility of the church setting for behavior change interventions (Resnicow et al., 2005).

Young & Stewart (2006) conducted a six-month church based physical activity intervention designed to target constructs from SCT to increase PA among sedentary African American (AA) women. Of the studies reviewed, this is one of two (Peterson et al., 2005) that targeted solely PA. Young & Stewart (2006) randomized churches to either an aerobic exercise condition or a stretch and health condition. As church pastors suggested that it was not acceptable to recruit participants from their church without guarantee of an active program, a true control group was not possible in this study. Yanek et al. (2001) likewise reported difficulties in randomizing churches and providing alternatives not viewed as being optimally beneficial.

The five churches randomized to the aerobic condition participated in weekly one hour aerobics exercise classes for six months led by certified instructors from the AA community to serve as role models to participants. The intervention targeted increasing self-efficacy, self-management skills and goal setting, and in particular, emphasized social support. A “buddy” system was used and women were asked to encourage their buddies or to contact them regularly for support with their programs. Participants were also asked to pray for their fellow participants. The six churches randomized to the comparison condition received alternating stretching and health classes on any health topic led by AA certified instructors.
Young & Stewart (2006) noted that attendance for both conditions was low over the six month intervention. Aerobic participants attended on average 21.6% of classes, and stretch and health participants 31.5% of classes. Nevertheless, at posttest, prevalence of physical inactivity declined from 39% at baseline to 32% in the aerobic exercise condition and from 38% to 31% in the stretch and health condition. The difference between the two groups, however, was not significant. Young & Stewart (2006) noted that the low levels of participation may have contributed to the lack of significance between groups. Another explanation is that participants were opposed to the aerobic activity component of the intervention and may rather have exercised alone or increased physical activity through accumulated changes in lifestyle activity.

Regardless of treatment assignment, higher levels of social support from friends and family at baseline predicted change in estimated daily energy expenditure and predicted change in the activity summary index measured by the Yale survey. Unfortunately, due to poor retention and small sample size, Young & Stewart (2006) did not report change in social support variables at posttest and follow up. Similar to the previous studies, it was not possible to determine whether the intervention positively influenced social support and whether social support contributed to the reduction in physical activity at posttest. Nonetheless, it is one of the only studies reporting inclusion of instruments to measure psychosocial variables. Moreover, the authors reported that aerobic classes at one of the churches continued for two years post intervention, indicating that this approach is both attractive and feasible for some churches.
A recent study by Wilcox et al. (2007) sought to evaluate the effects of a volunteer led statewide program Health-e-AME (African Methodist Episcopal) to improve PA and diet among members of African American churches. Wilcox et al. (2007) report on findings from a telephone survey conducted with a cohort of 20 randomly selected churches participating in the study, and present data from baseline, one, and two years follow up. In this study, the primary outcome measures were physical activity participation, meeting recommendations for PA, and stage of readiness for physical activity change (Wilcox et al., 2007). Secondary outcomes were change in BMI, fruit and vegetable consumption, and program awareness. The intervention drew on a social ecological model by targeting multiple levels, specifically the individual, organizational, and policy levels (McLeroy et al., 1988). Project staff trained volunteer church members to organize and implement the program.

At the individual level, different strategies targeted different stages of change (Prochaska & DiClemente, 1983). To reach individuals in the early stages of change, physical activity information was included in sermons, on bulletin boards and in the content of church websites and newsletter. To target members in contemplation and preparation, an 8 week volunteer led program provided participants with skills to change PA and diet, and praise aerobics, chair exercises and walking programs targeted individuals in the action stage of change. Churches were also encouraged to develop

---

13 Individuals progress through a series of stages when changing health behavior; Applied to exercise, Precontemplation = I am not physically active and not thinking about becoming physically active within the next 6 months, contemplation = I am thinking about becoming physically active within the next 6 months, preparation = I am taking steps to become physically active within the next 6 months, action= I am physically active, and maintenance = I have been physically active for 6 months or longer (Marcus & Forsyth, 2003).
policies to include PA and healthy food at church events. The latter strategies sought to change the organizational environment to be supportive of PA.

At follow up, the intervention had no significant impact on moderate intensity PA, meeting recommendations for PA (Pate et al., 1995), or stage of change. Even so, intervention group participants were significantly more likely to report speaking to their church about joining a program, and to have participated in a program compared to the self-monitoring only comparison group. In addition, participants who were aware of the program were significantly more likely to participate in moderate or vigorous PA and meet recommendations for PA, and pastor support significantly predicted greater rates of participation in moderate intensity PA.

Wilcox et al. (2007) reported several limitations with their study. Firstly, process evaluation indicated that six survey churches never implemented PA programs, five implemented programs in the past but not currently, and nine reported current implementation, and all programs implemented were action oriented, suggesting the program was not implemented as intended. Secondly, the number of congregations involved in the study created challenges in terms of cost and availability of resources, and prohibited in depth process evaluation of the program. This latter limitation supports Flay’s (1986) contention that efficacy should be established prior to determining the programs effectiveness. Thirdly, attrition was greater than expected, and was associated with younger age and less education, thus limiting the generality of the findings and reducing statistical power to detect significant differences in outcome variables. Finally,
Wilcox et al. (2007) did not report outcomes for the intrapersonal cognitive/behavioral variables targeted in the study.

As can be seen from the preceding review, the majority of church based health promotion programs have targeted African American congregations. Thus, the effectiveness of such interventions with other Christian populations is not well known. However, we identified three studies that evaluated the effectiveness of church based interventions to increase PA among predominantly non African American congregations (Peterson et al., 2005; Jorna, Ball & Salmon, 2006; Winett et al., 2007).

The “Heart and Soul Physical Activity Program” (HSPAP: Peterson et al., 2005) investigated the effectiveness of a 12 week church-based PA program that targeted social support to promote PA in midlife non-Hispanic Caucasian women. The intervention provided information on current PA recommendation, safety factors and CVD prevention, promoted walking partners, and provided services to assist members in meeting weekly activity goals. The comparison group received the American Heart Association booklet “exercise and your health” (AHA, 2001).

From baseline to 12 weeks, women in the intervention group increased PA on average 141 minutes per week, whereas women in the comparison group increased PA on average 67 minutes per week. The difference between groups was not significant, however the effect size for increase in weekly minutes of PA in the intervention group was medium ($\eta^2 = .09$). Similarly for EE, although there was no statistical difference between the two groups, a medium effect size was reported for the increase in the intervention group over time EE ($\eta^2 = .07$). And, a large effect size was reported for
increase in estimated V0\textsubscript{2Max} from baseline to 12 weeks (\(\eta^2 = .27\)) for intervention participants. Therefore, a small sample size may account for the lack of a significant difference between the two groups. Moreover, the comparison group was significantly younger, more active, and had better fitness levels at baseline than the intervention group.

Despite social support being integral to the intervention’s mechanism for change Peterson et al. (2005) did not report any instruments used to measure the different types of social support or any outcomes relating to the support constructs. As a result, it is not possible to conclude that social support increased estimated V0\textsubscript{2Max}, PA and EE. Regardless, the moderate to large effect sizes reported provide preliminary evidence for the effectiveness of the HSPAP intervention in increasing the amount of time spent in moderate intensity PA, EE and estimated V0\textsubscript{2Max}.

The study by Jorna, Ball & Salmon (2006) evaluated the effectiveness of a mind, body and spirit church based program to increase PA among a predominantly non African American female population. Physical activity was the primary outcome variable. Women in the intervention group attended 10 sessions based on SCT implemented over 8 weeks in a program entitled embracing a healthy lifestyle. The intervention used a holistic mind, body, spirit framework and intervention sessions addressed self-efficacy, observational learning, social support and overcoming barriers to PA. The comparison group was comprised of women attending a non health related relationship education and social support program run by the same local church. The program ran concurrently with the intervention group, at the same venue and with the same amount of contact time.
Findings from the study indicated that participants in the intervention condition significantly increased their PA levels, including total walking duration and total time spent in moderate and vigorous PA over and above the comparison group. Likewise, depression and spiritual health scores improved for the intervention group only. In their discussion, the authors reported that self-efficacy and social support significantly improved and barriers decreased from pretest to posttest in the intervention group relative to the comparison group. However, the authors did not present the measurements used or the findings relating to the SCT constructs. This study again highlights the importance of including valid and reliable measurement indices for all constructs targeted in a study, and of utmost importance to report the findings. Despite this limitation, the study by Jorna, Ball & Salmon (2006) provides preliminary support for the utility of programs conducted in churches to increase PA in non African American women.

Winett et al. (2007) assessed the impact of a tailored, social cognitive guide to health (GTH) internet intervention delivered through churches on nutrition, PA, and on the longer term prevention of weight gain. Again, participants were primarily female (67%) and non Hispanic Caucasian (70.6%). Winett et al. (2007) randomized fourteen Baptist and United Methodist churches to one of three conditions, which were 1) GTH only, 2) GTH- plus, GTH and church based supports, or 3) a wait list control group.

Churches randomized to the GTH condition received computers, internet, and the services of a research co-ordinator. Computer modules were designed to elicit behavior change through targeting change in cognitive and behavioral constructs theorized by SCT to mediate behavior change, such as increasing self-efficacy, and positive outcome
expectancies for the target behaviors, and decreasing barriers and negative expectancies. 
The PA portion targeted increasing daily step/counts. In addition to the GTH, 
participants in the GTH plus condition also received church supports to amplify the 
content of GTH. Prompts and reminders from the pulpit and church bulletins were 
designed to promote program use and to reinforce program content. Supports also 
included a church wide step goal. Church supports were faded after posttest (7-months) 
and ended prior to the follow up assessment (16 months post pretest). Although the study 
targeted physical activity and nutrition, results are presented in relation to the physical 
activity outcomes only.

The findings indicated that GTH plus participants had a significantly higher log 
on rate than GTH only participants (80% and 57% respectively) however, the number of 
modules completed did not predict PA outcomes among participants in either GTH 
condition. At posttest, participants in the GHT plus condition increased their steps/day 
by 1500, participants in the GTH only condition increased their steps/day by 1400, and 
those in the control groups increased by about 400 steps/day. Winett et al. (2007) did not 
mention whether the control group wore pedometers throughout the entire study period, 
or during assessment periods only. The difference in steps/day were significantly 
different between GTH plus and control participants, but the difference was not 
significant between the GTH groups or between the GTH only and control participants. 
With regards to the social cognitive constructs, at posttest and follow up participants in 
both GTH conditions made greater changes in their use of PA self-regulation behaviors 
compared to control participants. Increase in self-regulation predicted increase in
steps/day at posttest and follow up. Winett et al. (2007) suggested that the positive finding for self-regulation relative to the other SCT variables may be due to the GTH intervention revolving primarily around self-regulation strategies, including self-monitoring, goal setting, and planning. Interestingly, Winett et al. (2007) reported that analysis of pretest variables indicated that self-regulation had the strongest effect on PA, however social support influenced PA as a direct precursor to both self-efficacy and self-regulation. Self-efficacy on the other hand had little effect on PA independently from self-regulation. This latter finding once again supports the inclusion of both intrapersonal and interpersonal variables when examining their influence on PA.

There are several limitations with this study. Participants were given cash incentives for completion of each assessment, and monetary incentives ($1000) were provided to churches for participating, and an additional $500 was provided to the churches if 95% of remaining participants returned for follow up assessment. As monetary incentives were provided to churches for participants completing follow up, it is possible that the GTH only churches also provided additional support to their congregants for continued participation. However, without process evaluation it is not possible to make any definitive conclusions for the lack of difference between the GTH conditions. Concomitantly, widespread dissemination of the intervention may be costly owing to the method of implementation, that is, computer/internet mediated, and the incentives provided. Finally, although the majority of participants were female, a third of the participants were male. Tudor-Locke & Myers (2001) noted that there are known differences in pedometer determined PA between men and women. Likewise, Bennett et
al. (2006) reported that in general, women take fewer steps compared to men. Therefore, the steps/day reported in the study may overestimate the activity levels of women. Nevertheless, the study provides evidence for the feasibility of conducting interventions to increase PA through the church, and it is one of the few studies to report evaluative components relating to change in possible mediators of PA.

Summary

As can be seen from the preceding review, physical activity interventions conducted in the church setting are few and represent a relatively recent field of enquiry. The majority of church studies involve African American congregations. Ergo, there is a need for research with more diverse congregations to determine the efficacy and feasibility of physical activity interventions conducted in a church setting with different populations (Yanek et al., 2001; Resnicow et al., 2005). In addition, few studies have specifically focused on increasing physical activity, rather multiple health behaviors are targeted or physical activity is included as a secondary outcome. As noted by Wilcox et al. (2007), in studies that focus on multiple behaviors, in particular nutrition and physical activity, nutrition is emphasized to a greater extent than physical activity. As a result, changes in PA have been smaller in comparison to dietary changes. Resnicow et al. (2005) noted that a limitation of studies that address multiple behaviors is the problem of subadditivity, in that the effect of the intervention may be less potent than when behaviors are targeted independently.
McLeroy et al. (1988) recognized that an existing limitation with organizational programs is that the focus is still to change individuals within the organization rather than the organization itself. Likewise, a limitation noted with some of the presented studies is that the focus is still on changing the individual rather than changing the environment in which the behavior occurs, which in this instance is the church. The studies conducted by Wilcox et al. (2007) and Winett et al. (2007) were the only two identified that sought to change the church environment to be more conducive to physical activity. McLeroy et al. (1988) stated that there is a need to recognize that an important component of organizational interventions is not only to create healthier individuals but also to create healthier environments. For example, offering day care services, providing health education programs, and fostering managerial or pastoral support for policies related to behavior change may all be important strategies (McLeroy et al., 1988). Despite these limitations, a number of interventions have indicated significant increases in PA using a church setting, providing some preliminary support that physical activity programs centered in the church may present a successful approach to encourage women to be physically active and ultimately improve their health.

A benefit of using the church as a setting for health behavior change programs is the existing social support structure and the ability to tap into already existing social networks (Peterson et al., 2002). However, a major limitation with the existing church studies is that in depth evaluation is rare. Although a number of studies included process evaluation, outcomes relating to the mechanism for change are rarely reported. Therefore, it is not possible to determine whether the church is an effective setting for
changing behavior owing to their inherent support, experimentally induced support or due to other factors. Without reporting outcomes relevant to the proposed mechanism for change, it is not possible to determine what intervention components are successful or are unsuccessful in promoting PA behavior change.

Group Cohesion

Before leaving the discussion relating to the social ecological framework and physical activity, it is important to first consider the role of cohesion. Cohesion is a concept that is an important component of the social environment, distinct from social support that has received relatively little attention in regards to health behavior. Kawachi & Berkman (2000) define social cohesion as connectedness and solidarity among groups in society, which is similar to the relational definition of community proposed by McLeroy et al. (1988).

McNeil et al. (2006) identified aspects of the social environment that were empirically or theoretically associated with PA. Three broad categories were identified, including 1) interpersonal relationships (social network and social support), 2) social inequality (social-economic status and racial discrimination), and 3) neighborhood and community characteristics (social cohesion and social capital). According to Haughton et al. (2006), social cohesion and social capital are core social environment factors that influence health related behaviors. Sampson et al. (1997) suggested that organizations, neighborhoods and/or communities that have shared beliefs and shared expectations are
more able to take collective action. Moreover, research suggests that cohesive and socially integrated societies tend to experience lower mortality rates and greater life expectancy compared to less cohesive societies (Wilkinson, 2001).

On a smaller scale, Carron (1982) defined group cohesion as the “tendency of a group to stick together and remain united in the pursuit of goals and objectives” (p. 124), and in the present study is considered to function at the interpersonal level of the social ecological model. Carron, Widmeyer & Brawley (1985) proposed a conceptual model of cohesion based on three assumptions: 1) cohesion is a group property that can be assessed through perceptions of individual group members, 2) group members develop perceptions relating to bonding with the group and the extent to which the group satisfies personal needs and objectives, and 3) task and social are two general dimensions that members develop about the group with regards to satisfaction of personal needs and objectives.

The conceptual model proposed by Carron, Widmeyer & Brawley (1985) views cohesion as multi-dimensional, including Group Integration – Social (GI-S: closeness and bonding within the group related to social aspects of the group), Group Integration – Task (GI-T: closeness and bonding within the group related to group goals and objectives), Individual Attraction to the Group – Social (ATG-S: individual feelings about the group pertaining to aspects of social relationships), and Individual Attraction to the Group – Task (ATG-T: individual’s feelings about the group pertaining to matters of group goals and objectives).

Group cohesion has received relatively little attention within physical activity interventions, however, an early study by King & Frederiksen (1984) found that strangers who were randomly assigned to an intervention focusing on team building activities
demonstrated greater adherence to an exercise program than those in a control group. Toliver & Banks-Scott (1990) reported that group cohesiveness facilitated maintenance of PA among older African American women. And, Caron & Spink (1993) found that a team building intervention specifically addressing each dimension of cohesion increased perceptions of cohesion in an exercise class.

Two studies conducted by Estabrooks & Carron (1999) examined the relationship between class cohesion and exercise adherence in older adult exercisers. Participants were randomized to intervention, placebo or control conditions. The intervention group received the team building protocol outlined by Carron & Spink (1993)\(^\text{14}\). Findings indicated that participants in the team building condition attended significantly more classes than participants in either the placebo or control conditions. Moreover, participants in this group were more likely to return to exercise class following a 10 week break. The latter finding suggests that enhancing group cohesion may increase retention of participants at posttest and follow up.

Although limited, the findings implicate that group cohesion can be influenced through intervention, and may influence physical activity in support based interventions. The inclusion of group cohesion in physical activity research warrants further investigation and was therefore included in the present study.

\(^{14}\) Detailed in Chapter 3
Recommendations for PA

In 1995, the American College of Sports Medicine (ACSM) and the Centers for Disease Control and Prevention (CDC) issued a joint statement recommending that every adult in the United States accumulate 30 minutes or more of moderate intensity physical activity on most, preferably all days of the week (Pate et al., 1995). Moderate physical activity was defined as activity performed at an intensity of 3 to 6 METS – the equivalent of walking at 3 to 4 mph for most healthy adults (Pate et al., 1995). No specification was given as to the particular mode of activity, and accumulation was emphasized as an alternative to continuous activity. Likewise, lifestyle activities such as gardening, housework, and dancing were recommended as activities that could contribute to the daily 30 minutes as long as they were performed at a moderate intensity. The recommendations were subsequently supported by the Surgeon General’s Report on Physical Activity (USDHHS, 1996) and other reports, such as the Healthy People 2000, and 2010 (USDHHS, 2000).

The 1995 guidelines were based on a growing body of epidemiological and scientific evidence that a substantial reduction in risk for CVD and other chronic disease can be achieved with regular accumulated, moderate intensity PA (Pate et al., 1995; USDHHS, 1996). Moreover, the recommendations grew out of the recognition that few
individuals were meeting and/or able to maintain traditional protocols for PA\textsuperscript{15} (Buckworth & Dishman, 1996). The guidelines by Pate et al. (1995) reflected a shift from the exercise-fitness model to a broader model of physical activity and health. Despite strong evidence for a dose response relationship between physical activity and mortality from chronic disease, physical activity levels have remained relatively unchanged since the issuance of the 1995 guidelines, and physical inactivity is still a major health concern (Dishman, 2001). Technological advances have more or less filtered out the need to expend energy, and greater incentives are provided for sedentary versus active work (Haskell et al., 2007). Moreover, the prevalence of physical inactivity may in part be due to the continued promotion of structured and or planned physical activities as the main method to improve health. Although structured exercise programs are beneficial for improving health and fitness, individuals often find it difficult to incorporate structured exercise into their previously sedentary lives (Swartz, 2003). On the other hand, it has been suggested that a lack of PA may also be in part due to the misperception that light activities of daily living alone are sufficient to improve health (Porter, 2003).

In February 2003, an expert panel reviewed and updated the original CDC/ACSM recommendations (Haskell et al., 2007). The recommendations do not replace previous guidelines by Pate et al. (1995), but rather they elucidate the amount (frequency, duration, and intensity) and type (aerobic, muscular endurance) of PA necessary to gain

\textsuperscript{15} Traditional recommendations were for physical activity to be performed for a continuous 20 to 60 minutes of moderate to high intensity endurance exercise, at 50 to 85\% of maximal aerobic power (Caspersen, et al., 1985; ACSM, 1990).
health benefits. The revised recommendations by Haskell et al. (2007) are as such, to promote and maintain health, all healthy adults aged 18 to 65 years need moderate intensity aerobic PA for a minimum of 30 minutes on five days each week or vigorous intensity aerobic activity for a minimum of 20 minutes on three days each week. New to the guidelines is the emphasis on the recommended amount of PA being the minimum amount required to benefit health and should be performed in addition to light intensity activities of daily living that are less than 10 minutes in duration. Haskell et al. (2007) emphasized that adults wishing to improve their physical fitness or further reduce their risk for chronic disease should exceed this minimum. Also new to the updated recommendations is the specification of mode of activity; aerobic has been added to clarify the type of physical activity being recommended\(^\text{16}\). Of importance to the present study, the updated recommendations recognize the important role of the social and physical environment in the adoption of a physically active lifestyle if long term change is to take place (Haskell et al., 2007).

\(\textit{Lifestyle PA}\)

The promotion of lifestyle physical activity presents a promising approach to encourage sedentary women to meet the minimum recommendations for PA (Dunn, Anderson, & Jakicic, 1998). Defining features of lifestyle physical activity are the emphasis on accumulated and moderate intensity activities. Central to both prior and

\(^{16}\text{This new statement also includes recommendations for muscular strength training, however as the focus of the present study was walking, the discussion centers on the recommendations for moderate intensity aerobic PA only.}\)
updated recommendations is the recognition that accumulated PA of a moderate intensity amounts to significant improvements in health, in particular among the most sedentary portion of the population (Ebisu, 1985, DeBusk, 1990, Blair et al., 1992, Jakicic et al., 1999).

Accumulated PA can also help overcome barriers associated with participation in physical activity. One of the most frequently cited barriers is lack of time (Berg & Cromwell, 2002: Bopp et al., 2007) and intermittent programs have been proposed to address barriers of lack of time and other gym based objections for participants wanting to adopt an exercise program (Blair, Kohl & Gordon, 1992). Accumulated PA enables the individual to be physically active throughout the course of the day as opposed to setting aside 30 minutes of planned activity.

The emphasis on moderate intensity PA provides a more reasonable, achievable and possibly preferable goal for sedentary populations to begin to be physically active. Moreover, moderate intensity physical activity has been demonstrated to have comparable fitness benefits to more vigorous intensity activity. Dunn et al. (1999) compared a lifestyle physical activity intervention emphasizing moderate intensity physical activity with a structured intervention that emphasized vigorous intensity PA. At 24 month follow up both groups had significant and similar improvements in cardiorespiratory fitness, which is known to reduce risk for CHD and all cause mortality (Blair et al., 1995). In addition, although adherence declined in both groups at 24 month follow up, the decline was greatest in the structured group. A meta-analysis of PA intervention studies conducted by Dishman & Buckworth (1996) also indicated that
adherence was better for exercise interventions that promoted lower intensity leisure activities.

The majority of adults in the United States are currently sedentary, and less than half are meeting the recommended levels for PA (BRFSS, 2005). The nature of lifestyle interventions enables a person to individualize his or her physical activity program to include a wide variety of activities of moderate intensity and to accumulate bouts of these activities in a manner that fits with each one’s unique lifestyle (Dunn et al., 1998). Although greater levels of PA are often associated with greater health benefits, lifestyle interventions may be more beneficial by getting sedentary individuals to be active initially by making small lifestyle changes. According to Kahn et al. (2002), the largest public health benefit of PA interventions will result from small increases in PA among sedentary populations, rather than increased activity among already active people.

Walking

Walking is a mode of lifestyle physical activity and provides a viable alternative for meeting recommendations for moderate intensity aerobic activity as it can be planned or unplanned and it can be accumulated and/or continuous (Ziegel, Brackbill & Heath, 1995). Likewise, walking is a moderate intensity PA. Murtagh et al. (2002)

---

17 It should be noted that lifestyle physical activity by itself might not be appropriate for all sections of the population. In 2002 the Institute of Medicine (IOM) recommended 60 minutes of daily PA to prevent weight gain. Likewise, a report published by the International Association for the study of Obesity in 2003, recommended moderate intensity PA daily for 45 to 60 minutes daily to prevent the transition from overweight to obese, and for prevention of weight gain in formally obese individuals 60 to 90 minutes of daily moderate intensity PA was recommended (Saris et al., 2003).
demonstrated that both self-selected walking pace and brisk walking elicited moderate intensity PA.

Of all types of PA, walking is consistently reported as a preferred leisure time activity and is fundamental to daily activities (Rafferty, Reeves, & McGee, 2000; USDHHS, 2000). Walking is especially promising as a focus of public health interventions because of its accessibility and acceptability, particularly among populations with a low prevalence of PA (Siegel et al., 1995). Bopp et al. (2007) conducted a qualitative study as formative research for the Health-e-AME church based PA study (Wilcox et al., 2007). Men and women participated in focus groups to discuss personal, interpersonal, community and environmental barriers and enablers for PA. Both men and women reported the importance of enjoyment for PA and recommended the addition of walking programs in their church. In addition, lack of time, lack of support and family obligations were frequently cited barriers for PA participation.

Importantly, walking has been found to confer many health benefits. Observational studies provide evidence that walking reduces risk for CVD in middle-aged and older women. This association holds true when comparing different races, across a large BMI range, and in women with pre-existing medical conditions such as diabetes (Hu et al., 1999). The College Alumni Health Study found that higher walking volume was associated with greater CVD risk reduction in a 31 year follow up of women who were free of CVD when the study began (Sesso et al., 1999). And, findings from a prospective study of over 73,500 postmenopausal women reported that cardiovascular risk reduction can be realized from either brisk walking or vigorous exercise (Manson et
al., 2002). Reduction in risk for CVD also holds true for walking at lower intensities. The Women’s Health Study (Lee et al., 2001) found that time spent walking and walking pace were inversely associated with CHD risk. Interestingly, when both time and pace were entered into a multivariate model, the results indicated that time and not pace was the most important predictor of CHD risk. Moreover, the analysis did not include women who reported vigorous intensity PA, and therefore suggests that even without vigorous PA, walking can reduce CHD risk in women. In a review, Albright & Thompson (2006) suggested that walking can potentially decrease risk for CVD for women by impacting the modifiable risk factors for CVD development. Positive outcomes of walking include reducing blood pressure (Murphy et al., 2002), improving blood lipid profiles (Woolf-May et al., 1999), and decreasing risk of type II diabetes and ischemic stroke (Hu et al., 1999, 2000).

Accumulated walking has likewise demonstrated health effects comparable to continuous walking. A study by Woolf-May et al. (1999) with men and women, reported that walking in bouts of 15 minutes resulted in beneficial changes in low density lipoproteins (LDL) comparative to changes in LDL from a continuous 20 to 40 minutes of walking. Walking in bouts of 10 minutes appeared to be less effective. Nevertheless, all groups had a similar increase in cardiovascular fitness, suggesting that moderate intensity walking accumulated throughout the day can result in fitness and health benefits.

In general, the epidemiological evidence suggests a protective effect of walking on chronic disease and risk factors for disease. Evidence also suggests that walking can
be increased through intervention. Ogilvie et al. (2007) reviewed 48 walking studies and reported that the most successful interventions could increase walking among targeted participants by up to 30 to 60 minutes per week, at least in the short term. Ogilvie et al. (2007) reported that the greatest net increases in walking were among the most sedentary groups and concluded therefore that interventions designed to promote walking have the potential to make a substantial contribution to increasing the activity levels in particular of the most sedentary.

**Pedometers**

Because of the evidence that accumulated PA is associated with improvements in health, some researchers have advocated using pedometers to quantify daily walking (Hatano, 1993). Pedometers provide an objective measure of accumulated walking by counting steps, and are gaining acceptance among researchers not only as a measurement tool but also as a motivational method to increase lifestyle PA in intervention studies by providing immediate, quantitative feedback (Swartz et al., 2003). Pedometers are subject to some limitations in that they are not able to measure upper body movement, gradation or intensity. However the use of pedometers to assess and monitor PA levels in a group of people is attractive, as they are simple to use, inexpensive and measure walking (steps/day) with acceptable accuracy (Tudor-Locke et al., 2004).

A widespread assumption is that accumulating 10,000 steps/day is equivalent to meeting physical activity guidelines for 30 minutes of moderate intensity physical activity (Sidman et al., 2004). According to Pate et al. (1995), walking briskly for two
miles on most days of the week is equivalent to thirty minutes of moderate intensity physical activity. The average person walks 2000 steps in a mile (Bassett, et al., 2000, Sherman et al., 2007), and research suggests that the average 20 to 50 year old walks between 7000 and 13000 steps/day, and the average person over 50 years old walks on average 6000 to 8500 steps/day (Tudor-Locke et al., 2001)\textsuperscript{18}. Therefore, for most individuals, increasing daily walking by 4000 steps would total approximately 10,000 steps and would be consistent with the recommendations for moderate intensity aerobic PA (Haskell et al., 2007). In support, Le Masurier et al. (2003) reported that individuals who accumulate 10,000 steps/day were more likely to meet recommendations for PA than those who accumulated less.

Walking 10,000 steps/day has also been advocated as a means of improving health and reducing risk for chronic disease (Hatano, 1997). Almost 65\% of the adults in the United States are overweight or obese (Reeves & Rafferty, 2005), and findings suggest that women who accumulate more daily steps are less likely to be obese than women who are more sedentary. Thompson et al. (2004) reported that for women, higher volumes of steps/day were significantly associated with lower BMI values. Women who averaged > 10,000 steps/day were the only group in the recommended BMI range (\( \geq 18.5 \text{ to } \leq 24.9 \)). On the other hand, women who walked < 6000 steps/day had an average BMI of 29.3, and would be considered overweight (ACSM, 2000)\textsuperscript{19}. A weak inverse association was also reported by Tudor-Locke, Williams, Reis & Pluto (2004) between

\textsuperscript{18} Women engage in less physical activity than men, for women the numbers may be an overestimate.

\textsuperscript{19} Some experts speculate that 15,000 steps/day is optimal for achieving weight loss (Leermakers, Dunn & Blair, 2000), in particular for individuals who already accumulate a greater number of steps/day at baseline.
pedometer determined PA and age ($r = -.21$), BMI ($r = -.27$), and percent overweight ($r = -.22$).

Swartz et al. (2003) examined whether a goal to accumulate 10,000 steps/day for 8 weeks was effective at improving glucose tolerance in 18 overweight, inactive women with a family history of type II diabetes. Participants increased their steps by 85% from an average of 4972 to 9213 steps/day (Cohen’s $d = 1.8$). Despite no change in dietary behavior or change in body weight and waist circumference, participants gained significant reductions in blood pressure and blood glucose. A study by Moreau et al. (2001) also found that postmenopausal women with borderline to stage I hypertension who walked an additional 4300 steps/day above their baseline levels (5400 steps/day), decreased their SBP.

These findings have major practical and clinical significance. A meta-analysis by Lewington et al. (2002) found that a 20 mm Hg drop in SBP or a 10 mm Hg drop in diastolic blood pressure is associated with a 50% decrease in risk for CVD for people aged 40-69 years. Moreover, the findings demonstrate that weight loss is not necessary for a beneficial reduction in blood glucose levels or blood pressure (Swartz, et al., 2003). Research by Tully et al. (2005) also reported that increase in PA can decrease risk for CVD regardless of change in BMI. Finally, as 10,000 steps/day does not address intensity, the findings suggest that regardless of intensity, beneficial results can be obtained (Swartz et al., 2003).

A number of authors have suggested that a universal step goal may be inappropriate for many populations, especially for older and more sedentary populations.
Wilde et al. (2001; Sidman et al., 2004). Wilde et al. (2001) found that many sedentary women failed to accumulate 10,000 steps/day even when they performed a 30-min walk. Likewise, Sidman, Corbin, & Rhea (2003) found that sedentary women with initial low baseline step counts were less able to attain a 10,000 step/day goal on a regular basis.

Sidman et al. (2004) examined whether differences existed in weekly step counts and goal attainment for women randomly assigned to either a daily 10,000-step goal (TSG) or a personalized step goal (PSG) condition, and whether initial baseline steps (low, medium, high) interacted with treatment condition (TSG versus PSG). Participants were divided into low (L), medium (M), and high (H) groups based on their steps/day at baseline. The authors used a tertile split, with 5,500 (lower) and 7,000 steps/day (upper) corresponding to the less active and more active categories of sedentary women reported in previous research (Wilde et al., 2001). Women monitored their total steps/day over a four week period.

Results indicated that the LTSG group attained the 10,000 step/day goal only 23.0% of the time, while M and H TSG groups attained the goal 46.8% and 54.0% of the time respectively. For participants in the PSG condition, the percentage of days participants attained the step goal was 51.6% for LPSG, 47.6% for MPSG, and 48.2% for HPSG. The results suggest that attainment of a 10,000 daily step goal is less likely among participants with low baseline steps than those with higher initial steps. And, by the end of the four week intervention both groups overall were equal in step counts, suggesting that both conditions were effective in promoting step increases. Coleman et al. (1999) suggested that personalized goals may promote adherence as they provide
individuals with more flexibility in terms of choosing how and when to incorporate PA into their unique lifestyles.

Findings from a different study suggest that, for sedentary populations, small increments in steps/day can be beneficial for health. As part of the AusDiab study\textsuperscript{20}, Dwyer et al. (2007) examined the relationship between number of pedometer measured steps/day, self-report PA and obesity parameters (waist circumference and BMI) in a population based sample. Participants provided pedometer data for 2 days\textsuperscript{21}.

Results from the study indicated that decline in BMI and waist circumference varied according to baseline activity, with a larger decline for those who were more sedentary and who had a lower initial step count at baseline. Dwyer at el. (2007) reported that an additional 2000 steps/day for those only taking 2000 steps/day was associated with a reduction of 2.8 cm in waist circumference for men and 2.2 for women, compared to a reduction of .7 and .6 for men and women respectively who were already walking 10,000 steps/day. This association between obesity parameters and steps/day remained independent of other factors associated with obesity, such as time spent watching TV. The findings indicate that individuals who are at the lower end of daily energy expenditure would receive the greatest benefits by increasing their number of steps/days.

\textsuperscript{20} The AusDiab study estimated the national prevalence of diabetes and its risk factors in a representative sample of adults aged 25 years and older from six states and the Northern Territory of Australia during the year 2000.

\textsuperscript{21} Tudor-Locke et al. (2005) found that two consecutive days of pedometer recording captured 89\% of the variance in a seven day recording period.
Pedometer Interventions

A number of studies have provided support for the use of pedometers in interventions to increase physical activity levels among sedentary populations, and subsequently to improve health outcomes.

The First Step Program (FSP: Tudor-Locke et al., 2002) was developed to increase physical activity among individuals with type II diabetes. The primary outcome variable was change in PA, operationalized as pedometer measured walking. The researchers then translated steps into time, based on the number of steps participants took during 20 minutes of continuous recording. Tudor-Locke et al. (2002) measured time spent walking at baseline, one month following weekly FSP meetings (mid-point), and again one month post intervention. For the last month, participants returned their pedometers and received no further contact prior to the final follow up assessment. The program targeted constructs from SCT, including increasing self-efficacy and social support for physical activity.

Overall, the findings provided preliminary evidence for the First Step Program’s efficacy in elevating PA levels of a group of sedentary men and women with type II diabetes. Time spent walking increased significantly from baseline to mid point ($\Delta 34.3$ minutes per day) and from baseline until the end of the intervention ($\Delta 23.6$ minutes per day). Moreover, this increase remained following intervention and after all contact was terminated ($\Delta 22.6$ minutes). Tudor-Locke et al. (2002) reported a large effect size ($d = 1.1$) from baseline to midpoint, indicating that the FSP elicited immediate and large increases in steps/day. Moreover, a reduction in waist girth over the duration of the study
corroborated the increase in PA. The authors did not report any outcomes relating to the SCT variables. Therefore, it is not clear what variables contributed to the program’s success. Another limitation was the lack of a control or comparison group, however in a subsequent study Tudor-Locke et al. (2004) provided evidence for the efficacy of FSP using a randomized controlled outcome evaluation with a larger sample and for a longer duration.

Similar to the previous study, participants returned their pedometers and had no contact between 16 and 24 weeks. The main finding from the study indicated that at week 16, relative to the control group, intervention participants increased their steps/day by 3000 from baseline (< 8800), and their waist and hip girth decreased by 2-3 cm. However, change in waist and hip girth did not differ significantly between the intervention and control groups. The magnitude of change in steps/day from baseline to 16 weeks in the intervention group was moderate ($d = 0.7$), whereas the difference between change in steps/day between groups at this measurement point was large ($d = 0.96$). Compliance to recording steps was 100% at the beginning of the adoption phase, 88% at the beginning of the adherence phase, and 58% during the last weeks of the adherence phase when there was no ongoing contact. Tudor-Locke et al. (2004) noted that relapse by 24 weeks suggests that booster sessions may be necessary to maintain lifestyle changes. At 24 weeks, while steps were still higher on average in the intervention group, the difference between the two groups was no longer significant (Tudor-Locke et al., 2004).
The majority of pedometer based interventions have focused on increasing steps/day among clinical populations. Therefore, their contribution to increasing PA among non clinical populations is less well known. However, a number of studies were identified that sought to determine the impact of a pedometer based intervention with sedentary but otherwise healthy individuals.

A study by Chan et al. (2004) examined the impact of the Prince Edward Island First Step Program (PI-FSP) on employee PA levels in five worksites in Prince Edward Island, Canada. Similar to the First Step studies previously described, the intervention consisted of two phases, which were a four week adoption phase and an eight week adherence phase. During the adoption phase, participants met with a facilitator in each worksite who implemented a curriculum that included benefits of PA, goal setting, strategies for overcoming barriers, and preventing relapse. In addition, during this adoption phase participants monitored their steps/day. Participants set personalized goals and recorded their steps/day on a calendar. During the adherence phase participants continued to monitor their progress towards their goals and revise goals as necessary.

Unique to this study, Chan et al. (2004) examined increments in mean steps each week to determine time to reach a plateau, defined as no further significant increase in steps/day. Individuals increased their steps on average by 6981 steps/day to a plateau of 10,480 steps/day by week 4 of the adoption phase, which was sustained for the remainder of the program. Of note, nine participants (6.5%) had not yet reached a plateau at the end of the 12 week study. Participants also experienced significant decreases in BMI, waist girth, and resting heart rate. Multiple regression analysis indicated that waist girth
decreased with an increase in steps/day, suggesting that leaner individuals would need to increase their steps/day to a greater amount in order to achieve the same reduction in waist girth. This latter finding corroborates recommendations for achieving weight loss by Leermakers, Dunn, and Blair (2000). In contrast, higher baseline values predicted decrease in blood pressure and BMI rather than baseline activity or change in steps/day.

Limitations of the study were a lack of a control or comparison group and similar to the previous studies, Chan et al. (2004) did not report any outcomes relating to the SCT constructs targeted by the intervention. Therefore, it is not clear whether change in steps/day, change in diet and/or ongoing weight loss programs in the worksite influenced change in health values. Addition of a control group would help rule out alternative explanations and determine through what avenues the FSP exerts its effect on steps/day. Overall, the findings suggest that the First Step Program can be translated to sedentary healthy populations.

In a different study, Croteau (2004) conducted a preliminary pilot test to examine the effect of a minimal contact eight week pedometer intervention to increase lifestyle PA among healthy sedentary college employees. Participants attended a counseling session covering goal setting and strategy selection, and subsequently monitored their steps/day for eight weeks. Participants received different recommendations for steps goals depending on their baseline values. Participants accumulating 10,000 steps/day at baseline were asked to maintain, those completing between 8000 to 10,000 steps/day were asked to increase their steps by 5% every two weeks, and participants who accumulated < 8000 steps/day were asked to increase their steps by 10% every two
weeks. Participants also completed the Perceptions of Physical Activity Survey (PPA) to corroborate steps and examine whether their perception of their physical activity levels changed with step counts, and the Physical Activity Survey (PAS; Godin & Shephard, 1985), to measure whether changes in physical activity levels reported by participants corroborated the objectively measured step count. Measures were taken at baseline and immediately following the intervention.

For comparison, participants were placed into tertiles according to baseline steps (outlined above), and BMI (normal weight, overweight, and obese; ACSM, 2000). The group as a whole significantly increased steps/day from baseline to posttest (baseline = 8565 steps/day; posttest = 10538 steps/day, Cohen’s $d = 0.63$) and concomitantly perceived PA and PAS increased (Cohen’s $d = 0.47$, and $d = 0.50$ respectively). When examined by group, the 10% group increased steps/day by 39.9%, the 5% group by 24.9% and maintainers by 5%. By weight, normal weight participants increased steps/day by 16.4%, overweight participant by 24%, and obese participants by 34.4%. In support of Sidman et al. (2004), participants with the lowest baseline levels ($M = 5901$ steps/day) increased their steps on average to 8173 steps/day, suggesting that a goal of 10,000 step/day may not be viable for certain subpopulations.

Again, limitations of the study are the lack of control or comparison group and failure to report efficacious components of the intervention. Nevertheless, the study does provide preliminary support for a minimal contact, self-managed, pedometer based intervention as a method to increase daily PA among sedentary adults.
Hultquist et al. (2005) compared the number of steps accumulated by women randomized to one of two conditions, 1) 10,000 steps/day (10k), or 2) 30 minute brisk walk on most days. In the first condition, participants wore an unsealed pedometer and kept a daily step log, whereas participants in the latter condition wore a sealed pedometer and were unaware of their steps/day. Hultquist et al. (2005) reported that sedentary women accumulated significantly more total walking when instructed to walk 10k per day than when instructed to take a 30 minute brisk walk on most days of the week (10,159 ± 292 and 8270 ± 354, respectively). Participants in the 10k group reported that on days in which they met their goals, they took a planned, deliberate walk lasting between 10 and 75 minutes. Both groups met their walking goals on average 4.4 and 4.2 days per week (30 minute and 10k group respectively), and this difference was not significant. For both groups, blood pressure decreased over time, but body composition remained the same.

Interestingly, all the participants who dropped out of the study were in the 30 minute group indicating a threat to the external validity of the study through differential mortality. Also, this latter finding suggests that pedometers may promote greater adherence to PA interventions than more traditional structured walking interventions. However, as the intervention was conducted over a brief four-week period, examination of adherence to goals over a longer time is warranted. In this study, psychosocial instruments were not administered therefore it is not possible to determine what mechanisms were responsible for the increase in steps/day. Overall, the study found that 10k per day is a feasible and effective way to increase short term PA in sedentary
females. And, the fact that almost 9500 steps were taken on days in which the women took a 30 minute walk suggests a concordance between 10k and physical activity recommendations for this sample of women.

A study by Sherman, Gilliland, Speckman and Freund et al. (2007) assessed the feasibility of a walking intervention for rural women through a primary health care center. Women were given a pedometer, along with written information on the importance of exercising, an exercise tape with a walking program, and a daily log to keep their step counts. Participants were also contacted by phone by the program coordinator and a nurse practitioner at one week, one month, three and six months to collect step counts from the preceding three days. Change over the course of the study was determined by comparing pedometer counts at week one, with those from month six. In line with findings by Dwyer, et al. (2007), baseline step counts varied by BMI. Mean baseline step counts were 7415 steps/day for normal weight women, 6908 steps/day for overweight and 5545 steps/day for obese.

For all groups, step counts increased on average by 2573 steps/day over the 6 month course of the study. This increase amounted to an increase in walking of approximately 1.09 miles per day above baseline (Sherman et al., 2007). Increases were significant for all weight groups, and interestingly, the increase in step counts was significant for women who reported being active at baseline and those who were inactive at baseline, suggesting that both groups benefited from the intervention.

Limitations of the study were the absence of a control or comparison group, therefore it is not clear whether walking increased over time due factors other than the
intervention or to secular trends, and failure to report efficacious components of the intervention. Nonetheless, the study suggests that a brief intervention set within a primary care setting can achieve short term increases in PA in rural women. Of clinical significance, the Activity Counseling Trial Research Group (2001) reported that a modest 5% improvement in cardiorespiratory fitness is associated with a 9% reduction in mortality risk and improved disease outcome. Sherman et al. (2007) reported that the average increase in steps/day in their study would equate to cardiorespiratory changes greater than 5% based on previous research that correlated increases in step/counts with cardiorespiratory fitness (Perna et al., 2005).

Bravata et al. (2007) reviewed the pedometer based literature and reported that overall, intervention participants significantly increased their steps by 2004 steps/day more than control participants, and by 2183 steps/day above baseline, resulting in an overall increase of 26.9% steps/day among pedometer users. Of the studies reviewed, the majority of participants were middle non-Hispanic Caucasian women. Bravata et al. (2007) reported a trend for younger pedometer users and those with lower baseline PA to have the largest net increase in steps/day. Sex and race/ethnicity were not predictive, and in contrast to previous findings, BMI was not a significant predictor of increased PA (Tudor-Locke & Myers, 2001; Thompson et al., 2004; Dwyer et al., 2007).

With respect to intervention characteristics, duration was not a significant predictor of increasing steps/day and physical activity counseling was likewise not predictive of increase in steps/day. However, the reviewers reported that the heterogeneity across studies may have contributed to these findings. Bravata et al. (2007)
did not report any successful theoretical components in their review with the exception of goal setting. Having a step goal was the key predictor of increasing PA, whether the goal was for 10,000 steps or other. Interestingly, three studies that did not include a step/goal had no significant improvement in steps/day, suggesting that pedometer feedback alone is insufficient to produce a substantial increase in steps/day (Matevey et al., 2006).

Regarding the association between steps/day and health outcomes, Bravata et al. (2007) reported that in general intervention participants significantly reduced their BMI from baseline, and the decrease was associated with older age, being Caucasian, having a step goal, and longer duration interventions. Intervention participants significantly decreased their SBP independent of a decrease in BMI. However, this finding was inconsistent across studies. Similar to the findings by Chan et al. (2004), BP reduction was greater among participants with higher baseline values. Intervention participants did not significantly improve their serum lipid levels or decrease their blood glucose. Bravata et al. (2007) suggested that this may have been due to participants’ values being normal at baseline.

Limitations of pedometer interventions noted by Bravata et al. (2007) were that sample sizes were small and interventions were heterogeneous in their design, making it difficult to determine successful components of the interventions and generalizability of the findings. However, two studies not included in the review by Bravata et al. (2007) were located that provide preliminary evidence for the efficacy of larger scale pedometer interventions to increase PA.
The first study, Canada on the Move (COM) was a population wide campaign to increase awareness and ownership of pedometers and ultimately increase walking through pedometer usage. Canada on the Move evolved from a partnership between the Canadian Institutes for Health Research (CIHR) and Kellogg’s Canada (Diez, 2006). A mass media advertisement to add 2000 steps promoted pedometer use. Pedometers were distributed through cereal boxes with the message to “donate your steps to research” printed on the box. Participants could log on to the CIHR website to record their daily step accumulation. Craig, Tudor-Locke & Bauman (2007) examined the 12 month effects of the program, including awareness, pedometers ownership and/or usage among Canadian adults.

Craig et al. (2007) reported that awareness of COM was associated with 13% higher odds of sufficient walking after adjusting for age, sex, income and education. The odds ration of sufficient walking was 23% higher among those who recognized the tag line “donate your steps to research,” compared to those who did not. Participants owning a pedometer were 14% more likely than those who did not to engage in sufficient walking. Moreover, being aware of the specific tagline and owning a pedometer had an additive effect in that the odds of sufficient walking were 1.52 times greater than for those who did not meet both conditions. Finally, comparison of secular trends indicated that pedometer owners who were aware of the campaigns specific tagline had higher adjusted odds of sufficient walking, compared to walking reported in all quarters in 2003 (Spring, Summer, Fall and Winter), and among those unaware of the campaign in all quarters of 2004.
Although, the impact was restricted to those Canadians who had heard of the campaign, Craig et al. (2007) noted that the increase compares favorably with tobacco campaigns in the US, which ranged from an absolute decrease of 1.3% in smoking rates over a 1 year period in Michigan to a 2.7% decrease over 3 years in California (Friend & Levy, 2002). The main limitation with this campaign was that it was not theoretically driven.

The second study, by Merom et al. (2007) compared the effects of a mailed “no-contact” self-help walking program, with and without a pedometer, with a no-treatment control group on walking behavior in a community sample of healthy overweight inactive adults. Participants were randomized to one of three conditions: 1) WP – Walking Program Only: Participants were mailed a theoretically based self-help booklet, entitled “Step by Step.” The booklet was based on SCT constructs and was designed to help participants start a walking program in incremental stages. Individuals chose their starting stage; 2) WPP – Walking Program + Pedometer: Participants received the same materials as the WP group as well as a pedometer. Participants used their steps measured at baseline to determine their starting goal. Changes in daily step counts from baseline to the week after the follow up interview were measured only among participants in this group; and 3) Control: Participants in this group completed pre and posttest measures only. To corroborate walking, the Active Australia Questionnaire (AAQ: Timperio et al., 2002) was administered to participants to measure the frequency and total minutes accrued by walking continuously for at least 10 minutes in the past week for exercise,
recreation, and all purpose walking\textsuperscript{22} (APW). In addition, The College Alumni Questionnaire measured leisure time PA (LTPA) over the last 3 months (Paffenberger et al. 1993).

The average change in steps/day over three months was +1830 steps/day. This change was not significant. Findings from the AAQ indicated that participants in the WPP group participated in APW for almost 30 minutes more than both the WP and control groups at follow up assessment. Although this was significantly different from the control group, the difference was not significant between the WP and WPP group. A similar finding was reported for LTW (leisure time walking). With respect to other forms of physical activity, only participants in the WPP group were significantly more likely than the control group to meet criteria for LTPA. Of note, only 17\% of the WPP group were still wearing a pedometer at the follow up interview, which may have also contributed to the lack of a significant finding between the two intervention groups. As Merom et al. (2007) did not report measures of SCT variables it is not clear whether the intervention successfully changed these constructs, and whether or not the variables contributed to the increase in walking. A strength of this study was that it is the first to test the efficacy of a pedometer intervention without face to face contact.

Strengths of both Canada on the Move (Craig et al., 2007) and Merom et al’s (2007) walking intervention were that they examined the efficacy of a pedometer intervention in a larger sample of participants. Both studies provide evidence for the feasibility of pedometers to be distributed on a larger scale to promote walking, and both

\textsuperscript{22} All purpose walking (APW) was defined as getting to and from places.
studies provide preliminary evidence of pedometers to increase walking. Again, the main limitation of both studies was failure to report any outcomes relating to the theoretical variables on which the intervention was based.

Summary

The literature suggest that both traditional structured interventions and pedometer studies are successful in decreasing CVD risk, and therefore pedometers should be considered a viable option for increasing PA among women (Albright & Thompson, 2006). In addition, accumulating steps may lead to better adherence as it allows women to fit PA into their daily routine (Hultquist et al., 2005). Moreover, of the literature reviewed, findings suggest that pedometer based interventions provide a feasible and effective means of increasing walking among sedentary populations regardless of a personalized or 10,000 step/day goal.

The main limitations with the studies reviewed are the lack of intrapersonal, interpersonal or organizational levels targeted by the studies to enhance walking. For studies that do include such variables, few studies conduct or report an in depth evaluation relating to these program components. Similar to the first part of this review, only by understanding the cause of an intervention’s success or failure can we modify and improve theory, and thus design effective interventions to ultimately change physical activity behavior and impact public health. Despite the limitations noted, the implementation of interventions to promote walking using pedometers clearly has the
potential to make a substantial contribution to increasing the activity levels of the most sedentary.

Therefore, the primary purpose of the present study was to evaluate the utility of a social ecological intervention implemented in a church setting to increase daily walking among sedentary females. The study was based on the social-ecological model proposed by McLeroy et al. (1988). The intervention targeted to the intrapersonal and interpersonal levels and was delivered at the organizational level (i.e., the church). The primary research questions were answered using impact evaluation to determine the effect of the social ecological intervention on walking over a 10 week period, and in comparison to a self-monitoring only condition. Secondary research questions were evaluated with impact and process evaluation methods to determine the efficacy of the intervention to change each social ecological variable targeted, and their relative association with increasing daily walking. Finally, process evaluation was conducted to determine program implementation, group cohesion, appropriateness of program content, and overall participant satisfaction with the program.
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Joy (Yanek et al., 2001)</strong></td>
<td>Sedentary ( N = 529 ) African American women. Age: ( M = 53.6 (SD = 9) ) BMI: ( M = 32.6 (SD = 7) ). Design: 2 (pretest, posttest) * 3 (SI, SP, Control) Randomized control trial.</td>
<td>PA: (EE: Yale PA questionnaire). Body weight, BMI, blood pressure (BP), heart rate (HR), blood lipid levels, glucose, dietary nutrition intake, smoking and carbon monoxide.</td>
<td>Theory/model: Social Ecological Model (SEM): intrapersonal level (self-efficacy), interpersonal (social support), and organizational (church). Intervention sessions included a 30-40 min nutrition model and 30 minutes of aerobic activity. Length: 1 year in duration.</td>
<td>EE increased over time, the difference between groups was not significant. No outcomes reported for self-efficacy or social support.</td>
</tr>
<tr>
<td><strong>WATCH: Wellness for African Americans through Churches (Campbell et al., 2004).</strong></td>
<td>( N = 12 ) African American churches; ( N = 587 ) sedentary women. Age: 74% middle age BMI: 40% ( \geq ) BMI: 30. Design: 2 (baseline, follow up) * 2 (TPV, LHA) Randomized control trial.</td>
<td>PA (METS hours/week: Instrument developed for the study, Campbell et al., 2004). Dietary fat, fruit and vegetable consumption (National Cancer Institute Health Habits History and Food Frequency Questionnaire, Block et al., 1986). Colorectal cancer screening.</td>
<td>Theory: SCT, Health Belief and Social Support Model (Bandura, 1989; Israel, 1985; Janz &amp; Becker, 1984; Prochaska, DiClemente &amp; Nacrosse, 1992). TPV: electronic newsletters and videotapes tailored to individuals stage of change LHA: Lay health advisors provided same information Length: 1 year.</td>
<td>TPV: significant increase in recreational PA (2.5 METS hrs/week, ( d = 1.97 )). LHA: no improvements. No outcomes for theoretical constructs were reported.</td>
</tr>
<tr>
<td><strong>Health Body Healthy Spirit (Resnicow et al., 2005).</strong></td>
<td>( N = 16 ) African American churches; ( N = 906 ) sedentary participants (76.2% female). Age: ( M = 46.3 (SD = 13.3) ). Design: 2 (baseline, follow up) * 3 (self-help, self-help + MI, and control) Randomized control trial.</td>
<td>Diet (National Cancer Institute Health Habits History and Food Frequency Questionnaire, Thompson et al., 2000). PA: total weekly minutes of PA, minutes moderate to vigorous PA (( \geq 3.0 ), and intentional PA (Champs, Stewart et al., 2001).</td>
<td>Theory/Model: no theory specified. Group 1: standard educational materials (control) Group 2: culturally relevant self-help nutrition and PA materials (Surface structure, deep structure: Resnicow, et al., 1999). Group 3: same materials as Group 2 as well as four MI counseling sessions (MI: Miller &amp; Rollnick, 2002). Length: 1 year</td>
<td>Group 2 and 3 significantly increased total weekly minutes of PA (( d = 1.23 )), PA ( \geq 3.0 ) METS (( d = 3.2 )), and intentional activities (( d = 2.3 )), relative to Group 1. There were no significant differences between Groups 2 and 3.</td>
</tr>
</tbody>
</table>

*Note: Outcomes are presented for PA and psychosocial constructs only.*

Table 2.1: Church physical activity interventions.  
(Continued on next page)
Table 2.1: Continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A church based physical activity intervention for African American women (Young &amp; Stewart, 2006).</td>
<td>$N = 11$ churches; $N = 123$ participants. Sedentary African American women. Aerobic Exercise: Age: $M = 48.2 \ (SD = 2.2)$, BMI = 32.8 (SD = 0.7). Stretch and Health: Age: $M = 48.4 \ (SD = 2.3)$, BMI: $M = 33.0 \ (SD = 0.9)$. Design: 2 (pretest, 6 month follow up) X 2 (aerobic exercise, stretch and health) Randomized self-monitoring only control trial.</td>
<td>PA: EE (7-day recall, Blair et al., 1995; Yale PAS; DiPietro et al., 1993). BMI Self-efficacy for exercise (Sallis et al., 1988), Social Support for Exercise Scales (Sallis et al., 1987).</td>
<td>Theory: SCT, including increasing SE, SR, and SS. Aerobic exercise: 1 hr weekly aerobic exercise classes. Instructors were African American. Use of “buddies.” Brief discussion period at end of each session (&lt; 5min) about SCT strategies. Stretch and Health: alternating weekly stretching and health education classes. African American women led classes. Length: 6 months</td>
<td>There were no significant differences between groups at 6 months follow up. Aerobic: prevalence of physical inactivity decreased from 39% at baseline to 32% at follow up. Stretch: prevalence of physical inactivity decreased from 38% at baseline to 31% at follow up. Self-efficacy and social support for physical activity at baseline predicted PA increase at 6 months follow up. No outcomes were reported for SCT constructs at follow up.</td>
</tr>
<tr>
<td>Health – e – AME (Wilcox et al., 2007).</td>
<td>$N = 20$ African Methodist Episcopal churches; $N = 571$ participants, African American men and women. Design: 3 (baseline, 1, 2 year follow up) X 2 (Health-e-AME, self-monitoring only control group). Follow up conducted at 1 and 2 years.</td>
<td>PA: Behavioral Risk Factor Surveillance Survey (BRFSS): moderate and vigorous PA. Telephone survey measured health, internet use, PA behavior and correlates, weigh perceptions, diet, and process indicators assessed program awareness, use and implementation. SOC (Behavior Change Consortium, 2003).</td>
<td>Theory: Stages of Change (Prochaska &amp; DiClemente, 1983), Social Ecological Model (McLeroy et al. 1988). Health –e-AME: different programs targeted each SOC for PA and diet and sought to change the church environment to be more conducive to these health behaviors. Control: completed assessments only and were offered the intervention at follow up. Length: 3 years</td>
<td>No change in SOC or moderate and vigorous PA. No change in outcome variables. No outcomes were reported relating to intrapersonal or interpersonal variables.</td>
</tr>
</tbody>
</table>

(Continued on next page)
Table 2.1: Continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Heart and Soul Physical Activity Program (Peterson et al., 2005).</td>
<td>$N = 4$ churches; $N = 42$ non-Hispanic Caucasian sedentary women. Intervention group: Age: $M = 53.7$ (SD = 9.7) Self-monitoring only: Age: $M = 48.3$ (SD = 7.7). Design: 2 (pretest, posttest) X 2 Experimental repeated measures nested design.</td>
<td>PA: EE and PA $\geq 4$ METS: 7day recall), CR fitness (estimated $V_{02\text{max}}$; Rockport Walking Test).</td>
<td>Theory: social support. HSPA: weekly intervention sessions targeting appraisal, belonging, tangible, and self-esteem domains of social support. Each session incorporated 15 minutes of group physical activities. Control group: “exercise and your health” (AHA, 2001). Length: 12 weeks</td>
<td>No significant difference between $V_{02\text{max}}$ ($\eta^2 = .27$). No outcomes were reported for social support domains.</td>
</tr>
<tr>
<td>Effects of a holistic health program on women’s physical activity, mental and spiritual health (Jorna, Ball &amp; Salmon, 2006).</td>
<td>$N = 48$, sedentary non-Hispanic Caucasian women “Embracing a healthy lifestyle” $N = 18$ women Age: $M = 40.2$ (SD = 10.4), BMI = 29.5 (SD = 7.0). Comparison group: $N = 30$ women Age: $M = 38.3$ (SD = 13.0), BMI = 25.7 (SD = 5.2). Design: Quasi-experimental non equivalent pre to posttest control group design</td>
<td>PA: time spent walking and time spent in moderate and vigorous PA (Champs, Stewart et al., 2001). Mental Health (CES-D, Radloff, 1977) Spiritual health: Spiritual well being scale (Ellison, 1983).</td>
<td>Theory: SCT, targeting SE, observational learning, overcoming barriers, and social support. Embracing a healthy lifestyle: 10 sessions over 8 weeks, 45 min group teaching, 45 min group discussion, 30 minutes moderate intensity PA. Comparison: Existing non health related education and social support program. Matched in contact and duration to intervention group. Length: 8 weeks</td>
<td>The intervention group “embracing a healthy lifestyle” increased time spent walking by 30 minutes per week, and time spent in moderate and vigorous PA by 0.63 hrs per week. The increase was significantly greater than the comparison group. No outcomes were reported for SCT variables.</td>
</tr>
</tbody>
</table>
Table 2.1: Continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Guide to Health (Winett et al., 2007). | $N = 14$ Baptist and United Methodist churches; $N = 1071$, primarily female (67%), non Hispanic Caucasian (70.6%). Age: $M = 53$, and 57% of BMI: 57% $\geq 25$ Sedentary: 60% $< 7500$ steps/day. Design: 3 (pre, post and follow up) X 3 (GTH only, GTH plus, Control). | PA: Pedometer step counts (Accusplit AE120, San Jose CA). Nutrition: Block 98 Food Frequency (Berkeley, 1998). Social cognitive variables: The Health Beliefs Survey (Anderson et al., 2001, 2006). | Theory: SCT, social support, SE, outcome expectancies and SR.  
1. GTH only: internet delivered computer modules  
2. GTH plus: internet delivered computer modules and church support  
3. Control group: completed assessments only.  
Length: 7 months with follow up 16 months following pretest. | GTH participants increased steps/day significantly by 1,500 steps/day, GTH only by 1,400. The difference between GTH conditions was not significant, but both were significantly greater than control group 400 steps/day. Only SR improved significantly among intervention participants. Use of planning and tracking strategies predicted increase in steps at posttest and follow up ($r = .216$, $r = .193$), and use of strategies to fit PA into daily routine predicted steps/day at posttest $r = .299$, and follow up, $r = .170$. |
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Preliminary outcome evaluation of First Step Program: a daily physical activity intervention for individuals with type II diabetes (Tudor-Locke et al., 2002). | $N = 9$ (6 women, 3 men) 
Age: $M = 53.6$ ($SD = 6$), 
BMI: $M = 32.9$ ($SD = 3.4$). 
Sedentary adults with type II diabetes. 
Design: pre-experimental one group design | PA: pedometer measured steps/day (Yamax Digi-Walker, SW-200) 
Heart rate, Blood pressure, waist and hip girth and weight. | Theory: SCT, primarily targeting SE and SS. 
FSP: Adoption phase, 4 facilitated group meetings. 
Group meetings include progress reports, group discussion, goal setting, and a brief walk. 
Adherence phase: participants continue to monitor steps and have minimal telephone contact. 
Length: 8 weeks | Walking increased significantly from baseline to midpoint (34.3 min/day, $d = 1.1$), baseline to posttest (23.6 min/day). 
Waist girth decreased significantly from baseline to midpoint and from mid point to posttest. 
No outcomes for SCT constructs were reported. |
| Controlled outcome evaluation of First Step Program: a daily physical activity intervention for individuals with type II diabetes (Tudor-Locke et al., 2004). | $N = 47$ (55% men, 45% women) adults with type II diabetes. 
Age: $M = 52.7$ ($SD = 5.2$), 
BMI: $M = 33.3$ ($SD = 5.6$), 
sedentary < 8800 steps/day. 
Design: 3 (pre, post and follow up) X 2 (FSP, control) randomized control trial | PA: pedometer measured steps/day (Yamax Digi-Walker, SW-200) 
Heart rate, Blood pressure, waist and hip girth and weight. | Theory: SCT, primarily targeting SE and SS. 
FSP: Adoption phase, 4 facilitated group meetings. 
Group meetings include progress reports, group discussion, goal setting, and a brief walk. 
Adherence phase 12 weeks, participants continue to monitor steps and have minimal telephone contact. At week 16 participants returned pedometers. 
Control: monitored steps only. 
Length: 24 weeks (4 weeks adoption phase, 12 weeks adherence phase, follow up at 24 weeks. | Week 16: FSP participants significantly increased steps/day by 3000 ($d = 0.7$), increase was significantly greater than controls ($d = 0.96$). Waist and hip girth significantly decreased over time and relative to controls from baseline to 16 weeks (2-3 cm). 
24 weeks: difference in steps/day between groups was no longer significant. 
No outcomes for SCT constructs were reported. |

Table 2.2: Pedometer based physical activity interventions. (Continued on next page)
Table 2.2: Continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health benefits of a pedometer based physical activity intervention in sedentary workers (Chan et al., 2004).</td>
<td>$N = 106$ ($n = 92$ women, $n = 14$ men). Age: $M = 43$ ($SD = 9$) BMI: $M = 29.5$ ($SD = 6.2$) Steps/day: baseline, $M = 6981$ ($SD = 3140$) for women, and $M = 7661$ steps/day for men ($SD = 2474$). Non-clinical population Design: pre-experimental one group design</td>
<td>PA: pedometer measured steps/day (Yamax Digi-Walker, SW-200) Heart rate, Blood pressure, waist and hip girth and weight, SBP, DBP.</td>
<td>Theory: SCT, primarily targeting SE and SS. FSP: Adoption phase, 4 facilitated group meetings. Adherence phase week 5 to 12, participants continue to monitor steps. Length: 12 weeks (4 weeks adoption phase, 8 weeks adherence phase).</td>
<td>Steps per day increased from $M = 7,029$ ($SD = 3,100$) at baseline to a plateau of $M = 10,480$ steps/day ($SD = 3,224$) by 3.96 weeks of the intervention. No outcomes were reported relating to the SCT constructs.</td>
</tr>
<tr>
<td>A preliminary study on the impact of a pedometer based intervention on daily steps (Croteau, 2004).</td>
<td>$N = 37$, sedentary men and women (29 women, 8 men). Age: $M = 44.3$ ($SD = 9.3$) Steps/day: baseline, $M = 8565$ ($SD = 3121$). Design: pre-experimental one group design</td>
<td>PA: Yamax Digi-Walker SW0200. BMI: participants were placed into tertiles according to baseline steps (normal weight, overweight, and obese, ACSM, 2000). Perceptions of PA survey, and Physical Activity Survey (PPA, PAS: Godin &amp; Shephard, 1985).</td>
<td>Theory: no theory specified Intervention: participants completed an 8-week intervention “Healthy Steps”. Participants attended one counseling session covering goal setting and strategy selection, then monitored their steps/day over the subsequent 8 weeks. Different recommendations were given for step goals according to baseline steps: 10,000 = maintain, 8000-10,000 = 5% increase, &lt; 8000 = 10% increase. Length: 8 weeks</td>
<td>Significant increase in steps/day over time ($M = 1973$), and a corresponding significant increase in PAS and PPA ($d = 0.47$, and $d = 0.50$, respectively). Maintainers increased steps/day from baseline to posttest 5%, 5% group increased by 24.9%, and the 10% group by 39.9%. Individuals with lowest baseline levels increased steps/day to 8135 ($SD = 2598$). Normal weight increased steps/day from baseline to posttest by 16.4%, overweight by 24% and obese by 34.4%.</td>
</tr>
</tbody>
</table>

(Continued on next page)
Table 2.2: Continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The effect of a primary care exercise intervention for rural women (Sherman et al., 2007).</td>
<td>$N = 61$, sedentary Caucasian women. Age: $M = 42$ (range 22 to 64 years) BMI: $M = 30.6$ (SD = 7.4). Steps/day by BMI: baseline: 7415 = normal weight, 6808 = overweight, 5545 = obese. Design: Pre-experimental, pretest posttest single group design.</td>
<td>PA: steps/day (Accusplit model AX-120, San Jose, CA).</td>
<td>Theory: No theory specified. Intervention: women were provided with exercise counseling at intake, a pedometer and exercise video tape and asked to monitor their steps over 6 months. Length: 6 months</td>
<td>Normal weight women significantly increased $M = 2584$ steps/day (SD = 2790), overweight $M = 3348$ (SD = 2572), and obese $M = 2173$ (SD = 2626). The overweight group had the largest increase ($d = 1.32$).</td>
</tr>
<tr>
<td>Twelve-month effects of Canada on the Move: a population wide campaign to promote pedometer use and walking (Craig et al., 2007).</td>
<td>$N = 9935$ adults. Age: 18 years and older. Design: Cross-sectional telephone survey.</td>
<td>PA: International Physical activity questionnaire (IPAQ: short form (Craig et al., 2003). Participants were asked if they had heard of the campaign, if they had heard of the generic message to “add 2000 steps” and if they had heard of the specific COM tagline “donate your steps to research.”</td>
<td>Theory: no theory specified. COM was a partnership between Canadian Institutes for Health and Kellogg Canada. Cereal boxes promoted walking and disseminated pedometers. Length: 1 year.</td>
<td>2.4 and 2.3% higher prevalence of sufficient walking among those recognizing the campaign. Awareness of COM was associated with a 13% higher odds of sufficient walking. Prevalence of sufficient walking was 23% higher among those recognizing the specific tagline compared to those who did not. Those owning a pedometer were 14% more likely to engage in sufficient walking. Being aware of the specific tagline and owning a pedometer were 1.52 times more likely to report sufficient walking. Higher odds for sufficient walking were reported for Spring, Summer, Fall and Winter in 2004 when the campaign took place, compared to all quarters in 2003.</td>
</tr>
</tbody>
</table>
Table 2.2: Continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and design</th>
<th>Dependent variables</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting walking with pedometers in the community: the step by step trial (Merom et al., 2007).</td>
<td>$N = 369$ inactive adults (men and women). BMI: 72% of the sample was overweight. WPP steps/day: $M = 7500$ ($SD = 2668$). Design: 2 X 3 Pretest posttest randomized control trial.</td>
<td>PA: Steps/day (WPP group only): Yamax Digi-Walker SW-700. Walking: AAQ: Active Australia Questionnaire (Timperio et al., 2002). LTPA: The College Alumni Questionnaire (Paffenberger et al., 1993).</td>
<td>Theory: SCT. Length: 3 months. Intervention: both WP and WPP groups received a self-help booklet based on SCT providing information on increasing walking. Participants also used diaries to record their walking and steps. Participants in the WPP condition monitored their steps/day with a pedometer.</td>
<td>For all purpose walking: the WPP increased 30 minutes more than the WP group within the last week. For Leisure Time Walking, both WP and WPP groups increased significantly relative to controls. Percentage participating in LTPA was greater in both intervention groups relative to controls. In the WPP group mean change in steps/day was $M = 1820$ (CI: 1050-2591) from baseline to follow up. No outcomes were reported relating to the SCT variables.</td>
</tr>
</tbody>
</table>
Chapter 3

METHOD

Purpose

The primary purpose of the study was to evaluate the efficacy of a social ecological church based intervention to increase daily walking among sedentary females. Walking was defined as average daily step counts measured by a pedometer. Impact evaluation methods were used to determine whether the social ecological intervention increased daily walking over a 10 week period and to compare daily walking by the intervention participants to daily walking by women in a self-monitoring only comparison group. The intervention was based on the social-ecological model proposed by McLeroy et al. (1988) and targeted intrapersonal (self-efficacy and self-regulation) and interpersonal variables (social network and group cohesion) and was delivered at the organizational level (church).

There were four secondary purposes to this study. First, we sought to evaluate the efficacy of the intervention to change the intrapersonal and interpersonal variables on which the study was based. The second purpose was to examine associations between changes in these variables with change in daily walking to identify potential mediators of behavior change. Thirdly, process evaluation methods were used to examine the
relationship between fidelity of program implementation and change in steps/day, and group cohesion and change in steps/day. Finally, process evaluation methods were used to measure appropriateness of program content, and overall participant satisfaction. Permission to conduct the study was obtained from The Institutional Review Board, Office of Responsible Research Practices, of the Ohio State University.

RESEARCH DESIGN

When interventions are delivered in real world settings to groups or organizations, such as churches or communities, it is often not feasible to randomize pre-existing groups into treatment and control conditions. Firstly, it may be difficult to recruit and retain groups into control conditions, and secondly, withholding an intervention from a group that is potentially beneficial may be considered unethical (Cook & Campbell, 1979). Therefore, the present study utilized a pre and posttest quasi-experimental non equivalent control group design (Campbell & Stanley, 1963) with follow up at 10 weeks.
Quasi-experimental designs were developed for conducting research in field, or real life situations (Vogt, 1999). A quasi-experimental design is appropriate when it is not possible to randomly assign the experimental unit to treatment or control group. In this design individuals or group either self-select or are allocated non-randomly into the intervention or comparison group. In the present study churches were recruited on a first response basis to either the social ecological (SE) intervention group or a self-monitoring (SM) comparison group. The non equivalent control group design is one of the strongest quasi-experimental designs for controlling the majority of threats to both internal and external validity.

---

Following completion of data collection, participants in the self-monitoring only group were offered the educational sessions.
Controlling for Internal Validity

Internal validity is the assurance or certainty that change in the independent variable following exposure to an intervention is due to the intervention itself, and not due to other factors. A threat to internal validity occurs when the investigator is not able to rule out chance or alternative explanations. Campbell & Stanley (1963) delineated a number of threats that can occur to the internal validity of a study.

Selection is concerned with the threat to a study’s internal validity by the possible differential selection of participants or into the different conditions of the study. Any number of factors, including demographics, biological, and/or experience could differentiate recruitment churches and participants prior to the study onset. In order to control for threats to internal validity, the addition of an equivalent unexposed group to the intervention is necessary. The best method to ensure equivalence between groups is random assignment. Random assignment ensures each individual or group has an equal probability of being assigned to either the intervention or control condition. When participants or groups are randomly assigned, we can ensure that any other variables, characteristics or attributes of the participants or groups that may influence the dependent variable will be randomly distributed across conditions (Silverman & Solomon, 1998). Because random assignment was not feasible in the current study, the non equivalent control group design was used and the experimental units (church) were not randomly assigned to conditions. Therefore, in the present study, control for the threat of selection was accomplished by ensuring that participants in the social ecological intervention and the self-monitoring only comparison group were similar on variables or characteristics.
that might have influenced the outcome of the study, in particular the primary outcome of
the study, steps/day. To control for this threat, pretest measures for the primary outcome
variable steps/day, intrapersonal and interpersonal social ecological variables, and
participant demographics were examined prior to study implementation to ensure that the
two groups, social ecological intervention and self-monitoring only comparison group
were similar on these variables.

*History* is a threat to the internal validity of the study when events external to the
study itself are responsible for change in the dependent variable. This might have
occurred for instance, if a mass media campaign promoting the benefits of regular
walking took place at the same time as the intervention. Threat to history was controlled
by inclusion of the self-monitoring only comparison group. The inclusion of a
comparison group enabled measurement of whether the social ecological intervention
increased walking over and above any increase from other events. Changes that occurred
in variables on account of history should have occurred to a similar extent in both groups.

Another threat to the internal validity of studies noted by Campbell & Stanley
(1963) is *maturation*. Maturation represents changes in the dependent variable that could
have occurred due to changes in participants over the course of time. As before,
inclusion of a comparison group provides a measure of whether the increase in the
intervention group is over and above the increase that would have occurred through
maturation. In the present study, the self-monitoring comparison group (SM) was
compared to the social ecological intervention group (SE) at pretest for all measured
variables to assure that the groups were similar. Therefore, we can assume that change
due to maturation would occur in both groups to a similar degree. Moreover, threat due to maturation is more likely to occur when studying younger age groups. On account of the age range of the sample in the current study and brevity of the intervention, maturation should not have been a threat.

*Instrumentation* is a threat to internal validity when the interviewer(s) or instrument(s) changes from pre to posttest. In this instance, any changes observed in the dependent variable may be due to change in instrumentation rather than due to the intervention itself. In the present study, instrumentation was controlled for by using instruments with established reliability and validity in the population of interest, sedentary women. As all instruments were self-administered, change in interviewer was not a threat to internal validity.

*Mortality* occurs when participants drop out before the study is completed. Mortality poses a threat if participants from one of the conditions drop out more frequently than participants from the other condition. Differential mortality from conditions may result in differences in the dependent variable at posttest that are not a consequence of the intervention itself. The addition of a self-monitoring only comparison group in the present study enabled the investigator to examine differential mortality between groups, and differences between women who completed the study and women who did not.

*Testing* is a threat to the internal validity of a study if the effects of initial administration of a test impact the scores on a subsequent administration of the same or equivalent test because the individual is more aware of the purpose of the test, or how to
take the test. This is sometimes referred to as the practice effect of multiple tests (Gliem, 2005). In the current study, both the intervention and comparison group completed pretest, posttest and follow up measures, therefore it was expected that the impact of the pretest on subsequent administration was equivalent for both groups. Inclusion of a comparison group controlled for the threat of testing.

Regression to the mean can occur with participants who have extreme scores on dependent variables at pretest. Participants with extreme scores will on average regress closer to the group mean on subsequent testing (Gliem, 2005). Regression to the mean was accounted for by the inclusion of a comparison group. It was expected that regression would be the same for both groups, if groups were similar on the variables of interest at pretest.

Controlling for External Validity

External validity is the extent to which study findings can be generalized when delivered under typical conditions. To whom can the results be generalized reflects population validity, and to what settings or situations can the results be generalized is a measure of ecological validity. In this study the setting of interest was the church. A major threat to external validity is the extent to which the results from the study are generalized. It is often not possible to study all members of a population or all settings in a population, therefore samples are utilized. Samples are a selection of individuals or settings from the population of interest who are studied. Samples are thus used to make inferences about the larger population. In order to generalize to the larger population, the
sample must be as representative of the target population as possible. This is most accurately achieved with probability sampling. Probability sampling is the random selection of individuals or churches from a population to make up a sample. This method of sampling ensures that each individual has an equal chance of being selected. If probability sampling is not used, it is possible that individuals or churches who do not participate in the intervention are different on important characteristics compared to those who do participate, meaning the sample is not representative of the population at large. Generalizing from a non-probabilistic sample to the broader population constitutes a major threat to external validity.

Threats to external validity can also occur when the investigator exerts too much control, and the study is not reflective of typical conditions. In this instance, variables other than the intervention (independent variable) interact and participants behave in a manner that is not typical. Therefore, results of the study cannot be generalized to the larger population or to other settings. For instance, if the participants were given access to a private gym and provided with expensive equipment for the duration of the study, they would likely increase their physical activity levels. However, when the study ends and the facility and equipment is no longer available, their physical activity levels would likely decrease.

Depending on the purpose of the investigation, the researcher must determine whether it is more important to maximize the internal or the external validity, as often one cannot be increased without the other being compromised. According to Flay
(1986), research should progress through a series of developmental stages\textsuperscript{24}. In the first few stages of problem selection and experimental design, the researcher should be concerned with examining the efficacy of an intervention. In this case, the researcher should be concerned with whether an intervention does more good than harm when delivered under ideal conditions and with controlling the internal validity of a study. In the latter stages, Flay (1986), proposed that examining the effectiveness of efficacious interventions is a priority. The effectiveness of an intervention is the extent to which an intervention does more good than harm when delivered under real world circumstances and thus focuses on the external validity of a study.

The present study is a preliminary pilot test of a brief church based intervention and thus is in the early stages of program development (Flay, 1986). Therefore, internal validity as opposed to external validity of the program is a priority (see previous sections for methods to control for threats to internal validity). In the present study, a convenience sample of churches was used; churches available to the investigator were recruited and probabilistic sampling was not used. In addition, the women who participated in the study were volunteers. Therefore, threat to external validity was controlled for by limiting generalization of the findings to individuals and churches who participated in the study as opposed to the population of females who attend churches in Ohio, or church goers in general.

A further consideration for research methods and analysis is the definition of the unit of analysis. When delivering interventions to intact groups, such as churches the

\textsuperscript{24} Stages of research are outlined in detail in chapter 1 (Flay, 1986).
group rather than individual becomes the unit of analysis (Silverman & Solomon, 1998). The inherent correlation between members of intact groups such as churches can underestimate variance. Therefore, if all members are treated as independent, and the individual participant rather than the church is analyzed as the experimental unit, the possibility of a type I error is increased (Murray & Wulfginger, 1994). However, practical considerations such as time and money restraints can often limit recruitment of a sufficient number of groups to ensure appropriate power for the statistical analysis, which could then increase the probability of a type II error. In the present study, although the intervention was delivered to intact groups (churches), the individual was examined as the unit of analysis. Justification for this decision was based on the fact that this study was an exploratory pilot test to determine the efficacy of a brief church based intervention to increase walking among sedentary females. Moreover, an examination of the literature suggests that studies that have reported Intraclass Correlation Coefficients for individuals within churches participating in physical activity interventions tend to be low, ranging from .04 to .0001 (Campbell et al., 2004; Resnicow, et al., 2005). Therefore, the independence of observations assumption was violated in the present study, and is acknowledged as a limitation in the interpretation and generalization of the study findings.

---

25 The null hypothesis is rejected when it is true
26 The null hypothesis is accepted when it is false
Sample Size

Sample size determination was based on number of individuals, as opposed to the number of churches. In order to determine the sample size for this study, three factors were taken into consideration, which were power to detect a statistical difference, significance level, and effect size. According to recommendations made by Keppel (1991) and conventions within the literature reviewed, power was set \textit{a priori} to .80. Likewise, convention within behavioral research recommends alpha level ($\alpha$) to be set \textit{a priori} to .05.

The third factor considered in the determination of sample size was effect size. Within the last decade, there has been a push for health educators to supplement results from their statistical analysis with the reporting of effect size (Buhi, 2005). Probability values are the predominant measure of significance (Watkins et al., 2006), but are largely influenced by sample size. The greater the size of the sample, the greater the probability of finding a statistically significant result. Probability values do not necessarily provide us with information concerning the practical importance of the findings (Thompson, 2003). Effect size on the other hand can provide the reader with information concerning the magnitude of change between variables, and therefore an indication of the practical significance of the findings (Kirk, 1996). In order to recruit a sample that was appropriate to detect the expected effect, it was important to determine \textit{a priori} the magnitude of the expected effect size. As steps/day was the primary outcome of interest,
the magnitude of the expected effect size was determined by change in steps/day reported in the physical activity literature. To determine the magnitude of effect size across studies, Cohen’s $d$ was calculated (Cohen, 1988). Cohen’s $d$ is based on the variance expected as a consequence of the intervention, which can be represented by change in treatment and comparison groups in studies that use more than one group, or in one group designs by change between pre and posttest values. Change is then divided by the pooled variance between groups or pre and posttest (Figure 3.2). Effect size is reported in standard deviation units enabling comparison across studies (Watkins et al., 2006).

$$ \text{Cohen's } d = \frac{M_1 - M_2}{\sigma_{\text{pooled}}} $$

*Figure 3.2 Cohen’s $d$. Where: $M =$ Mean, and $\sigma_{\text{pooled}} = \sqrt{\left(\sigma_1^2 + \sigma_2^2\right)/2}$*

Cohen (1988) suggested certain benchmarks against which the reported effect size can be interpreted, that is, 0.2 is indicative of a small effect, 0.5 a medium and 0.8 a large effect size. To estimate effect size for sample size determination, studies were selected that were as similar to the intervention as possible in terms of primary outcome variable, population of interest, and length of intervention. Values from the studies reviewed are presented in Table 3.1.
<table>
<thead>
<tr>
<th>Study</th>
<th>Δ</th>
<th>Pooled SD</th>
<th>Effect Size in SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherman et al. (2007). Rural women, 6 month intervention</td>
<td>2668**</td>
<td>2696</td>
<td>0.98</td>
</tr>
<tr>
<td>Hultquist et al. (2005) Sedentary women, 4 week intervention</td>
<td>4219** (10k)</td>
<td>770</td>
<td>5.48</td>
</tr>
<tr>
<td></td>
<td>2667** (30 min walk)</td>
<td>632</td>
<td>4.21</td>
</tr>
<tr>
<td>Crouteau (2004). Sedentary workers, 8 week intervention (78% female)</td>
<td>1953**</td>
<td>3412</td>
<td><strong>0.63</strong></td>
</tr>
<tr>
<td>Chan et al. (2004) Sedentary workers, 12 week intervention (86% female)</td>
<td>3451 **</td>
<td>3162</td>
<td>1.09</td>
</tr>
<tr>
<td>Swartz et al. (2003). Overweight sedentary females, 8 week intervention</td>
<td>4722**</td>
<td>1624</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*Note. Δ = Change in steps/day, ** Represents difference within groups from pre to posttest or follow up mean scores.

Table 3.1: Studies used for effect size estimation

In order to detect the smallest possible change in walking, an effect size of 0.63 was selected, which was the smallest effect size reported in the literature. G*Power (version 3.0, Faul & Erdfelder, In Press) was used to calculate sample size for a power of 0.8, alpha = .05, and a moderate effect (0.63). The calculation indicated a total \( N = 44 \) women was required with \( n = 22 \) participants in the social ecological intervention group,
and $n = 22$ participants in the self-monitoring only comparison group. The literature suggests a 20% attrition rate for pedometer programs (Bravata et al., 2007), therefore attempts were made to recruit a sample size of $N = 54$ to allow for 20% attrition.

Cohesion is considered by social scientists as an important variable for small groups (Spink & Carron, 1994). Therefore, the intervention sessions within churches were limited to a minimum of two and a maximum of 12 women per group in order to meet the definition of a group (two or more: Merriam-Webster’s Online Dictionary, 2007) and to enhance cohesion and interaction through a small and manageable size. As a 20% attrition rate was expected, the minimum number of women was limited to three per group.

Setting and Recruitment

To recruit a sample of $N = 54$ women, a list of Christian churches in the Greater Columbus area was generated. From this list, a convenience sample of $N = 15$ Christian churches in the Greater Columbus area was selected and respective church leaders were approached to participate in the study. The churches were selected on the basis of the author having direct or indirect contacts with a church member. Christian churches were selected on account of the literature, which suggests that only 3.5% of church based health education programs have been conducted within other interfaith organizations (Chaves et al., 1996). Thus, we are able to compare the results of the current study with the established literature.
Recruitment of churches started in June 2007 and continued through August 2007. Church pastors were initially contacted by the author through an introductory letter. The letter introduced the importance and the purpose of the study, defined eligibility criteria, requested their participation, and provided contact information (Appendix A). When an e-mail address was available, introductory letters were sent electronically. Interested churches were invited to contact the author either by phone or e-mail to learn more about the study.

Description of Recruited Churches and the Final Sample

Of the churches contacted, nine past ors declined participation and a final convenience sample of $N = 7$ pastors agreed to have their churches participate in the study. The main reasons cited for not participating was existing activities within the church and the exclusive nature of the study (i.e., only open to women between the ages of 18 to 69 years). Churches were assigned to the study conditions on a first response basis. To maximize affordability and manageability, the first three churches whose pastor responded to the recruitment letter were assigned to the social ecological intervention group ($n = 3$), and all churches whose pastor accepted thereafter were allocated to the self-monitoring comparison group ($n = 4$). Demographic information for the participating churches was collected from each church official for descriptive purpose only. Data collected included size of congregation, male/female percentage, age range (median age is reported) and racial/ethnic composition.
Participant Recruitment

All participants were women volunteers recruited from participating churches. A list of inclusion criteria was made available to church leaders who then compiled a list of potential participants for the author to contact to participate in the study. Participants were also recruited through flyers posted in the church (Appendix B), included in church bulletins, and on church websites, if applicable. Recruitment flyers detailed eligibility criteria and provided the authors’ contact information for interested women to find out more about participating in the study. Participants were also recruited through announcements by the church pastor and/or church activity leaders. Finally, participants were recruited through word of mouth. Women were assigned to the social ecological intervention group or self-monitoring only comparison group according to the assignment of the church they attended.

Participant Eligibility

Eligible participants met the following criteria: Women, age ≥ 18 and ≤ 69 years, BMI ≤ 18.5 or ≥ 34.9, sedentary (< 30 minutes of accumulated moderate intensity PA on five or more days of the week, and/or ≥ 4000 ± 100 and ≤ 7000 ± 100 steps per day), not currently pregnant or planning to become pregnant for three months following recruitment, no contraindications for participation in regular moderate PA, and not intending to move away from the area within the subsequent three months following recruitment.
Women were selected as the target population on account of the epidemiological evidence that suggests women are less active than men across all age, ethnic and racial groups (BRFSS, 2005). Age for participation was determined based on the age range of participants in similar studies, and also based on the rational that individuals who are ≥ 70 years old may be more likely to have functional limitations that prohibit them from regular walking. Moreover, research suggests that the pedometer is less accurate when measuring slower walking speeds (Bassett et al., 1996; Hatano, 1993), and slower walking speeds are more likely among older individuals. Furthermore, the Physical Activity Readiness Questionnaire (PAR-Q; Canadian Society for Exercise Physiology, 2002) and the American College of Sports Medicine (2000) recommendations state that individuals over the age of 69 should seek physician approval before embarking on a physical activity program.

Volunteers were excluded from participation if they had a BMI ≤ 18.5 or ≥ 34.9 (normal weight to obese II; ACSM, 2000). The criterion for exclusion for BMI was based on the literature, which suggests that the majority of women who have participated in church based physical activity studies fall within this range. A BMI of ≤ 18.5 is considered underweight (ACSM, 2000). No studies were found that reported inclusion of underweight individuals. As it was not clear whether the intervention would have a positive or negative impact on this population, individuals falling into this category were excluded from participation. Similarly, for individuals with a BMI ≥ 34.9, risk for

---

27 Updated recommendations for 30 minutes of accumulated moderate intensity PA on five days of the week are targeted to adults age 18 to 68 years old (Haskell, et al., 2007). It should be noted that the current study design and approval were completed prior to publication of the updated recommendations. Eligibility criteria were based on previous PA recommendations for all US adults outlined by Pate et al. (1995).
chronic disease is high, and it may not be suitable for these individuals to be active without supervision. Moreover, Tudor-Locke et al. (2001) noted that placement of the pedometer may not be optimal for obese individuals. It is recommended that the pedometer be attached at the waist, centered over the dominant foot (Welk et al., 2002). Tudor-Locke et al. (2001) suggested that this may be less comfortable for some participants with greater abdominal adiposity. The authors noted that although infrequent, pedometers sometimes fall off, and suggested that this risk may be increased in individuals with greater abdominal adiposity, which would likewise extend to pregnancy.

The Physical Activity Seven-day Recall of Exercise Questionnaire (7DRE-Q; Petosa, 1995) was used to measure current physical activity. All women had to be sedentary to be eligible to participate in the study. If women self-reported participating in 30 minutes or more of moderate intensity PA on five or more days of the week and/or 20 minutes of vigorous intensity PA on three or more days of the week (i.e., meet recommendations for PA: Pate et al., 1995\textsuperscript{28}) they were designated as physically active and were not eligible to participate. Using sedentary as an inclusion criterion was based on evidence that physical inactivity is an independent risk factor for chronic disease (USDHHS, 1996), and epidemiological evidence suggests that sedentary individuals accrue the greatest improvements in health through small increases in PA, as opposed to individuals who are already active (Blair et al. 1995). The 7DRE-Q was administered

\footnote{Recruitment took place prior to the publication of the updated physical activity recommendations (Haskell et al., 2007).}
during screening and was used primarily as a screening tool and to corroborate pedometer values measured at baseline. The 7DRE-Q is described in greater detail under the measurement section.

A criterion value for steps/day of 4000 ± 100 to 7000 ± 100 steps/day was also selected to confirm sedentary status. A review of the literature conducted by Tudor-Locke et al. (2001) reported that pedometer values range from 7,000-13,000 steps/day in healthy younger adult samples (lower for women than for men), 6,000-8,500 steps/day in healthy older adult samples, and 3,500-5,500 steps/day in individuals with disabilities and chronic diseases. Bassett & Strath (2002) reported that the average sedentary adult walks 4000 to 6000 steps per day. Moreover, Hultquist et al. (2005) found that women who walk on average 8000 steps per day may still meet current recommendations for physical activity (USDHHS, 1996). Therefore, inclusion values ensured that the study captured older, younger, sedentary, and non disease populations.

Pregnant women were excluded from the study. A prospective study by Ogita et al. (1989) examined pedometer assessed ambulatory activity in pregnant women, and reported that steps/day decreased from an average of 6000 steps/day in the first trimester to approximately 3000 steps/day in the third trimester in comparison to a control group. Women were asked to self-report whether they were pregnant or intending to become pregnant during the three months following recruitment. Individuals were excluded from participation if they had any contraindications for physical activity in particular weight bearing activity because walking was targeted in the present study. Contraindications for physical activity were determined using the Physical Activity Readiness Questionnaire.
(PAR-Q Revised; Canadian Society for Exercise Physiology, 2002; Appendix C). One additional question was added to screen for any walking related limitations: “Do you have any functional or mobility limitations that would prohibit you from walking briskly for a continuous duration of 10 minutes on most days of the week?”

Participants were also excluded if they were planning to move away from the area within the three months following recruitment to ensure that participants were able to attend all study sessions. This was determined by self-report during screening. Finally, to be included in the final sample, women had to sign a consent form and complete all pretest instruments and baseline step/count measurements, which are detailed in a later section.

MEASURES

_Yamax SW-200 Digi-Walker Step Counter_

The primary outcome variable in the current study was walking, which was described and measured as pedometer measured steps per day (steps/day). Steps/day were measured using the Yamax SW-200 Digi-Walker Step Counter (New Lifestyle, Inc., Kansas City, MO). The Yamax SW-200 Digi-Walker is an electronic pedometer that operates on a horizontal spring suspended lever arm that moves up and down with vertical acceleration. With each vertical acceleration the lever makes contact with an electrical device, and a count of one is recorded (Bassett et al., 1996). The Digi-Walker pedometer's dimensions are 2"x 1.5"x .75" and it weighs only 3/4ths of an ounce. It is simple to operate, only having one button – the reset button, and is relatively inexpensive
compared to other Digi-Walker step counters, retailing at around $16.95. The Digi-Walker can be sealed or unsealed. All participants were given pedometers at no cost and were allowed to keep the pedometers following study completion.

The Yamax Digi-Walker has been tested under laboratory conditions, and has been found to have an acceptable level of reliability and validity (Welk, 2000). Bassett et al. (1996) examined the accuracy of five different models of electronic pedometers, and found that the Yamax Digi-Walker model exhibited exceptional reliability and validity in comparison to the other models. The Digi-Walker pedometer was more accurate for both step counts and distance walked at a variety of walking speeds. Likewise, in a field based evaluation conducted by the same authors, the Digi-Walker measured the number of steps and distance walked to within 1% of actual values. A study conducted by Leenders, Sherman & Nagaraja (2000) compared four different methods of estimating physical activity in adult women under free living conditions, including self-report, Tritrac-R3D accelerometer, a Computer Science Applications Inc. activity monitor (CSA), and the Yamax Digi-Walker 500. Although the Digi-Walker underestimated energy expenditure to a greater degree than the other measures, the number of steps recorded by the Digi-Walker was found to be representative of the amount of PA performed during the day as estimated by the CSA and Tritrac (Leenders et al., 2000). As mentioned previously, reviews by Tudor-Locke et al (2002, 2004) provided evidence that pedometers have both convergent and construct validity for measurement of physical activity.

In order to standardize placement, participants were instructed to wear their pedometer in the midline of the thigh over the dominant foot, based on recommendations
by Welk (2002) who indicated that mid thigh is the most reliable position for recording step counts (see Appendix D). Participants were trained on proper placement and use of the pedometer at pre-test. Safety clips\(^{29}\) were provided for participants to safeguard against losing pedometers in the circumstance that they become unattached.

For the duration of the study period, participants were asked to wear their pedometer every day during waking hours during normal and planned activity. Pedometers remained unsealed to provide participants with feedback concerning their progress towards achieving their personal goals. Participants were provided with a walking log, and were asked to record their daily steps at the end of each day in a walking log developed for the purpose of the study (Appendix E). Participants were also asked to record the time within which they wore their pedometer, and any barriers or problems they encountered either with the pedometer or reaching their daily goals. Freedson & Miller (2000) noted that in addition to a measurement tool, pedometers can also be used as a motivational tool, in particular when they are used in combination with individual goal setting and calendars or logs for daily recording. However Tudor-Locke et al. (2001) recommended that if pedometers are to be used as motivational or intervention tools, then information concerning participant compliance and experiences should be provided to assist with interpretation. Therefore, in addition to recording steps/day participants were asked to record any strategies that they used to achieve their walking goals or to remind them to wear their pedometer, such as planning a walk with

\(^{29}\) Safety clips consisted of a 4 inch loop of black woven cord with a metal clip. The cord could be wrapped around the clip of the pedometer and the metal clip could be attached to participant’s belts, waist bands or pockets.
friends or placing a sign on the refrigerator as a reminder to wear the pedometer. The main outcome variable, which was mean steps per day, was calculated by summing total steps per week, and dividing total steps by the number of days the pedometer was worn.

**Self-Report Measures**

*Demographics:* At screening participants were asked to self-report their age, race, marital status, education level, and how frequently they attend the church (service or church related activities) in which the intervention was based. Participants were asked to select one of the following: more than once a week, once a week, bi-weekly, monthly, less than monthly and never. For screening purpose, participants were asked to self-report whether they were currently pregnant or planning to become pregnant over the subsequent three months (Appendix F).

*BMI:* Body Mass Index (BMI: Quetelet index) was used to determine weight relative to height (weight in kg/ by height in m^2; ACSM, 2000). According to norms, individuals with a BMI \( \geq 18.5 \) to 24.9 are normal weight, individuals with a BMI \( \geq 25 \) are considered overweight, and individuals with a BMI \( \geq 30 \) are considered obese (ACSM, 2000). The greater the BMI, the greater the risk for chronic disease. At screening, participants were asked to self-report their height in inches and weight in pounds on the demographic survey, which was subsequently converted to kilograms and meters. BMI is recommended as a simple cost-effective method for assessing weight relative to height in population based studies (ACSM, 2000).
Physical activity: The 7-day Recall of Exercise Questionnaire (7DRE-Q; Petosa, 1995) was used to determine physical activity status during screening to determine eligibility, corroborate pedometer measures at baseline, and to describe the final sample (See Appendix G). According to Kriska & Casperson (1997) corroborative measures should be used to detect participation in specific behaviors to increase confidence in both descriptive and outcome studies. The 7DRE-Q was used for corroboration and descriptive purposes only.

The 7DRE-Q is a variation of the original 7-day Physical Activity Recall (Blair et al., 1985), which has established reliability and validity across numerous studies and populations (Dishman & Steinhardt, 1987; Rauh et al., 1992). In the 7DRE-Q, separate sections are provided to record participation in either moderate or vigorous physical activities (Petosa, 1995). In the present study, the 7DRE-Q was adapted to be specific to physical activity. Participants were asked to indicate with an “X” if they participated in moderate or vigorous physical activities on a given day, and with an “O” if they did not. If they did participate in physical activity, participants were asked to indicate the type of activity by selecting from a list provided or to state the activity if it was not on the list. Participants were also asked to indicate minutes of participation, and whether the physical activity was planned “P” or unplanned “U”. Total weekly minutes of participation in moderate or vigorous, planned or unplanned physical activity was then determined by summing minutes per day for each type of activity. Physical activities were only considered into the total if they were performed for a continuous duration of at least 10 minutes.
Participants were asked to complete all remaining self-report measurements, described in the following pages, at three different time points. Pretest assessment was conducted during the informational session following eligibility screening and consent. Posttest assessment was conducted at the end of the last study lesson in week 6. Follow up assessment took place at the start of the wrap up party in week 10.

Self-efficacy: Self-efficacy is concerned with one’s beliefs about his or her capabilities in specific domains or situations. Two existing self-efficacy instruments that measure self-regulatory self-efficacy and task self-efficacy were adapted to be specific to physical activity and walking for the purpose of this study. Self-regulatory self-efficacy was assessed using a validated scale by Garcia & King (1991; See Appendix H). In a sample of older sedentary adults, internal consistency for the scale was found to have a Cronbach’s alpha of .9 and a test retest reliability of .67 (Garcia & King, 1991). The instrument consists of 15 items that assess the respondent’s ability to be physically active when faced with certain social, personal and environmental barriers to PA, such as time, weather, and family demands. For example, “I could be physically active when the weather is bad.” Respondents are asked to rate their confidence for each barrier on a scale of 0 to 100% (0 = I cannot do it at all to 100% = I am certain that I can do it). Total mean scale scores were used to calculate self-regulatory self-efficacy for physical activity. Total mean scores can range from 0 to 100.

Task self-efficacy is concerned with an individual’s belief in his or her ability to successfully engage in incremental bouts of physical activity, for instance, “I believe that I can walk for 10 minutes at a moderate intensity without stopping.” In the present study,
Task Self-Efficacy was assessed using items developed by McAuley & Mihalko (1998), and adapted specifically for walking (Appendix I). Participants were asked to rate their confidence for five statements relating to their belief they can participate in moderate intensity walking on a scale of 0 to 100% (0 = I cannot do it at all to 100% = I am certain that I can do it). The first statement indicates measures respondent’s ability to walk for 5 minutes at a moderate intensity without stopping, the next statement 10 minutes, and so forth up until duration of 30 minutes without stopping in statement five. Total mean scale scores were used to calculate task self-efficacy for walking. Total mean scores can range from 0 to 100. The scale has been adapted previously for older adults and their participation in physical activities, and internal consistency of the scale was $\alpha = .94$ (Estabrooks & Carron, 2000).

**Self-regulation:** Self-regulation for physical activity is the use of methods to overcome barriers to physical activity and regulate physical activity behavior, including scheduling time for physical activity, monitoring physical activity and planning for relapse. Self-regulation was measured using an instrument developed by Anderson et al. (2006) for a church based intervention with African American congregations (Appendix J). The investigators reported that primary axis factor analysis of responses to each item indicated one factor with a Cronbach’s $\alpha = .83$. The instrument was adapted to be specific to walking and consisted of eight items reflecting strategies for walking. For example, “I make plans for bad weather.” Participants were asked to indicate on a five point Likert scale how often they use each strategy, ranging from 1= Never to 5 = All the
Time. Total mean scale scores were used to calculate self-regulation for walking. Total mean scores can range from 8 to 40.

Social support: Social support is the function of interpersonal relationships, and was operationalized in the present study as the aid and assistance exchanged through social relationships and interpersonal transactions (Heaney & Israel, 1997). Social support was measured using the Social Provisions Scale for Physical Activity (SPS-PA: Duncan & McAuley, 1993; Appendix K). The scale was originally developed and validated by Cutrona & Russell (1987), and subsequently adapted as a measure of social support for physical activity among adults by Duncan & McAuley (1993). The SPS-PA is a 24 item scale that taps the overall level of support available to an individual. The instrument has 6 subscales, each with four items. These subscales were designed to tap the six functions of social support identified by Weiss (1974), which are emotional, tangible, and informational support, reciprocality and integration within respondent’s social network.

Factorial validity of the modified scale for physical activity was assessed by Duncan & McAuley in a prospective study using a sample of sedentary males and females participating in a physical activity class (n = 85; Duncan & McAuley, 1993). Results from their confirmatory factor analysis supported the 6 subscales that were represented by a single second order factor, social resources. The scale was administered on three occasions (4, 8 and 12 weeks). Internal consistency (IC) for subscales ranged from .88 for guidance to .66 for reassurance of worth, at time 1; at time 2 IC’s ranged from .89 for guidance to .70 for reassurance of worth; at time 3 IC’s ranged from .92 for
guidance and .69 for reassurance of worth. Subsequent studies have provided evidence of discriminant validity of the scale, a relationship between social provisions and exercise behavior, and a mediated relationship between social provisions, and exercise through self-efficacy (Duncan et al., 1994; Duncan & McAuley, 1993; Courneya & McAuley, 1995; Rhodes et al., 2002). A more recent study by Motl, et al. (2004) validated the factorial and construct validity, and stability of the scale for use among black and white adolescents. In the Motl, et al. (2004) study, the scale exhibited long term invariance over a 1 year period.

The degree to which each social provision is being met is measured using a 5 point Likert Scale with anchors of 1 = disagree a lot, to 5 = agree a lot; items 2, 3, 9, 10, 14, 15, 18, 19, 21, 22, and 24 are negatively worded and thus reverse scored. The total mean scale score from the instrument was used as a measure of total support available to participants. Total possible mean scale scores range from 24 to 120 points.

Social network: Social network is the collective structure of social relationships that surround an individual and the interaction of the individual in those social relationships (Institute of Medicine, 2001). Social network includes the structural elements number, type, density, proximity and interactional, frequency, durability, and intensity of social relations. In the present study, the focus was on the type of social network members that provide support resources. We examined specifically the interaction with those network members in terms of degree of support desired, received and provided. The type of social network members examined specifically in this study were friends/family/partner, and church.
Support network was measured using a shortened version of the University of California Social Support Inventory (UCLA-SSI: Dunkel-Schetter, Feinstein & Call, 1986) adapted specifically for the study to measure the amount of support desired, received and provided for physical activity from friends/family/partner and church (Appendix L). The UCLA-SSI questionnaire was originally designed to assess social support among college students as part of the Stress and Coping Project at the University of California at Berkeley (Dunkel-Schetter, Feinstein & Call, 1986).

The UCLA-SSI instrument was not designed as a standardized measure; rather the authors recommend that it serves as a general conceptual framework and format for the measurement of support that can be adapted easily to specific research needs. The authors argue that each research problem and or sample has its unique sources, types and dimensions of interest, and the dimension subsets as well as the item content can be adjusted to the specific research context (Schwarzer, et al., 1994).

Schwarzer et al (1994) adapted and administered a shortened 16 item version of the UCLA-SSI to gay men, as a measure of received support for HIV infection and AIDS from four support sources (i.e., friends, relatives, partner, and organization). The adapted instrument was administered at two time points to determine the psychometric properties of the instrument and its factor structure. The investigators reported moderate internal consistencies for type of support (informational, tangible, and emotional), ranging from $\alpha = .58$ for informational to $\alpha = .66$ for tangible, whereas the internal consistencies reported for the four support sources yielded excellent reliabilities (ranging from $\alpha = .89$ for
In Schwarzer and colleagues’ study, the stability coefficients were moderate; $r = .42$, for informational, $r = .51$ for tangible, and $r = .46$ for emotional support; for sources of support $r = .44$ for friends, .56 for relatives, .47 for partner, .51 for groups; and .54 for reciprocity. The authors argued that moderate stability coefficients are to be expected, owing to the behaviorally based and non-dispositional nature of the concept (Schwarzer et al., 1994). Exploratory Factor Analysis was conducted with the 16 items that assessed source and type of support. The findings indicated that four factors represented support resources, whereas type of support did not have any substantial factor loadings. The authors reported that their findings suggest support provision is more homogeneous within sources than within types of support. In addition, a multitrait multi-method matrix (MTMM) Confirmatory Factor Analysis was conducted and Schwarzer et al. (1994) found that source and type factors were weakly correlated, indicating evidence for discriminant validity. The authors recommended that on account of their results, the UCLS-SSI may best be scored into source subscales, as opposed to the types of support.

For the present study, the UCLA-SSI was adapted to measure amount of support provided specifically for physical activity from two support sources. Friend, family and partner were combined into one source of the support and Church was the second. The instrument was adapted to measure three dimensions of support, which were the extent to which support was desired, participants’ perception of support received, and participants’

---

30 Friends, family and partner were combined into one source as the categories are all sources of interpersonal support and are not mutually exclusive. Moreover, the intervention lesson to target interpersonal support was designed to enhance interpersonal support from all sources.
perception of support they provided for informational (advice), tangible (aid and assistance), and emotional (encouragement and reassurance) types of support. For example, “how often have you received reassurance and encouragement for physical activity from your friend/family/partner” (emotional support for physical activity). The scale consists of two subscales (for each of the support sources, friends/family/partner and church) each with 10 items. Within each subscale, one item measured frequency of contact with source in the past month. Participants were asked to indicate on a 6-point Likert scale ranging from 1 = Less than 6-months to 6 = Everyday. For the friend/family/partner subscale participants were asked to select only one person and respond to the questions on the subscale with regards to the same person at each time point. Participants were asked to indicate the person’s initials at each time point to ensure they responded with respect to the same person on each administration of the questionnaire.

Nine items measured the amount of support desired for PA (3-items measured informational, tangible and emotional support), amount of support received (3-items measured informational, tangible and emotional support), and amount of support provided (3-items measured informational, tangible, and emotional support). Participants were asked to indicate on a five point Likert scale how often support was desired, received or provided, ranging from 1 = Never to 5 = Very Often. The questions in the inventory were all within a specified time frame, “the past month.”

Social network was scored by source. Participant’s responses to items within each subscale were summed and the sum was then divided by the number of items to find
the total mean scale score. Separate total mean scale scores were calculated for each of the two subscales, friends/family/partner, and church. Scores for each source of support can range from 10 to 51.

*Group cohesion:* Group cohesion is a dynamic process defined as “the tendency of a group to stick together and remain united in the pursuit of goals and objectives” (Carron, 1982, p. 124). Group cohesion is a social construct, distinct from social support, which is the aid and assistance exchanged through social relationships and interpersonal transactions (Courneya & McAuley, 1995).

In this study, group cohesion was assessed using the Physical Activity Group Environment Questionnaire (PAGEQ: Estabrooks & Carron, 2000). The PAGEQ consists of 21 items with four subscales measuring each dimension of cohesion outlined by Caron, Widmeyer & Brawley, (1985): Group Integration – Social (GI-S; closeness and bonding within the group related to social aspects of the group), Group Integration – Task (GI-T; closeness and bonding within the group related to group goals and objectives), Individual Attraction to the Group – Social (ATG-S; individual feelings about the group pertaining to aspects of social relationships), and Individual Attraction to the Group – Task (ATG-T; individual’s feelings about the group pertaining to matters of group goals and objectives). Participants were asked to respond to each item on a nine point Likert Scale, in which 1 = *Very Strongly Disagree*, 5 = *Neither Agree or Disagree*, to 9 = *Very Strongly Agree*. Total scale scores for overall group cohesion can range from 9 to 189 (Appendix M).
The PAGEQ is a modification of the Group Environment Questionnaire (GEQ; Carron, Widmeyer & Brawley, 1985), which was originally developed to measure coherence in sport, but was later adapted for use within the exercise domain (Carron, Widmeyer, & Brawley, 1988).

Concurrent validity was established by administering both the original GEQ and the PAGEQ to a group of university students (Estabrooks & Carron, 2000). Correlation between the two instruments was $r = .81$. For the PAGEQ, all internal consistency values were high (i.e., .91, .87, .72, and .85 for ATG-T, ATG-S, GI-T, and GI-S, respectively), suggesting that the PAGEQ may be an appropriate measure for younger adults. As a measure of predictive validity, group cohesion was related to exercise adherence and self-efficacy. The PAGEQ was also administered to older adults (Mean age = 68, $SD = 6.1$) attending physical activity classes. Measures of internal consistency of the instrument with older adults were good, ranging from $\alpha = .72$ to .94 (Estabrooks & Carron, 2000).

Generally, the findings from the study by Estabrooks & Carron (2000) provide support for the reliability and criterion validity of the PAGEQ for younger adults and partial support for predictive validity for older adults. In the current study, total mean scale score on the PAGEQ was used as a process measure of group cohesion for the social ecological intervention group only.
PILOT TEST

Prior to study implementation, content validity of all adapted instruments was determined using an expert panel. Following expert panel review, all adapted instruments and study materials were field tested with a sample of $N = 6$ women to determine their appropriateness for the target population. On the basis of the field test, final adjustments were made to the instruments, which were then tested for internal consistency and stability reliability with a pilot sample of $N = 27$ women. The next section presents findings relating to the content validity, field test, and reliability (i.e., internal consistency and stability reliability over time) for the instruments.

CONTENT VALIDITY

To ensure that the adapted instruments were still representative of the constructs being measured, all instruments were submitted to two experts in the field of Sport and Exercise Science. One expert is a faculty member at Deniston University, Ohio, and the other expert a faculty member at the University of Queensland, Australia. Both experts have conducted extensive research on measurement of physical activity and support constructs respectively. To provide an overall picture of how each social ecological construct targeted in the intervention would be measured, all questionnaires were sent to the expert panel. The expert panel was only asked to assess content validity for the instruments that had been adapted for the purpose of the study, namely the 7-day Recall
of Exercise Questionnaire (7DRE-Q; Petosa, 1995), Task Self-Efficacy (McAuley & Milhalko, 1998), and the University of California Social Support Inventory (UCLA-SSI: Dunkel-Schetter, Feinstein & Call, 1986). Along with the instruments, each member of the expert panel was provided with a summary of the study purpose, research questions, design, target population, and a description of the constructs that each questionnaire was purported to measure.

The expert panel was asked to examine each adapted instrument for content validity in terms of the research questions being addressed and for the target population described. The expert panel was asked to determine content validity based on the following criteria: 1) how well each items measured the constructs that the instrument was purported to measure, and 2) complexity of instructions and wording. Each questionnaire was presented in a Microsoft word document, and the expert panel was asked to include their comments, deletions or additions within the documents using the track changes function.

The process of establishing content validity resulted in the following changes. Changes were made to simplify the wording of each instrument to ensure the reading level would be appropriate for the target population. To increase clarity, the formatting of the 7-DREQ (Petosa, 1995) was altered to increase font size from 10 point to 12 point, and recall of moderate and recall of vigorous physical activity were measured on separate pages as opposed to the same page. Items on the Self-Regulatory Self-Efficacy Scale (Garcia & King, 1991), Task Self-Efficacy (McAuley & Milhalko, 1998), Self-Regulation for Physical Activity (Anderson, et al., 2006), and Physical Activity Group
Environment Scale (Estabrooks & Carron, 2000) were reworded to be specific to walking as opposed to physical activity in general. One item on the Self-Regulation Scale was divided into two for ease of responding, resulting in an 8 item scale. “Write plans for walking in a calendar or diary”, became two items, one for writing plans in a diary, and the other for writing plans on a calendar. To reduce complexity, items on the UCLA-SSI (Dunkel-Schetter, Feinstein & Call, 1986) were reordered so that questions relating to friends/family/partner were grouped together, as were questions relating to church. The original instrument grouped items together in terms of the type of support they were measuring (desired, received, provided). Items from the social network subscale “Physical Activity Group” were eliminated on the rational that participants in the social ecological intervention group would not yet be in a physical activity group at pretest, and participants in the self-monitoring only comparison group would likewise not be in a physical activity group till completion of follow up measures. The final UCLA-SSI subscales consisted of 10 items (per subscale) that assessed the extent to which support for physical activity was desired, received and provided from friends/family/partner and church.

FIELD TEST

Description of Field Test Sample

To determine the appropriateness of both the instruments and intervention materials, such as handouts and worksheets, all materials were field tested with a
convenience sample of \( N = 6 \) women. The women were volunteers recruited from one of the two pilot churches. The women participating in the field test were between 48 and 58 years old \((M = 52.5, SD = 3.62)\), with a Body Mass Index (BMI) between 20.40 and 28.30 \((M = 23.88, SD = 2.62)\). BMI was calculated using the Quetelet index (weight in kilograms/ height in meters\(^2\); ACSM, 2000). According to norms, individuals with a BMI ranging between 18.5 to 24.9 are of normal weight, individuals with a BMI \(\geq 25\) are considered overweight, and individuals with a BMI > 30 are considered obese (ACSM, 2000). On average, the women participating in the field test would be considered normal weight.

All women were non-Hispanic Caucasian (100%). Fifty percent of the women reported high school as their highest level of educational achievement, 16.7% reported technical college, and 33.4% reported obtaining a college degree (16.7%) or post college (16.7%). Half of the sample was married and the other half were divorced. The majority of the field test sample reported attending church at least one time per week (50% more than once a week, 16.7% once a week). The remaining participants reported attending church bi-monthly (16.7%), and less than monthly (16.7%). The women reported participating in between 0 and 175 minutes per week of planned moderate intensity physical activity per week \((PMPA; M = 60.00, SD = 65.80)\), and 0 to 40 minutes of unplanned moderate intensity physical activity per week \((UMPA; M = 6.67, SD = 16.33)\). With regards to vigorous intensity physical activity, the women reported participating in between 0 to 120 minutes of planned vigorous intensity physical activity per week \((M =
No women reported participation in unplanned vigorous physical activity.

Field Test Protocol

The women who volunteered to participate were consented and subsequently administered all the instruments and program materials that would be used in the intervention. Participants were asked to complete each instrument and its corresponding evaluation form. The evaluation forms asked participants to indicate in hours and minutes how long it took them on average to complete each instrument, and to indicate on a five point Likert Scale the amount of effort required to complete the questionnaires with 1 = the least effort (e.g., I did not really have to think hard about how I should answer the questions) and 5 = most effort (e.g., I had to think hard about how to answer the questions). The women were then asked to indicate either yes or no to 1) “Did you understand all the questions”, and 2) “Did you understand how to complete the questionnaire.” If they responded “No” to either or both questions, they were asked to write down the question number with which they had concerns or questions. Women were also asked to comment on any specific problems they encountered, such as “I did not understand the words in the question(s),” or “I did not understand why this question was being asked.” The women also completed the same evaluation forms for each handout and worksheet intended for the social ecological church based study. As each handout and/or worksheet differed greatly in its requirements for completion, women
were asked only to read and comment on understanding of instructions for completion and content.

On average the women indicated that all questionnaires took 20 minutes to complete ($M = 19.67$, $SD = 1.51$) and completion was relatively effortless ($M = 1.33$, $SD = 0.52$). No changes were indicated in the evaluation forms for the instruments and study materials. Therefore, data from questionnaires completed by the six field test participants could be included in the pilot study. All field test participants completed the same questionnaires seven days later, and thus their data from two administrations of the questionnaires were included as part of the pilot sample data to determine internal consistency and stability reliability.

Description of Recruited Pilot Churches

A convenience sample of $N = 2$ Christian churches were recruited from the Greater Columbus Area. The churches that participated in the pilot study were selected on account of the author having personal contacts within each church. Demographic information for both participating churches was collected from the church contacts for the purpose of generalizing the results from the pilot test to the final sample. Data collected included size of congregation, male/female percentage, age range, and racial/ethnic composition.
<table>
<thead>
<tr>
<th></th>
<th>Church 1</th>
<th>Church 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Number in Congregation</strong></td>
<td>1476</td>
<td>140</td>
</tr>
<tr>
<td><strong>Gender (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48.4%</td>
<td>60%</td>
</tr>
<tr>
<td>Female</td>
<td>51.6%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Racial/Ethnic Composition (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Hispanic Caucasian</td>
<td>99.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Non Hispanic African American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.0%</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Median Age (y)</strong></td>
<td>48</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 3.2: Description of Pilot Churches, \((N = 2)\).

*Description of the Pilot Sample*

To determine the internal consistency and stability reliability of the adapted instruments, all questionnaires with the exception of the Physical Activity Group Environment Scale (Estabrooks & Carron, 2000) were administered to a convenience sample of \(N = 27\) volunteer women recruited from two Christian churches in the Greater Columbus area. To recruit women, church leaders sent e-mails to those whom they thought would be interested and eligible for the study. Announcements were also made by the pastor during the church service. All interested women were asked to contact the author for further information. To be eligible to participate in the pilot study, the women had to be between the ages of 18 and 69 years old.

Twenty seven women including the six field test participants completed the first administration, and 17 of the same 27 women completed the second administration \((N = \)
Women who participated in the pilot study were between 20 to 68 years old ($M = 49.07$ years, $SD = 10.63$), with a BMI ranging from 18.5 to 37.4 ($M = 26.09$, $SD = 4.39$). According to norms for BMI the women participating in the pilot sample would be considered overweight (ACSM, 2000). T-tests for independent samples indicated that there were no significant differences between participants who completed the instruments at time 1, and those who completed the instruments at both time 1 and time 2, for age $t(25) = 1.22$, $p > .05$, and BMI $t(25) = .328$, $p > .05$. Independent t-tests also suggested there were no differences between women who participated in the field test ($N = 6$) and women who participated in the pilot test ($N = 21$), for age $t(25) = -1.48$, $p > .05$, and BMI $t(25) = 1.43$, $p > .05$.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>29</td>
<td>68</td>
<td>49.07</td>
<td>10.63</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>18.5</td>
<td>37.4</td>
<td>26.09</td>
<td>4.39</td>
</tr>
</tbody>
</table>

$M$ = mean, $SD$ = Standard Deviation

Table 3.3: Descriptive Statistics for age and BMI, pilot sample ($N = 27$)

The frequency distribution of pilot participants’ race/ethnicity, education, marital status and church attendance is presented in Table 3.4. The sample was primarily non-Hispanic Caucasian (88.9%). Only two participants reported being Hispanic (7.4%), and one woman reported being of another racial/ethnic background (3.7%). Examination of the table indicates that 29.6% of pilot participants reported post college as their highest level of educational achievement, 26.0% college, 11.1% technical college, 22.2% high
school, and 11.1% reported an unspecified level of educational attainment. The majority of participants were married (63%), 22.2% were divorced, 11.1% single, and 3.7% widowed. In addition, the majority of the pilot sample reported attending church at least one time per week (37% more than once a week, 33.3% once a week). The remaining participants reported attending church bi-weekly (7.4%), monthly (7.4%), less than monthly (7.4), and 7.4% reported an unspecified frequency of church attendance.
### Characteristic

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>n</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Hispanic White Caucasian</td>
<td>24</td>
<td>88.9</td>
</tr>
<tr>
<td>Non Hispanic African American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>African American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

### Education

<table>
<thead>
<tr>
<th>Education</th>
<th>n</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>6</td>
<td>22.2</td>
</tr>
<tr>
<td>Technical College</td>
<td>3</td>
<td>11.1</td>
</tr>
<tr>
<td>College Degree</td>
<td>7</td>
<td>26.0</td>
</tr>
<tr>
<td>Post College Degree</td>
<td>8</td>
<td>29.6</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>11.1</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

### Marital Status

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>n</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>3</td>
<td>11.1</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Married</td>
<td>17</td>
<td>63.0</td>
</tr>
<tr>
<td>Divorced</td>
<td>6</td>
<td>22.2</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

### Frequency of Church Attendance

<table>
<thead>
<tr>
<th>Frequency of Church Attendance</th>
<th>n</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than once per week</td>
<td>10</td>
<td>37.1</td>
</tr>
<tr>
<td>Once per week</td>
<td>9</td>
<td>33.3</td>
</tr>
<tr>
<td>Bi-weekly</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Monthly</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Less than monthly</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3.4: Demographic distribution of pilot sample (N = 27).
Two-way \( \chi^2 \) tests for independent samples were conducted to compare the demographic characteristics of women who completed instruments at time 1 only (\( n = 10 \)) with women who completed instruments at time 1 and time 2 (\( n = 17 \)), and to compare women who participated in the pilot test only (\( n = 21 \)) with women who participated in the field test (\( n = 6 \)). Findings indicated that there were no significant differences between women completing time 1 with women who completed time 1 and 2 for race/ethnicity \( \chi^2 (1) = 0.693, p > .05 \), education, \( \chi^2 (1) = 0.244, p > .05 \), marital status \( \chi^2 (1) = 0.787, p > .05 \), and frequency of church attendance, \( \chi^2 (1) = 0.201, p > .05 \).

Likewise, there were no significant differences between women participating in the pilot test only (\( n = 21 \)), and women who participated in the field test (\( n = 6 \)) for race/ethnicity \( \chi^2 (1) = 0.617, p > .05 \), education, \( \chi^2 (1) = 0.349, p > .05 \), marital status \( \chi^2 (1) = 0.259, p > .05 \), and frequency of church attendance, and \( \chi^2 (1) = 0.561, p > .05 \).

Table 3.5 presents the number of minutes per week pilot participants reported engaging in moderate and vigorous planned and unplanned physical activity. Women reported participating in between 0 and 285 minutes per week of planned moderate intensity physical activity per week (PMPA; \( M = 112.3, SD = 85.19 \)), and 0 to 165 minutes of unplanned moderate intensity physical activity per week (UMPA; \( M = 34.62, SD = 53.76 \)). With regards to vigorous intensity physical activity, the women reported participating in between 0 to 200 minutes of planned vigorous intensity physical activity per week (\( M = 26.29, SD = 55.06 \)), and 0 to 20 minutes of planned vigorous intensity physical activity per week (\( M = 0.74, SD = 3.85 \)). Independent t-tests indicated that there were no significant differences for PMPA \( t(25) = -1.19, p > .05 \), UMPA \( t(25) = 0.282, p > .05 \).
.05, PVPA t(25) = -1.52, p > .05, and UVPA t(25) = -7.61, p > .05, between women completing the pilot test at time 1, and women completing the pilot test at time 1 and 2. Likewise, there were no significant differences between the women participating in the pilot test only and the women participating in the field test for PMPA t(25) = 1.77, p > .05, PVPA t(25) = 3.12, p < .05, and UVPA t(25) = 0.53, p > .05. There was, however, a significant difference between women for UMPA t(25) = 0.019, p < .05, with women participating in the field test reporting lower levels of unplanned moderate intensity PA than women who participated in the pilot test only. As unplanned moderate intensity physical activity was gathered purely for descriptive purposes, the author determined that this difference between women would not pose a threat to the study findings.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMPA</td>
<td>.00</td>
<td>285.00</td>
<td>112.22</td>
<td>85.19</td>
</tr>
<tr>
<td>UMPA</td>
<td>.00</td>
<td>165.00</td>
<td>34.63</td>
<td>53.76</td>
</tr>
<tr>
<td>PVPA</td>
<td>.00</td>
<td>200.00</td>
<td>26.29</td>
<td>55.06</td>
</tr>
<tr>
<td>UVPA</td>
<td>.00</td>
<td>20.00</td>
<td>.741</td>
<td>3.85</td>
</tr>
</tbody>
</table>

Note. PMPA = planned moderate intensity PA, UMPA = unplanned moderate intensity PA, PVPA = planned vigorous intensity PA, UVPA = unplanned vigorous intensity PA, M = mean, SD = standard deviation.

Table 3.5: Descriptive statistics for total weekly minutes of physical activity, pilot sample (N = 27).

Descriptive statistics are presented in Table 3.6 for the dependent variables measured by each instrument during the first administration. To determine whether there were any significant differences between participants who completed the pilot test at time
1 only with participants who completed the pilot test at time 1 and 2, t-tests for independent samples were conducted for each dependent variable with $\alpha = .05$. There were no significant difference between participants completing the pilot test at time 1 with those completing the pilot test at time 1 and 2 for the dependent variables self-regulatory self-efficacy $t(25) = -5.38, p > .05$, task self-efficacy $t(25) = -1.23, p > .05$, self-regulation for walking $t(25) = -0.64, p > .05$, social network index friends and family $t(25) = 0.60, p > .05$, and social network index church $t(25) = -0.41, p > .05$. There was however a significant difference between levels of social support for physical activity, with women who completed the pilot test at both time 1 and 2 reporting higher levels of social support than women completing the pilot test at time 1 only $t(25) = -3.76, p < .001$. This finding may suggest that women who had greater levels of support for PA were more motivated to participate in the pilot test on a second occasion.

There were no significant difference between participants completing the pilot test only with those completing the field test for any of the dependent variables, self-regulatory self-efficacy $t(25) = -1.27, p > .05$, task self-efficacy $t(25) = 0.813, p > .05$, self-regulation for walking $t(25) = 1.41, p > .05$, social support for physical activity $t(25) = -1.12, p > .05$, social network index friends and family $t(25) = 0.351, p > .05$, and social network index church $t(25) = -0.498, p > .05$. 

162
<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRSE</td>
<td>10.00</td>
<td>99.00</td>
<td>56.21</td>
<td>25.38</td>
</tr>
<tr>
<td>TSKSE</td>
<td>10.00</td>
<td>100.00</td>
<td>89.01</td>
<td>19.10</td>
</tr>
<tr>
<td>SRWLK</td>
<td>1.00</td>
<td>4.25</td>
<td>2.26</td>
<td>0.78</td>
</tr>
<tr>
<td>SSPA</td>
<td>1.63</td>
<td>4.71</td>
<td>3.11</td>
<td>0.86</td>
</tr>
<tr>
<td>SNFF</td>
<td>1.00</td>
<td>3.90</td>
<td>2.65</td>
<td>0.68</td>
</tr>
<tr>
<td>SNCH</td>
<td>1.00</td>
<td>3.70</td>
<td>1.51</td>
<td>0.63</td>
</tr>
</tbody>
</table>

Note. M = mean, SD = standard deviation, SRSE = self-regulatory self-efficacy, TSKSE = task self-efficacy, SRWLK = self-regulation for walking, SSPA = social support for physical activity, SNFF = social network index friends and family, SNCH = social network index church

Table 3.6: Descriptive statistics for dependent variables at first administration of instruments, pilot sample (N = 27).

**RELIABILITY**

To determine the internal reliability of the adapted instruments, all questionnaires with the exception of the Physical Activity Group Environment Scale (Estabrooks & Carron, 2000) were administered to the pilot sample (N = 27). To determine stability of instruments over time, the instruments were administered again 7 days later. The Physical Activity Group Environment Scale (Estabrooks & Carron, 2000) was not included in the pilot test administration on the rational that the questionnaire is specific only to those who are part of a physical activity group. As the women participating in the pilot study would not all be part of a physical activity group, it was deemed inappropriate by the author to administer this instrument at this time. Likewise, the 7DRE-Q (Petosa, 1995) was administered on the first occasion only. Again, this was based on the rational that to determine the test retest reliability for this instrument the same seven days
reported on the first administration would have to be recalled for the second administration. This would require that the 7DRE-Q be completed twice within the same 24 hour period. As this was unfeasible, the 7-DREQ was administered on the first occasion only. Therefore, the information gathered from this instrument was used solely for the purpose of describing the physical activity levels of the pilot group.

The women were informed that the purpose of the study was to examine the suitability of a series of questionnaires that measure confidence for walking in various situations, strategies for walking, and perceived support for physical activity. It was determined by the author and pilot study participants that the most appropriate time to administer the questionnaires would be before or after the Sunday church service as participants would be at the church already. Women from one pilot church completed the questionnaires prior to the church service, and women from the other pilot church completed the questionnaires following the church service. The second administration was scheduled at the same time seven days later.

*Internal Consistency*

To derive a measure of internal reliability, Cronbach’s alpha was computed for each instrument. Cronbach’s alpha provides a measure of the extent to which items on a given questionnaire measure the same thing (Vogt, 1999). Alpha coefficients can range in value from 0 to 1. The higher the score, the more reliable the generated scale is. Nunnaly (1978) indicated a threshold of 0.70 to be an acceptable reliability coefficient. Cronbach’s alphas were calculated for all items comprising the total scale than for
subscales, with the exception of the UCLA Social Support Inventory (Dunkel-Schetter, Feinstein & Call, 1986), for which Cronbach’s alpha was calculated separately for the two social network subscales, friends/family/partner and Church.

The results from the pilot study suggested that the internal reliability for each instrument was acceptable: For the Self-Regulatory Self-Efficacy Scale (15 items; Garcia & King, 1991), Task Self-Efficacy Scale (6 items; McAuley & Milhalko, 1998), and Social Provisions for Physical Activity Scale (24 items; Duncan & McAuley, 1993), the internal consistency values were high, $\alpha = .945$, .948, and .891 respectively. For the UCLA friends/family/partner and UCLA Church social network subscales (10 items per subscale; Dunkel-Schetter et al., 1986) and the Self-Regulation for Walking scale (8 items; Anderson et al. 2006) Cronbach’s alpha was lower but still within an acceptable range, $\alpha = .823$, .886, and .790 respectively (Nunnaly, 1978).

Stability Reliability

The extent to which scores on an instrument change from day to day or from test to retest is a measure of that instrument’s stability. Scores that remain stable over repeated administrations are considered to be reliable. In order to assess the stability of the items on each instrument over time, the study instruments were administered on two separate occasions, seven days apart. To determine the test-retest reliability of each instrument, stability reliability coefficients ($R$) were calculated using the formula illustrated in Figure 3.3.
\[ R = \frac{MS_A - MS_W}{MS_A} \]

*Figure 3.3:* Formula for calculating Stability Reliability Coefficients. Where \( R \) is the correlation between the two sets of scores (time 1 and time 2) and is therefore the stability reliability coefficient, \( MS_A \) represents the Mean Square among participants, and \( MS_W \) is the Mean Square within participants (first administration vs. second administration).

\( R \) is the stability reliability coefficient, and can range from 0 to +1. The closer the coefficient is to 1, the more stable and thus reliable the instruments can be considered.

Univariate repeated measure ANOVA’s were calculated in SPSS (version 15; SPSS Inc., Chicago, IL) for each instrument to generate and extract the Mean Square components for calculating \( R \). Scores from each administration of the instruments were coded as time 1 and time 2, representing the first administration and the second seven days later. Scores were only included for those participants who completed the instruments on both occasions (\( N = 17 \)). Time was entered as a fixed factor in the model. Separate Univariate ANOVA’s were calculated for the social network subscales “friends/family/partner” and “church” for the UCLA social support inventory. Results from the ANOVA’s and calculated \( R \)’s are presented in Table 3.7.

Examination of the stability coefficients suggests that the adapted instruments are reliable over time. Stability coefficients were relatively high, ranging from \( R = .87 \) for Task Self-Efficacy to \( R = .99 \) for Self-Regulatory Self-Efficacy.
<table>
<thead>
<tr>
<th>Source</th>
<th>MS</th>
<th>F</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Regulatory Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1201.12</td>
<td>98.24</td>
<td>0.99</td>
</tr>
<tr>
<td>Within</td>
<td>14.66</td>
<td>0.351</td>
<td></td>
</tr>
<tr>
<td>Task Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>156.23</td>
<td>1891.81</td>
<td>0.87</td>
</tr>
<tr>
<td>Within</td>
<td>20.87</td>
<td>0.714</td>
<td></td>
</tr>
<tr>
<td>Self-Regulation for Walking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.16</td>
<td>167.41</td>
<td>0.92</td>
</tr>
<tr>
<td>Within</td>
<td>0.09</td>
<td>1.27</td>
<td></td>
</tr>
<tr>
<td>Social Support for Physical Activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.01</td>
<td>397.27</td>
<td>0.94</td>
</tr>
<tr>
<td>Within</td>
<td>0.06</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>Social Network Friends/Family/Partner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.99</td>
<td>240.45</td>
<td>0.88</td>
</tr>
<tr>
<td>Within</td>
<td>0.11</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>Social Network Church</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.05</td>
<td>80.12</td>
<td>0.98</td>
</tr>
<tr>
<td>Within</td>
<td>0.02</td>
<td>0.38</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.7: Univariate repeated measures ANOVA’s for instruments, pilot study, N = 17.
PROCEDURE

Social Ecological Church Based Study

Screening

Interested women were referred by the church pastors or leader to the investigator, who then contacted the women by telephone or e-mail to conduct preliminary eligibility screening (Appendix N). Participants were asked their age, height in inches and weight in pounds, whether they were currently participating in 30 minutes or more of moderate intensity physical activity on five or more days of the week, whether they were pregnant or planning to become pregnant within the next three months, and whether they were planning to move out of the area during the next three months. Finally, participants were asked whether they had any contraindications for physical activity, such as heart problems, chest pain and or mobility limitations. Based on this preliminary screening, eligible women were asked to attend an informational session that took place one week prior to the first study lesson in the church from which the woman was recruited.

Informational Session

During the informational session, participants were informed about the objectives of the study and consent forms were administered to participants and signed. Eligibility criteria was then verified by asking participants to complete the PAR-Q (Revised, Canadian Society for Exercise Physiology, 2002) to determine whether the participant
had any contraindications for participating in regular physical activity, the 7-DRE-Q (Petosa, 1995) to verify their current physical activity level, and the demographics survey to verify age, Body Mass Index (BMI), and pregnancy status (Appendix F). Women were assigned to the social ecological intervention group or to the self-monitoring only comparison group according to the assignment of their church.

Women in the social ecological intervention churches were asked to attend four, 60 minute sessions that were implemented in the church from which the women were recruited. The start date and time of each educational session were scheduled around ongoing church activities and participant availability. Women in the self-monitoring only condition were asked to complete self-report measures at the same time and within the same time frame as participants in the social ecological intervention condition, which were pretest (prior to week 1), posttest (week 6), and follow up (week 10). The social ecological intervention group attended the four lessons subsequent to pretest and prior to posttest and follow up, and the self-monitoring only comparison group was offered the lessons subsequent to the collection of follow up data. Each lesson was educational, and women were not expected to exercise during any session. The primary purpose of the study was to increase walking by increasing steps taken per day, therefore participants were encouraged to walk in their own time.

Following consent, all pretest paper and pencil self-report instruments were administered to eligible women in both groups, social ecological intervention and self-monitoring only comparison group. Eligible women in both groups were provided with a pedometer and given instruction on how to use the pedometer.
To effectively interpret and compare change in pedometer-assessed steps/day, and to determine variance estimates for calculating effect size, and/or sample size, it is important to determine threshold or normative values for step counts (Myers, 1999). To measure baseline walking, participants in both groups were asked to wear the pedometer for four consecutive days, including one weekend day following screening and consent and prior to the first study session. Masse et al. (1998) found that recording steps over four days provides an accurate estimate of usual steps/days for sedentary populations. The Yamax SW-200 Digi Walker can be sealed, or it can be unsealed to provide participants with feedback regarding their accumulated steps. To measure baseline steps, a blinded protocol was used. During the informational session after consent and completion of pretest questionnaires, all eligible participants were provided with a pedometer. Participants were instructed to set their pedometer to zero and then seal the pedometer with a sticker provided on the first day they wore it during the baseline assessment. Participants were asked to wear the pedometer during waking hours, and during normal activity (Tudor-Locke et al., 2004). The pedometer instruction sheet provided a space for participants to record the beginning and ending times and dates they wore their pedometer over the baseline period. Participants were asked to return the sealed pedometers during the first session. Baseline steps recorded during this period were used to verify eligibility criteria, and for social ecological intervention participants only, were used to devise personal goals to increase their steps/day. Baseline steps/day were determined by dividing the total number of steps by the number of days the pedometer was worn. Participants were asked to maintain their current level of physical
activity over the baseline period. Based on protocol within the literature, the pedometer was sealed during baseline measurement to prevent the participant receiving feedback concerning steps/day (Masse et al., 1998). At the end of the four day period participants returned their sealed pedometer to the investigator, who checked and then broke the seal to record baseline step values. The sticker would tear if tampered with and non-compliance would be obvious.

**Social Ecological (SE) Intervention group**

The social ecological intervention was tapered over a 10 week period.  

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4/post</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 3.4: Time line for the intervention group. Numbers indicate week number, L1, L2, L3 and L4 indicate the lesson number, pre is pretest assessment, post is posttest assessment, and FU is follow up assessment.

The intervention consisted of four lessons that included lecture, discussions, and activities to cover the following topics: Personal Support for PA, Enlisting and Providing Support for PA with Friends/Family/Partner, Being Active with a Group, and Enhancing Church Support for an Active Lifestyle. Each lesson was designed to target a different level of the social environment (i.e., intrapersonal, interpersonal and organizational) and different constructs within each level (i.e., self-efficacy, self-regulation, social support,
social network, and group cohesion). Refreshments, including light healthy snacks and beverages were provided at no cost to participants each session. Each session and pre/post/follow up assessment were completed within the church through which the participant was recruited. Participants in the intervention condition were asked to wear the pedometer and record their steps daily in a walking log during all normal activity with the exception of bathing and sleeping for the 10 week study period. From posttest to follow up, participants were instructed to continue monitoring their steps/day, although they did not attend any educational sessions and no further contact was made with them until the follow up assessment. The period between posttest and follow up enabled an examination of the effects of the intervention on short term maintenance of steps/day after a brief intervention. A conceptual model of the intervention is illustrated in Figure 3.5 and a detailed intervention plan is included in Appendix O. Table 3.8 presents the objectives and constructs targeted in each session.
Figure 3.5: Conceptual model of the social-ecological intervention. Group cohesion is highlighted in yellow as it is a process measure. As it was assessed at posttest only, it was not possible to determine whether group cohesion mediated the impact of the intervention on steps/day. Justification for the inclusion of group cohesion as a process measure is detailed in chapter 1.
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Objectives</th>
<th>Social Environment Construct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personal support for Walking</td>
<td>Describe and discuss: ✓ Benefits of regular PA ✓ Recommendations for PA ✓ Types of PA ✓ Monitoring intensity ✓ Scheduling time for walking ✓ Goal setting</td>
<td>Self-Regulation Self-Efficacy</td>
</tr>
<tr>
<td>2. Enlisting and providing support for walking with friends/family/partner</td>
<td>Describe and discuss: ✓ Types of support to aid walking ✓ Ways to provide support for walking ✓ Scheduling time for walking with friends/family/partner ✓ Goal setting with friends/family/partner</td>
<td>Social Support Social Network: Friends/family/partner</td>
</tr>
<tr>
<td>3. Being active with a group</td>
<td>Team building: ✓ Identify a group name ✓ Identify opportunities to be active as a group ✓ Identify opportunities to be social as a group ✓ Providing support to the group ✓ Collective goal setting for the group</td>
<td>Group Cohesion</td>
</tr>
<tr>
<td>4. Enhancing church support for an active lifestyle</td>
<td>Discuss: ✓ Existing church resources for walking ✓ Methods to increase visibility of walking group ✓ Methods to encourage the church to be physically active ✓ Collective goal setting for the church ✓ Contingency plan to maintain walking and walking group</td>
<td>Social Support Social Network: Church</td>
</tr>
</tbody>
</table>

Table 3.8: Intervention lesson plans
Self-Monitoring (SM) Comparison Group

As presented in the literature review, the majority of church based studies have incorporated a comparison group, as opposed to a true no treatment control. This method is considered necessary to enhance participation and to maintain a good working relationship with the church (Wisdom et al., 2002). To overcome ethical implications of withholding a potentially beneficial intervention from participating churches and to enhance participation, a self-monitoring only comparison group was utilized. Participants in this group were provided with a pedometer and asked to record their daily steps for four days using the same protocol outlined for the social ecological intervention group. The investigator met with participants to collect their sealed pedometers, and to record their steps at the end of the four days. Participants in this condition were asked to wear the pedometer and record their steps daily in a walking log during the same 10 week study period as the social ecological intervention group. The investigator collected all walking logs at the same point as the social ecological intervention group. The self-monitoring only comparison group completed pre, post and follow up measures during the same time as the social ecological intervention group in their church. Subsequent to completion of data collection for follow up, the self-monitoring only intervention comparison group members were offered the same educational sessions as the social ecological intervention group.
DATA ANALYSIS

All analyses were conducted using SPSS (Version 15.0; SPSS Inc., Chicago, IL).

Descriptive Statistics

All quantitative data that were interval or ratio are presented as means (\(M\)) and standard deviations (\(SD\)), and all categorical variables are presented as frequencies and percentages. Descriptive statistics are presented for church demographic variables, including denomination, number of members, and gender, racial and ethnic composition. Descriptive statistics are also presented for participants’ demographic variables, including age, BMI, and race. One-way ANOVA’s were used to examine differences between groups at pretest for all interval or ratio level data including age, BMI, the primary outcome variable steps/day, and the secondary social ecological outcome variables (self-efficacy, self-regulation, social support, and social network). Two-way Chi-square (\(\chi^2\)) tests were conducted to determine differences between groups for all categorical variables, including race/ethnicity, education, marital status, and frequency of church attendance. For all analyses, alpha was set a priori to .05.

Mean values (\(M\)) and standard deviations (\(SD\)) are presented for all outcome variables at posttest and follow up. Mean values (\(M\)) and standard deviations (\(SD\)) are presented for changes in steps/day from week 1 to week 10 for descriptive purpose only.
Evaluation

Process, impact and outcome evaluation are inextricably related to one another. Process evaluation is essential to determining the variables that may contribute to the success or failure of a given intervention. Impact evaluation is necessary to identify what elements of a program are successful and whether they contribute to behavior change. And, outcome evaluation is necessary to determine if the intervention is successful in improving health after all the process and impact variable are considered. A comprehensive evaluation is crucial to evaluating the effectiveness of an intervention and why it was effective. For this study, only measures of impact and process evaluation were included because this was a brief exploratory pilot study and the relationship between health and physical activity has been clearly established (Blair et al., 1993; Pate et al., 1995; USDHHS, 1996; Haskell et al., 2007).

Process Evaluation

The presented study included process measures of implementation, cohesion, appropriateness and participant satisfaction with the overall intervention for women in the social ecological intervention group only.

Program implementation was determined by attendance. Low dose was defined as participants who attended 50% or 25% of the educational sessions (≥ 1 and ≤ 2 lessons), moderate dose was defined as participants who attended 75% of the educational sessions (3 lessons), and high dose were those participants who attended all educational sessions (100%; 4 lessons). Dose was determined by dividing the number of sessions
attended by the total number of sessions offered. A one-way ANOVA was conducted to examine differences between low dose, medium dose and high dose participants in the social ecological intervention group, for the primary outcome variable steps/day at posttest. Alpha was set a priori to .05. Dose of implementation (low/medium/high) was the independent variable (IV), and steps/day at posttest was the dependent variable (DV). The association between program implementation and change in steps/day was examined using Pearson Product Moment Correlations for each time point, pretest to posttest, pretest to follow up, and posttest to follow up.

Group cohesion was included as a process measure by administering the Physical Activity Group Environment Scale to the social ecological intervention group only at posttest (Estabrooks & Carron, 1999). Cohesion has historically been considered by social scientists as an important variable for small groups (Golembiewski, 1962, Lott & Lott, 1965). Cross-sectional and predictive studies have indicated that cohesion is related to exercise behavior (Spink & Carron, 1993, 1994). The majority of studies examining cohesion and exercise adherence have been conducted with participants attending exercise groups, such as Fitness Clubs or University group fitness classes, therefore the role of group cohesion in the physical activity behavior of a church based educational program is unknown.

In order to enhance cohesion, lesson 3 was based on the protocol outlined by Carron & Spink (1993; See Chapter 2). The protocol is based on the principal that groups become more cohesive when their distinctiveness increases, roles within the group are clear, group goals are clear, and communication between group members is facilitated.
The lesson targeted task cohesion by having group members work together to solve problems and to set group and organizational goals (e.g., incorporate physical activities into church events). Social cohesion was targeted by creating opportunities for participants to communicate with one another and to walk together outside of class time. The protocol is explained in more detail in the detailed intervention outline (Appendix O).

Group cohesion was included as a process variable rather than an outcome variable owing to the nature of the PAGEQ. Cohesion is a group property, therefore prior to the program implementation the physical activity group did not exist (Carron & Spink, 1993). Examining difference in group cohesion between groups was also not possible, as the comparison group likewise was not a physical activity group. Moreover, administering the PAGEQ prior to the third lesson, which specifically targeted group cohesion, and again at posttest was not possible as the intervention group had already received two weeks of intervention. As an alternative, bivariate correlations were conducted to examine the relationships between group cohesion measured at posttest, and significant change in steps/day at pretest to posttest, pretest to follow up, and from posttest to follow up.

Appropriateness of the program material was determined with a field test and is described in detail in a previous section. Program satisfaction was evaluated at the end of the last educational session. Women in the social ecological intervention group were provided with an evaluation form and asked to provide answers to four open ended questions: 1) “Were you satisfied with the program content”? 2) “Were you satisfied with
the amount of support you received”? 3) “Were you satisfied with the pedometer”? And 4) “Were there any aspects of the program you think should be added or dropped”? (Appendix P). Women were not asked to provide their names in order to keep the evaluation forms anonymous. As satisfaction was measured using open-ended questions, participants’ responses to the questions are presented as a written qualitative description in the subsequent chapter.

**Impact Evaluation**

In the current study, impact evaluation was conducted to primarily determine whether the intervention successfully changed walking, defined as steps/day, and secondly whether the intervention successfully changed the social environment variables that the intervention lessons were designed to change. The social ecological variables include intrapersonal (self-efficacy, self-regulation) and interpersonal (social support, social network).

The impact of the intervention on walking was determined by examining the difference between steps/day over time (pre, post and follow up) and between groups (intervention and comparison) using data measured objectively by the Digi-Walker step counter and recorded by the participants’ in the walking diary. Likewise, to examine the impact of the intervention on social ecological variables, analysis was conducted to examine the difference over time and between groups for each variable (intrapersonal and interpersonal variables).
In order to determine whether the social-ecological intervention had a significant impact on steps/day and on the social environmental variables, general linear model ANOVA’s within-between 3 (time) X 2 (group) were conducted for each dependent variable. The within-between model was selected as it enables the comparison of several independent variables simultaneously and the examination of possible interaction between different levels of the IV’s. Group (social ecological intervention/self-monitoring comparison), and time (pre, post and follow up) served as the independent variables. Separate ANOVA models were used for each dependent variable, specifically steps/day, self-efficacy, self-regulation, social-support, and social network (friend/family/partner) and social network (church). Measures of effect size in ANOVA are measures of the degree of association between an effect (e.g., a main effect, interaction) and the dependent variable. Partial Eta Squared ($\eta^2$) provides an estimate of the degree of association for the sample, and is the default effect size reported by SPSS (version 15; SPSS Inc., Chicago, IL). Moreover, $\eta^2$ was used to determine the appropriate sample size for the study. Therefore, the magnitude of difference between means for each ANOVA model is reported using $\eta^2$. Reporting effect size for each outcome variable enables future researchers to determine the sample size necessary to determine an effect size of a given magnitude for each dependent variable measured in the present study.

In a 3 X 2 ANOVA, if there is a significant main effect for the IV with three levels, it indicates only that there is a difference between two or more means but it does not tell us exactly where the significance exists (Keppel, 1991). If there was a significant
interaction, paired t-tests were conducted within each group and independent t-tests were conducted between groups for change in the dependent variables at each time point (i.e., pre to post, pre to follow up, and posttest to follow up). If there was a significant main effect for time, paired t-tests for each group were conducted with change scores to determine where there was a significant difference (i.e., pre to post, pre to follow up, and posttest to follow up). Cohen’s $d$ was calculated to provide a measure of the magnitude of effect for change at each time point and between the two groups. As mentioned previously, Cohen’s $d$ also enables a comparison of the findings with other studies.

To look for possible mediators, bivariate correlation coefficients were calculated and examined. According to the framework for mediation outlined by Baron & Kenny (1986), and detailed in chapter 1, to meet the conditions for mediation, the intervention must significantly change the hypothesized mediators, which in the case of the current study were the social ecological variables. Therefore, relationships were only examined between steps/day and the social ecological variables that significantly changed with the intervention. To examine the relationship (association) between two continuous variables, Pearson Product Moment Correlation Coefficients (PPMC) were conducted. Separate PPCM’s were calculated to determine the strength and direction of the linear relationship between significant change in social ecological variables and change in steps/day. Relationships between social ecological variables were also examined. Separate PPCM’s were examined for each time point where there was a significant change for that variable, pretest to posttest, pretest to follow up, and/or posttest to follow up. Correlation coefficients between demographics, social ecological variables
and steps/day were examined for both groups combined. If a relationship exists between two variables, then this relationship should exist in degree. For instance, if support from the church mediates change in steps/day, then increase in support from the church should result in increase in steps/day. If the variable is a true mediator, this relationship would be the same regardless of the group, only the magnitude of the association would differ. Moreover, $r$ is essentially an unbiased estimate if $n \geq 25$ (Gliem, 2005). Combining both groups enables a large enough sample size to produce an unbiased estimate of the association between two variables.

Values of the PPMC can range from -1.0 to +1.0, where the closer the correlation coefficient is to ±1, the stronger the relationship. Several authors have offered guidelines for the interpretation of a meaningful correlation coefficient, and Cohen’s (1988) guidelines are presented in Table 3.9. However, as observed by Cohen himself such criteria are in some ways arbitrary and should not be observed too rigorously. The interpretation of a correlation coefficient depends on the context and purposes, and a correlation coefficient only takes into consideration two variables. In social studies, an $r = .30$ is usually the only relationship we see (Annis, 2008). In the context of the present study therefore, all observed associations where $r \geq .30$, were considered meaningful and potential mediators of the intervention’s impact on steps/day.
<table>
<thead>
<tr>
<th>Correlation</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>.10 to .29</td>
<td>-.10 to -.29</td>
</tr>
<tr>
<td>Medium</td>
<td>.30 to .49</td>
<td>-.30 to -.49</td>
</tr>
<tr>
<td>Large</td>
<td>.50 to 1.00</td>
<td>-.50 to – 1.00</td>
</tr>
</tbody>
</table>

Table 3.9: Interpretation of the correlation coefficient, Cohen (1988).

Finally, to describe how accurately one variable predicts the other, coefficients of determination were also calculated ($R^2$). The coefficient of determination gives an indication of how much variance a given variable explains in the dependent variable, in this instance steps/day.

The relationships between physical activity and demographic variables, such as age, BMI and race are well established (Bauman et al., Trost et al. 2002). Although such variables cannot be changed through intervention and can therefore not mediate the impact of the intervention on steps/day, it is possible that they can moderate the influence of the intervention on steps/day. For this reason, the relationship between participant demographic variables and change in steps/day at each time point were also examined. As BMI and age are continuous variables, their relationship with change in steps/day was examined using PPCM’s. Likewise, education and frequency of church attendance were coded as interval level data, therefore their relationship with change in steps/day was also examined using PPCM’s. Race/ethnicity and marital status were coded as categorical variables, however no analysis was conducted with these variables on account of the relative homogeneity across cells.
RESEARCH QUESTIONS AND STATISTICAL HYPOTHESES

The primary research question was developed to examine the efficacy of the social ecological church based program to increase walking among sedentary females. Secondary research questions were designed to determine whether the intervention successfully increased the targeted social ecological variables, intrapersonal (self-efficacy and self-regulation), and interpersonal (social support and social network). Secondary research questions were also developed to examine whether changes in the social ecological and demographic variables were associated with change in women’s steps/day over time, thus providing a method of identifying possible mediators and moderators of the intervention’s impact. Finally, secondary research questions addressed the association between process measures of program implementation and group cohesion with change in steps/day. Research questions are presented with their corresponding alternative ($H_1$) and null hypothesis ($H_0$).

Primary Research Question:

1. Did the social-ecological intervention increase steps/day over time?
   
i. $H_0$: There was no difference in steps/day over time
   
ii. $H_1$: There was a difference in steps/day over time
2. Did the social-ecological intervention increase steps/day over and above the self-monitoring only comparison group?
   
   i. H₀: There was no difference in steps/day between groups
   
   ii. H₁: There was a difference in steps/day between groups

**Secondary Research Questions:**

1. Did the social-ecological intervention increase self-efficacy over time?
   
   i. H₀: There was no difference in self-efficacy over time
   
   ii. H₁: There was a difference in self-efficacy over time

2. Did the social-ecological intervention increase self-efficacy over and above the self-monitoring only comparison group?
   
   i. H₀: There was no difference in self-efficacy between groups
   
   ii. H₁: There was a difference in self-efficacy between groups

3. Did the social-ecological intervention increase self-regulation of walking over time?
   
   i. H₀: There was no difference in self-regulation of walking over time
   
   ii. H₁: There was a difference in self-regulation of walking over time
4. Did the social-ecological intervention increase self-regulation of walking over and above the self-monitoring only comparison group?
   i. $H_0$: There was no difference in self-regulation of walking between groups
   ii. $H_1$: There was a difference in self-regulation of walking between groups

5. Did the social-ecological intervention increase social support for physical activity over time?
   i. $H_0$: There was no difference in social support over time
   ii. $H_1$: There was a difference in social support over time

6. Did the social-ecological intervention increase social support for physical activity over and above the self-monitoring only comparison group?
   i. $H_0$: There was no difference in social support between groups
   ii. $H_1$: There was a difference in social support between groups

7. Did the social-ecological intervention increase social network support for walking over time?
   i. $H_0$: There was no difference in social network support for walking over time
   ii. $H_1$: There was a difference in social network support for walking over time
8. Did the social-ecological intervention increase social network support for walking over and above the self-monitoring only comparison group?
   i. $H_0$: There was no difference in social network support for walking between groups
   ii. $H_1$: There was a difference in social network support for walking between groups

9. Was change in social ecological variables associated with change in steps/day?
   i. $H_0$: There was no association between change in social ecological variables and change in steps/day
   ii. $H_1$: There was an association between change in social ecological variables and change in steps/day.

10. Were participant demographic characteristics associated with change in steps/day?
    i. $H_0$: There were no associations between participant demographic characteristics and change in steps/day
    ii. $H_1$: There were associations between participant demographic characteristics and change in steps/day.
11. Was group cohesion among participants in the social-ecological intervention condition associated with change in steps/day?
   i. \( H_0 \): Group cohesion was not associated with change in steps/day
   ii. \( H_1 \): Group cohesion was associated with change in steps/day

12. Was program dose for participants of the social-ecological intervention condition associated with change in steps/day?
   i. \( H_0 \): Program dose was not associated with change in steps/day
   ii. \( H_1 \): Program dose was associated with change in steps/day

**ASSUMPTIONS OF THE ANOVA MODEL**

*Random Sampling*

One assumption of the ANOVA is that the subjects used to obtain the data were randomly selected. Random sampling helps to ensure that the sample is representative of the population from which it is drawn. Violation of this assumption is important if the researcher wants to generalize from the study. As previously mentioned the priority of the study was to maximize the internal validity of the study as opposed to the external validity, therefore this assumption was violated in the present study and acknowledged as a limitation in the interpretation and generalization of findings.
**Interval Level Data**

As the ANOVA model compares variances, all data entered into the ANOVA model must be at least interval level data. The study met this assumption.

**Independent Observations**

For ANOVA, the values in the data must consist of independent observations. Observations are independent if there is no consistent, predictable relationship between the first observation and the second, or in the context of the present study, between one participant and another. As discussed previously, independence of observations was violated in the present study as the individual rather than the group was analyzed as the experimental unit. Violation of this assumption can inflate the probability of a type 1 error, prohibiting generalizing from the results. Again, the purpose of the present study was to examine the efficacy of the study to change steps/day and was not concerned with generalization.

**Normal Distribution**

The assumption implies that the data collected have a normal distribution. In general researchers do not tend to be concerned with the assumption of normality, especially if large samples are used. Keppel (1991) suggested that in general the F-test is robust against violation of this assumption if sample size is greater than 12. Therefore, the current study was robust against violation of this assumption.
Homogeneity of Variances

Homogeneity of variance is the assumption that the populations from which the two samples are drawn have equal variances (Vogt, 1999). Again, Keppel (1991) suggested that the F-test is robust against violation of this assumption if large samples are utilized. Box’s M was used to test for violation of this assumption (Gravetter & Wallnau, 2002).

CONSIDERATIONS FOR CORRELATIONAL ANALYSIS

Interval Level Data

Pearson Product Moment Correlations compares the linear relationship between two continuous variables. This assumption is violated when the relationship between the two variables is non-linear. All variables were examined for linearity, therefore this assumption was met in the current study.

Factors which Influence $r$

Measurement error: Error in measurement can lead to bias in the estimation of $r$ and $r^2$. This bias can be unpredictable and can either overestimate or underestimate the variance explained by a given IV. The best protection against this violation is to measure the variables using instruments with established reliability and validity. In the current study, this assumption was met by choosing instruments with established reliability and
validity, and by establishing content validity, internal consistency and stability of
equivalents for the study population prior to study implementation.

**Variance:** Variance of the variables influences $r$. The greater the variability
among the observations, the greater the value of $r$. Standard deviations were examined to
determine variance. In addition, scatter plots were examined and outliers replaced with
the nearest value to the outlier.

**Shapes of the distributions:** The less similar the shapes of the distributions, the
lower the value of $r$. Values for skewness and kurtosis were examined for each variable
to assure that this assumption was met.

**Interpretation of Findings**

Correlation simply describes a relationship between two variables, and it does not
explain why the variables are related. A correlation should not and cannot be interpreted
as proof of a cause and effect relationship between variables. This assumption was
adhered to in the present study in both the interpretation and generalization of the
findings.

**DATA AND CODING**

All data was entered into an SPSS data sheet (Version 15; SPSS Inc., Chicago, IL). Each variable measured was named and classified according to whether it was
nominal, ordinal or interval scale (Appendix Q). Demographic variables including race
(RACE), education (EDU), marital status (MARST), and church attendance (CHATT) were coded as categorical variables and were used for descriptive purposes only. Age (AGE) and BMI (BMI) were coded as interval level data and were likewise analyzed for descriptive purposes. To determine differences between the intervention and comparison groups, and change within groups over time, group assignment was coded as a categorical variable and named GROUP. Participants belonging to the intervention group were coded as 1, and participants belonging to the comparison group as 0.

Data for all other variables were coded as interval level data and named with the suffix PRE for pretest data, POST for posttest data, and FU for follow up data.

Outliers

The explore function in SPSS (Version 15.0; Chicago, Il) was used to identify outliers. Scores that were classified as outliers were replaced with the next highest or lowest score.

Missing Data

To be included in the data analysis, participants had to complete 80% of walking logs between each measurement period. Four logs had to be completed between pretest and posttest and three logs between posttest and follow up. Walking logs were considered incomplete if participants recorded < 4 days of steps/day for a given week within the study period from pretest to posttest or from posttest to follow up. Previous research has suggested that 4 days of pedometer-measured physical activity is sufficient
for sedentary populations because they participate in few and relatively unvaried physical activities (Masse et al., 1999). Participants failing to meet this criterion were considered to be dropouts from that time point and were excluded from the analysis.

For all other measurements, mean replacement was used to replace incomplete items on self-report instruments. For instruments with 80% or more of items completed, the mean value from the whole sample was used to replace the missing value. For instruments with less than 80% of items completed, data were excluded from the analysis. If participants completed more than 80% of items at posttest, but completed less than 80% of items at follow up, their data were included in the pre to posttest analysis. If participants completed less than 80% of items at posttest, their data were excluded from the data analysis. Percentage of completed items was calculated by dividing the number of completed items by the total number of items for that particular instrument. Missing demographic data were not replaced.

**Drop Outs**

Drop out was defined as a permanent discontinuation of recording steps/day (Chan et al., 2004), or failure to complete 80% of walking logs between any measurement time point. In the circumstance that participants failed to complete posttest self-report measures or completed less than 80% of items on each instrument, they were treated as drop outs, and were excluded from the analysis. Drop outs were compared to participants who completed all measurements to determine if there were any significant differences between drop out and completers on demographic and outcome variables.
The ratio of dropouts between groups was compared to examine whether differential mortality was a threat to the internal validity of the study. Participants who did not complete pretest measures, including measurement of baseline steps/day were not included in the analysis. Participants who completed both pretest and posttest measures, but not follow up, were excluded from any analysis using follow up data.
Chapter 4

RESULTS

Purpose

The primary purpose of the study was to evaluate the efficacy of a social intervention to increase daily walking among sedentary females compared to a self-monitoring only condition. Daily walking was operationalized as pedometer accumulated steps/day.

There were four secondary purposes to this study. First, we sought to evaluate the utility of the intervention to change the intrapersonal (self-efficacy and self-regulation) and interpersonal social ecological levels (social support and social network) on which the study was based. The second purpose was to examine associations between change in the social ecological variables, and participant demographic characteristics with change in steps/day to identify potential mediators and moderators of behavior change. Impact evaluation methods were used to examine the efficacy of the intervention to change steps/day and the social ecological variables, and to examine associations between variables. Thirdly, process evaluation methods were used to examine the relationship between fidelity of program implementation and group cohesion to daily walking.
Finally, process evaluation methods were used to determine appropriateness of program content and overall participant satisfaction.

The results of this study are presented in three sections. The first section provides a demographic description of the churches that were recruited to participate in the study \((N = 7)\), and a description of the final sample of women \((N = 38)\). As women were the unit of analysis in the study, descriptive data for the sample are presented and compared by group (i.e., social ecological intervention and self-monitoring only comparison group) and not by church. In this section, women are described and compared by group on demographic variables and mean scores of the dependent variables at pretest, namely steps/day, self-regulatory self-efficacy (SRSE), task self-efficacy (TSKSE), self-regulation of walking (SRWLK), perceived social support for physical activity (SSPA), and social network support variables (UCLA-SSI; sources: friends/family/partner and church). The first section also presents data regarding participant mortality during the 10 week study. Demographic and mean scores for all dependent variables at pretest are presented to describe and compare women who completed the study with women who did not complete the study. Likewise data for women who did not complete the study are compared between groups to determine whether differential mortality occurred.

The second section presents the results from the impact analysis. Data are presented to describe and examine the impact of the intervention on the primary outcome variable steps/day and the secondary outcome social ecological variables. Change in each outcome variable is presented and examined over time from pretest to posttest, pretest to follow up, and posttest to follow up, and compared between the social
ecological intervention and self-monitoring comparison groups. In this section, associations between social ecological variables that significantly changed with the intervention and change in steps/day at each time point (pretest to posttest, pretest to follow up, and posttest to follow up) are presented. Associations are also examined between participant demographic variables (age and BMI) with change in steps/day. The last part of this section presents qualitative data to describe the strategies women cited for increasing their steps/day, barriers they encountered to increasing their steps/day and problems with the pedometer itself.

The third and final section presents findings from the process evaluation. Data are presented and examined to determine whether there were differences in changes in steps/day as a function of intervention dose, that is, among woman who attended 100%, women who attended 75%, and women who attended 50% or less of the social ecological intervention sessions. In addition, correlations are presented to examine relationships between the process variables program implementation and group cohesion, with the primary outcome variable change in steps/day at each time point among women in the social ecological intervention group. Finally, a qualitative summary of participants’ satisfaction with the social ecological intervention and evaluation of study content is presented.

The findings from the impact and process evaluation are limited to women included in the final sample.
RESEARCH QUESTIONS

Primary Research Question:

1. Did the social-ecological intervention increase steps/day over time?
2. Did the social-ecological intervention increase steps/day over and above the self-monitoring only comparison group?

Secondary Research Questions:

1. Did the social-ecological intervention increase self-efficacy over time?
2. Did the social-ecological intervention increase self-efficacy over and above the self-monitoring only comparison group?
3. Did the social-ecological intervention increase self-regulation of walking over time?
4. Did the social-ecological intervention increase self-regulation of walking over and above the self-monitoring only comparison group?
5. Did the social-ecological intervention increase social support for physical activity over time?
6. Did the social-ecological intervention increase social support for physical activity over and above the self-monitoring only comparison group?
7. Did the social-ecological intervention increase social network support for walking over time?
8. Did the social-ecological intervention increase social network support for walking over and above the self-monitoring only comparison group?
9. Was change in social ecological variables associated with change in steps/day?
10. Were participant demographic characteristics associated with change in steps/day?
11. Was group cohesion in participants of the social-ecological intervention condition associated with change in steps/day?
12. Was program dose of participants of the social-ecological intervention condition associated with change in steps/day?

PART I

Description of Recruited Churches, Final Sample

A convenience sample of $N = 15$ Christian churches in the Greater Columbus area was selected and approached to participate in the study. Churches were contacted by the author through an introductory letter and phone call to the pastor. Nine churches declined participation, and a final convenience sample of $N = 7$ churches agreed to participate in the study. The main reason cited for not participating was existing activities within the church, and the fact that the study was exclusive to certain groups (i.e., women between the age of 18 to 69 years). Churches were assigned to groups on a first response basis. The first three churches accepting to participate in the study were allocated to the social ecological intervention group ($n = 3$), and all churches accepting thereafter were allocated to the self-monitoring only comparison group ($n = 4$). Demographic information gathered on the church’s’ congregation is presented in Table 4.1.
Examination of Table 4.1 indicates that the churches participating in the final study were relatively homogeneous. The majority of churches were predominantly non-Hispanic Caucasian, with the exception of one church in the social ecological intervention group, for which the largest percentage of the church members was Asian (47.91%). The majority of churches had fairly equal numbers of men and women, and the age range was 0 to 98 years.
<table>
<thead>
<tr>
<th></th>
<th>SE Intervention (n = 3)</th>
<th>SM Comparison (n = 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (# members)</td>
<td>382 120 239</td>
<td>256 200 200 725</td>
</tr>
<tr>
<td>Participants (n) Final sample</td>
<td>7 5 8</td>
<td>7 5 1 5</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>45.80 50.00 51.10</td>
<td>42.58 45.00 50.00 40.00</td>
</tr>
<tr>
<td>Female</td>
<td>54.20 50.00 48.90</td>
<td>57.41 55.00 50.00 60.00</td>
</tr>
<tr>
<td>Racial/Ethnic (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Hispanic Caucasian</td>
<td>95.0 94.1 40.5</td>
<td>97.7 90 95 98.6</td>
</tr>
<tr>
<td>Non Hispanic African American</td>
<td>2.4 1.7 5.1</td>
<td>0.8 5.0 5.0 1.4</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.5 1.7 0.0</td>
<td>0.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td>Native American</td>
<td>1.6 1.7 47.9</td>
<td>1.5 5.0 0.0 0.0</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0.0 0.0 0.0</td>
<td>0.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td>Other</td>
<td>0.0 0.0 0.0</td>
<td>0.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td>Median Age (y)</td>
<td>45 60 30</td>
<td>45 40 50 49</td>
</tr>
</tbody>
</table>

Note. SE = Social ecological intervention group, SM = Self-monitoring only comparison group.

Table 4.1: Description of churches, final sample (N = 7)

Subject Mortality and Description of Final Sample

An original convenience sample of N = 77 women was recruited for the study from the seven participating Christian churches in the Greater Columbus area. Of these 77 women, N = 44 were eligible to participate in the study and completed all pretest measures (n = 22 social ecological intervention group, n = 22 self-monitoring only comparison group). Eligibility criteria are outlined in the previous chapter. Of the N = 77
44 eligible women, a final sample of $N = 38$ women ($n = 20$ social ecological intervention, $n = 18$ self-monitoring only comparison group) completed the study and were included in the impact and process evaluation. Participants were lost at posttest due to failure to complete the posttest measures and/or failure to attend the educational sessions. There was an overall attrition rate of 13.36% across both groups from pre to posttest (social ecological group 9.10% attrition, and self-monitoring only 18.18% attrition). No further participants were lost at follow up (0% attrition from posttest to follow up), resulting in an overall attrition rate of 13.36% across both groups from pre to follow up (social ecological group 9.10% attrition, and self-monitoring only 18.18% attrition). Figure 4.1 illustrates the flow of participants through each phase of the study, church recruitment and assignment to condition (social ecological vs. self-monitoring only), participant recruitment, participation and attrition from pre, post to follow up.
Recruitment
$N = 15$ Churches approached for participation

Declined
$n = 8$ Churches Declined

Accepted
$N = 7$ Churches Accepted

Allocated to SE intervention group:
3 Churches
$n = 35$ women assessed
$n = 22$ eligible

Pretest
$n = 22$ completed pretest

Posttest
$n = 20$ completed
2 (9.09%) lost at Posttest

Follow Up
$n = 20$ completed
0 (0%) lost at Follow up

Allocated to SM comparison group:
4 Churches
$n = 41$ assessed
$n = 22$ eligible

Pretest
$n = 22$ completed pretest

Posttest
$n = 18$ completed
4 (18.18%) lost at Posttest

Follow Up
$n = 18$ completed
0 (0%) lost at Follow up

Final Sample $N = 38$
$n = 20$ SE intervention group
$n = 18$ SM comparison group

Figure 4.1: Flow diagram of participant recruitment, retention and attrition.
Women who participated in the social ecological intervention group were 26 to 67 years old ($M = 46.45$ years, $SD = 11.58$), and had a Body Mass Index (BMI) of 18.8 to 34.8 ($M = 26.72$, $SD = 5.45$). Twenty-five percent of the women in this group were overweight (BMI $\geq 25$ and $\leq 29.9$) and 20% were obese ($\geq 30.0 \leq 34.9$). Women who participated in the self-monitoring only comparison group were 29 to 66 years old ($M = 46.14$ years, $SD = 11.59$), and had a BMI of 19 to 34.9 ($M = 25.02$, $SD = 4.42$), 11.1% of the women in this group were overweight (BMI $\geq 25$ and $\leq 29.9$) and 16.7% were obese ($\geq 30.0 \leq 34.9$). There were no significant differences between groups for age and BMI, t(36) = 0.268, $p > .05$, and t(36) = 1.27, $p > .05$, respectively. Descriptive statistics for age and BMI for the final sample are presented by group in Table 4.2.

Independent t-tests were also conducted to determine whether there were any significant differences for age and BMI between women who completed the study ($n = 38$) and non-completers ($n = 6$). Non-completers were slightly older ($M = 52.5$, $SD = 8.85$) with a greater BMI ($M = 28.25$, $SD = 3.34$) than women who completed the study, however the differences were not significant for age, t(42) = -1.447, $p > .05$, or BMI t(42) = -1.270, $p > .05$.

As differential mortality can be a threat to the internal validity of the study, t-tests for independent samples were conducted to examine whether there were any differences between non-completers in the social ecological intervention group and non-completers in the self-monitoring only comparison group for age and BMI. The results indicated that there were no significant differences between groups for non-completers for age and BMI, t(4) = 0.139, $p > .05$, and BMI t(4) = 0.253, $p > .05$. 

205
Table 4.2: Descriptive statistics for age and BMI, final sample (N = 38).

<table>
<thead>
<tr>
<th></th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>26</td>
<td>67</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>18.8</td>
<td>34.8</td>
</tr>
</tbody>
</table>

Note. SE = social ecological intervention group, SM = self-monitoring only comparison group, M = mean, SD = Standard Deviation

Descriptive statistics for weekly minutes of planned and unplanned moderate and vigorous intensity PA is presented in Table 4.3. Examination of Table 4.3, indicates that women in both groups were sedentary at screening and engaged in less than 30 minutes of moderate intensity PA on five or more days of the week (Pate et al., 1995, Haskell et al., 2007), and less than 20 minutes of planned or unplanned vigorous intensity PA on three or more days of the week. Independent t-tests indicated that there were no differences between groups for weekly minutes of moderate and vigorous planned and unplanned PA; PMPA, t (36) = -1.659, p > .05, UMPA, t(36) = 0.449, p > .05, and PVPA, t(36) = 0.860, p > .05. As no participants reported participating in unplanned vigorous intensity PA, no t-test was generated for this variable (UVPA).
Table 4.3: Descriptive statistics for total weekly minutes of physical activity, final sample ($N = 38$).

Independent t-tests were also conducted to determine whether there were any significant differences for weekly minutes of moderate and vigorous intensity planned and unplanned PA between women who completed the study ($n = 38$) and non completers ($n = 6$). The findings indicated that there were no significant differences between completers and non completers for PMPA, $t (42) = -0.442, p > .05$, UMPA, $t (42) = -1.372, p > .05$, and PVPA, $t (42) = -0.674, p > .05$. As no women reported participating in UVPA no t-test was generated for this variable. Women who completed the study participated in $M = 61.05$ ($SD = 51.32$) weekly minutes of PMPA, $M = 29.34$ ($SD = 38.01$) weekly minutes of UMPA, $M = 2.37$ ($SD = 8.52$) minutes of PVPA, and no minutes of UVPA. Women who did not complete the study participated in $M = 50.83$ ($SD = 61.35$) weekly minutes of PMPA, $M = 7.50$ ($SD = 18.37$) weekly minutes of UMPA, and no weekly minutes of PVPA and UVPA.

Finally, t-tests for independent samples were conducted to examine whether there were any differences between non-completers in the social ecological intervention group.
and non-completers in the self-monitoring only comparison group for weekly minutes of PMPA, UMPA, PVPA and UVPA. The results indicated that there were no significant differences between groups of non completers for PMPA, \( t(4) = 2.511, p > .05 \), and UMPA \( t(4) = 1.633, p > .05 \). Non completers reported no weekly minutes of PVPA or UVPA, therefore t-tests were not generated for these variables.

The frequency distribution for participants’ race/ethnicity, education, marital status and frequency of church attendance is presented by group in Table 4.4. Women participating in the social ecological intervention group were primarily non-Hispanic Caucasian (70%), with three African American women (15%) and three Asian women (15%). All women in the self-monitoring only comparison group were non-Hispanic Caucasian (100%). Examination of the table indicates that the majority of women in both groups reported attaining a college degree or higher as their highest level of educational achievement (85% social ecological, 78.4%, self-monitoring). Two women in the social ecological group reported high school as the highest level (10%), and one woman reported other (5%). In the self-monitoring only group, two women reported high school as the highest level of education attainment (11.1%), one women reported technical college (5.6%), and one woman reported other (5.6%). The majority of participants in both groups were married (70% social ecological, 88.9% self-monitoring only). Four women in the social ecological group were single (20%), one women was a widow and the other divorced (5%, respectively). Two women in the self-monitoring only group were single (11.1%). The majority of the participants in the final sample reported attending church one or more time per week (95% social ecological, 88.9% self-monitoring only).
monitoring only). The remaining participants in the social ecological group reported attending church less than monthly (5%), and in the self-monitoring only group 11.1% reported attending church bi-weekly.

Two-way $\chi^2$ tests for independent samples were conducted to compare the demographic characteristics between women in the social ecological and self-monitoring only groups. An examination of Table 4.4 suggests there were no significant differences between groups for education, $\chi^2 (1) = 3.377, p > .05$, marital status $\chi^2 (1) = 2.702, p > .05$, or frequency of church attendance, $\chi^2 (1) = 5.634, p > .05$. There was however a significant difference between women in the social ecological and self-monitoring only groups for race/ethnicity $\chi^2 (1) = 6.413 p < .05$. The latter finding raised the possibility that race could influence the findings between the two groups.

Sometimes the effect of an intervention differs according to another variable known as an effect modifier or moderator (Bauman et al., 2002). A moderator is equivalent to a statistical interaction and can affect the direction and/or strength of the relation between the intervention (IV) and outcome variables (DV). For instance, a physical activity intervention may increase physical activity behavior for Caucasian females, but have no effect on the physical activity levels of Asian females. If moderators are identified during the design phase of the study, data can be stratified by levels of the moderator. However, if the moderating variable is discovered post program implementation, the variable can be entered as a covariate for analysis. The main reason to include a covariate in the analysis of data is the existence of a strong or moderate
association between the covariate and primary outcome measure, which in this instance was average steps/day.

To determine whether race should be included as a covariate in the data analysis, a review of the literature was conducted to examine the relationship between race/ethnicity and pedometer step counts. A review of the pedometer based literature by Bravata et al. (2007) concluded that race/ethnicity was not a significant predictor for increased steps/day. In a different review of the walking literature, Ogita et al. (2007) noted that few investigators report how the effect of walking interventions differ by demographics.

With regards to physical activity in general, there is evidence to suggest that a relationship exists between race/ethnicity and physical activity levels (Trost et al., 2002). Caucasian women tend to have greater levels of physical activity than other racial ethnic groups (Crespo et al., 2002). Therefore, as the non-Caucasian women were recruited into the social ecological intervention group, this finding suggests that PA could be biased in the negative direction for this group. To investigate the relationship between race and steps/day in the present study, an exploratory analysis was conducted. Univariate ANOVA’s were calculated with race/ethnicity as the independent variable, and change in steps/day at each time point, pre to posttest, pretest to follow up and posttest to follow up as the dependent variable. An examination of the results indicated that there were no significant differences at any time point for change in steps/day between different race/ethnic groups; pretest to posttest, $F(2, 37) = 2.181, p > .05$, pretest to follow up, $F(2, 37) = 1.884, p > .05$, and follow up to posttest, $F(2, 37) = 2.083, p > .05$. Because of
these findings and owing to the preliminary nature of the study, race/ethnicity was not included as a covariate in the analysis of data.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
<th>( \chi^2 ) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Hispanic White Caucasian</td>
<td>14 (70.0)</td>
<td>18 (100)</td>
<td>6.413*</td>
</tr>
<tr>
<td>Non Hispanic African American</td>
<td>3 (15.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3 (15.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (100)</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>2 (10.0)</td>
<td>2 (11.1)</td>
<td>3.377</td>
</tr>
<tr>
<td>Technical College</td>
<td>0 (0.0)</td>
<td>1 (5.6)</td>
<td></td>
</tr>
<tr>
<td>College Degree</td>
<td>8 (40.0)</td>
<td>3 (16.7)</td>
<td></td>
</tr>
<tr>
<td>Post College Degree</td>
<td>9 (45.0)</td>
<td>11 (61.1)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1 (5.0)</td>
<td>1 (5.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (100)</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>4 (20.0)</td>
<td>2 (11.1)</td>
<td>2.702</td>
</tr>
<tr>
<td>Widowed</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>14 (70.0)</td>
<td>11 (88.9)</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (100)</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency of Church Attendance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than once per week</td>
<td>11 (55.0)</td>
<td>5 (27.8)</td>
<td>5.364</td>
</tr>
<tr>
<td>Once per week</td>
<td>8 (40.0)</td>
<td>11 (61.1)</td>
<td></td>
</tr>
<tr>
<td>Bi-weekly</td>
<td>0 (0.0)</td>
<td>2 (11.1)</td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Less than monthly</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (100)</td>
<td>18 (100)</td>
<td></td>
</tr>
</tbody>
</table>

*Note. SE = social ecological, SM = self-monitoring, \( * = p < .05 \), \( \chi^2 \) (1) = Chi-Square

Table 4.4: Demographic characteristics, final sample (N = 38).
Two-way $\chi^2$ tests for independent groups were conducted to compare the demographic characteristics of women who completed the study ($n = 38$), and those who dropped out of the study ($n = 6$). There were no significant differences between women who completed the study ($n = 38$), with women who dropped out ($n = 6$) for race/ethnicity, $\chi^2 (1) = 1.097, p > .05$, education, $\chi^2 (1) = 5.946, p > .05$, marital status, $\chi^2 (1) = 3.363, p > .05$, and frequency of church attendance, $\chi^2 (1) = 0.548, p > .05$.

Two-way $\chi^2$ tests for independent samples were also conducted to examine differences in mortality rates between the two groups for race/ethnicity, education, marital status and frequency of church attendance. This analysis likewise indicated that there was no significant difference in overall mortality between groups for any demographic variables; marital status, $\chi^2 (1) = 0.600, p > .05$, education, $\chi^2 (1) = 3.750, p > .05$, and frequency of church attendance, $\chi^2 (1) = 0.000, p > .05$. No $\chi^2$ statistic was produced for race/ethnicity as non-completers from both groups were non-Hispanic Caucasian.

Finally, differences between the two groups comprising the final sample were examined for measures of all dependent variables at pretest using one-way ANOVA’s. The analysis indicated that there were no significant differences between groups for any dependent variables; steps/day, $F(1, 37) = 1.164, p > .05$, self-regulatory self-efficacy, $F(1, 37) = 2.888, p > .05$, task self-efficacy, $F(1, 37) = 0.374, p > .05$, self-regulation of walking, $F(1, 37) = 0.340, p > .05$, social support for PA, $F(1, 37) = 0.317, p > .05$, social network index friends/family/partner, $F(1, 37) = 0.006, p > .05$, and social network index church, $F(1, 37) = 0.371, p > .05$. Descriptive statistics for all dependent variables at pretest are presented in Table 4.5.
<table>
<thead>
<tr>
<th></th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>PRE-STEPS</td>
<td>5923</td>
<td>1457.45</td>
</tr>
<tr>
<td>PRE-SRSE</td>
<td>59.85</td>
<td>19.01</td>
</tr>
<tr>
<td>PRE-TSKSE</td>
<td>88.08</td>
<td>16.17</td>
</tr>
<tr>
<td>PRE-SRWLK</td>
<td>2.25</td>
<td>0.71</td>
</tr>
<tr>
<td>PRE-SSPA</td>
<td>3.29</td>
<td>0.83</td>
</tr>
<tr>
<td>PRE-SNFF</td>
<td>2.69</td>
<td>0.77</td>
</tr>
<tr>
<td>PRE-SNCH</td>
<td>1.85</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Note. SE = social ecological intervention, SM = self-monitoring only comparison, M = mean, SD = standard deviation, PRE = pretest, STEPS = average steps/day, SRSE = self-regulatory self-efficacy, TSKSE = task self-efficacy, SRWLK = self-regulation for walking, SSPA = social support for physical activity, SNFF = social network index friends/family/partner, SNCH = social network index church. * = p < 0.05, ** = p < 0.01, *** p < 0.001. Steps are rounded up to nearest whole number.

Table 4.5: Descriptive statistics for dependent variables by group, final sample (N = 38)

One-way ANOVA’s were also conducted to determine whether there were differences for the dependent variables between women who completed the study (n = 38) and women who dropped out over the course of the study (n = 6). The analysis indicated that there were no significant differences between groups for any dependent variable, thus there was no threat to the internal validity of the study through subject mortality (see Table 4.6 in Appendix R). Likewise, examination of differential mortality between the two groups for these variables indicated no significant differences (see Table 4.7 in Appendix S).
PART II
Impact Evaluation Results

Steps/day

Table 4.8 presents the findings relating to the impact of the intervention on the primary outcome variable steps/day, and the secondary outcome social ecological variables.
<table>
<thead>
<tr>
<th>Source</th>
<th>MS</th>
<th>$F$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steps/day</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>302390.18</td>
<td>0.024</td>
<td>.001</td>
</tr>
<tr>
<td>Time</td>
<td>67641522.09</td>
<td>42.101***</td>
<td>.539</td>
</tr>
<tr>
<td>Group</td>
<td>6259820.17</td>
<td>3.896*</td>
<td>.098</td>
</tr>
<tr>
<td><strong>Self-Regulatory Self-Efficacy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>398.18</td>
<td>3.891*</td>
<td>.098</td>
</tr>
<tr>
<td>Time</td>
<td>213.69</td>
<td>2.136</td>
<td>.056</td>
</tr>
<tr>
<td>Group</td>
<td>383.72</td>
<td>0.391</td>
<td>.011</td>
</tr>
<tr>
<td><strong>Task Self-Efficacy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>27.99</td>
<td>0.142</td>
<td>.004</td>
</tr>
<tr>
<td>Time</td>
<td>21.44</td>
<td>0.109</td>
<td>.003</td>
</tr>
<tr>
<td>Group</td>
<td>648.37</td>
<td>0.933</td>
<td>.025</td>
</tr>
<tr>
<td><strong>Self-Regulation for Walking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>0.02</td>
<td>0.070</td>
<td>.002</td>
</tr>
<tr>
<td>Time</td>
<td>4.36</td>
<td>17.57***</td>
<td>.328</td>
</tr>
<tr>
<td>Group</td>
<td>0.84</td>
<td>1.017</td>
<td>.027</td>
</tr>
<tr>
<td><strong>Social Support for Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>0.17</td>
<td>1.556</td>
<td>.041</td>
</tr>
<tr>
<td>Time</td>
<td>0.89</td>
<td>7.890***</td>
<td>.180</td>
</tr>
<tr>
<td>Group</td>
<td>0.002</td>
<td>0.002</td>
<td>.000</td>
</tr>
<tr>
<td><strong>Social Network Friends/Family/Partner</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>0.30</td>
<td>1.532</td>
<td>.041</td>
</tr>
<tr>
<td>Time</td>
<td>0.38</td>
<td>1.945</td>
<td>.051</td>
</tr>
<tr>
<td>Group</td>
<td>0.89</td>
<td>0.688</td>
<td>.019</td>
</tr>
<tr>
<td><strong>Social Network Church</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time X Group</td>
<td>1.99</td>
<td>10.420***</td>
<td>.224</td>
</tr>
<tr>
<td>Time</td>
<td>2.60</td>
<td>13.572***</td>
<td>.274</td>
</tr>
<tr>
<td>Group</td>
<td>9.78</td>
<td>8.527**</td>
<td>.192</td>
</tr>
</tbody>
</table>

*Note.*  * = $p < .05$, ** $p < .01$, and *** $p < .001$

Table 4.8: Mixed model $3_{\text{time}} \times 2_{\text{group}}$ repeated measures ANOVA’s for dependent variables, final sample, $N = 38$. 

216
To answer the primary research questions and determine whether the intervention had a significant impact on changing steps/day, a $3_{\text{time}} \times 2_{\text{group}}$ ANOVA was conducted to compare change in steps/day between groups (social ecological intervention and self-monitoring only comparison groups) over the three study time points (pretest, posttest and follow up). Descriptive statistics for Steps/day for the final sample at pre, posttest and follow up are presented in Table 4.9 and are illustrated in Figure 4.2.

<table>
<thead>
<tr>
<th></th>
<th>SE intervention ($n = 20$)</th>
<th>SM comparison ($n = 18$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>PRE</td>
<td>5934</td>
<td>1457.45</td>
</tr>
<tr>
<td>POST</td>
<td>8094</td>
<td>2599.08</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>8594</td>
<td>2481.49</td>
</tr>
</tbody>
</table>

*Note. SE = social ecological intervention group,  SM = self-monitoring only comparison group, $M$ = mean, $SD$ = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up. Steps are rounded up to nearest whole number.*

Table 4.9: Descriptive statistics for average steps/day by group over time, social ecological intervention group ($n = 20$), self-monitoring only comparison group ($n = 18$)
The 3 x 2 ANOVA indicated a significant interaction for time by group, \(F(2,36)=2.896, p < .05, \eta^2 = .098\), and a significant main effect for time, \(F(2,36)=42.101, p < .001, \eta^2 = .539\). The main effect for group was not significant, \(F(1,36)=504.729, p > .05, \eta^2 = .001\). Post hoc analysis was conducted to determine where the significant differences lay. For time, separate paired t-tests were calculated for each group to determine change in steps/day from pretest to posttest, pretest to follow up, and posttest to follow up. For the social ecological intervention group, the findings indicated that mean steps/day increased significantly for all time points, pretest to posttest, \(t(19) = 218\).
-6.123, \( p < .001 \), pretest to follow up, \( t(19) = -7.390, p < .001 \), and posttest to follow up, \( t(19) = -2.372, p < .05 \). For the self-monitoring only comparison group there was also a significant increase in average steps/day from pretest to posttest, pretest to follow up, but not from posttest to follow up; \( t(17) = -4.26, p < .01 \), \( t(17) = -2.868, p < .05 \), and \( t(17) = 1.913, p > .05 \), respectively. Indeed, for the self-monitoring only comparison group steps/day slightly decreased from posttest to follow up, this decrease however was not significant. Independent t-tests were also conducted to determine whether there was a significant difference between groups for change in steps/day for each time point. The difference between groups for change in steps/day from pretest to posttest was not significant, \( t(36) = 0.729, p > .05 \). However, there was a significant difference between groups for change in steps/day from pretest to follow up, \( t(36) = 2.345, p < .05 \), with the social ecological intervention group increasing their steps/day to a greater degree than the self-monitoring only comparison group. There was also a significant difference between groups for change in steps/day from posttest to follow, \( t(36) = 3.017, p < .05 \). Women in the social ecological intervention group continued to increase their steps/day from posttest to follow up, whereas there was no significant change in steps/day from posttest to follow up for women in the self-monitoring only comparison group. The latter findings indicate that the interaction observed was due to the social ecological intervention group increasing their steps/day from pretest to follow up, and from posttest to follow up to a greater degree than the self-monitoring only comparison group.

To provide an indication of the magnitude of change, Cohen’s \( d \) was calculated for change in steps/day for each time point, pretest to posttest, pretest to follow up and
posttest to follow up, and to examine the magnitude of difference in steps/day between
groups for each time point.

Using Cohen’s (1969) benchmarks, an examination of Table 4.10 indicates a large
effect size for the social ecological intervention group from pretest to posttest ($d = 1.03$)
and from pretest to follow up ($d = 1.31$), and a small magnitude of change from posttest
to follow up ($d = 0.19$). For the self-monitoring only comparison group, the change in
steps per day from pre to post was large ($d = 0.86$), and from pretest to follow up
moderate ($d = 0.65$). For this group, steps/day decreased from posttest to follow up,
therefore no effect size was calculated.

<table>
<thead>
<tr>
<th></th>
<th>$\Delta$</th>
<th>$\sigma_{\text{pooled}}$</th>
<th>Cohen’s $d$ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social ecological</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre to post</td>
<td>2160</td>
<td>2107</td>
<td>1.03</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>2660</td>
<td>2034</td>
<td>1.31</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>500</td>
<td>2541</td>
<td>0.19</td>
</tr>
<tr>
<td><strong>Self-monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre to post</td>
<td>1763</td>
<td>2043</td>
<td>0.86</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>1316</td>
<td>2028</td>
<td>0.65</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>-447</td>
<td>2572</td>
<td>***</td>
</tr>
</tbody>
</table>

*Note. $\Delta =$ change in mean steps, $\Delta$ and $\sigma_{\text{pooled}}$ are rounded up to nearest whole number, *** No effect size calculated as $\Delta$ is negative*

Table 4.10: Cohen’s $d$ for change in steps over time for group, final sample ($N = 38$).

With respect to the magnitude of difference between groups for change in steps/day,
from pretest to posttest with $\Delta = 397$, and $\sigma_{\text{pooled}} = 2351$, Cohen’s $d$ indicated a small
effect size, $d = 0.17$. For pretest to follow up with $\Delta = 1344$, and $\sigma_{\text{pooled}} = 2031$, the effect
size was moderate $d = 0.66$, and from posttest to follow up with $\Delta = 947$, and $\sigma_{\text{pooled}} = 2557$, Cohen’s $d$ was also small, $d = 0.37$.

Descriptive statistics were also calculated for change in steps/day by group from week 1 to week 10 (see Appendix T for Table 4.11 and Figure 4.3). Frequency distributions indicated that thirty five percent of women in the social ecological intervention group were accumulating $\geq 10,000$ steps/day at follow up, compared to $22.2\%$ of women in the self-monitoring only comparison group. Descriptive statistics were also calculated to examine the number of days the pedometer was worn in each group (see Appendix U, Table 4.12). Women in the social ecological intervention group wore the pedometer $M = 6.27$ ($SD = 0.19$) days, and women in the self-monitoring only intervention comparison group wore the pedometer for $M = 6.32$ ($SD = 0.46$) days. A $t$-test for independent samples indicated that there was no significant difference between groups for the mean number of days the pedometer was worn over the 10 week study period, $t (18) = -0.298, p > .05$.

*Enablers and Barriers to Increasing Steps/day and Pedometer Use*

Women in both groups were provided with space in their walking logs to record successful strategies (enablers) they used for increasing their steps/day, and any barriers they encountered to meeting their goals to increase their steps/day. Participants were also invited to record any enablers and/or barriers they encountered specific to using the pedometer. A summary of the barriers and enablers to increasing steps/day are presented
in Table 4.13 and a summary of the barriers and enablers encountered with using the pedometer are presented in Table 4.14.

<table>
<thead>
<tr>
<th>Enablers</th>
<th>N</th>
<th>Percent %</th>
<th>Barriers</th>
<th>N</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key themes and sub themes</td>
<td></td>
<td></td>
<td>Key themes and sub themes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning walks</td>
<td>34</td>
<td>28.1</td>
<td>Lack of time</td>
<td>41</td>
<td>28.7</td>
</tr>
<tr>
<td>Lifestyle (e.g., parking the car further away to walk, taking the stairs, walking while talking on the phone)</td>
<td>26</td>
<td>21.5</td>
<td>Sick/Injured</td>
<td>31</td>
<td>21.7</td>
</tr>
<tr>
<td>Social support (e.g., planning walks with someone, requesting support from friends and family)</td>
<td>22</td>
<td>18.2</td>
<td>Weather</td>
<td>23</td>
<td>16.1</td>
</tr>
<tr>
<td>Walking for transportation (e.g., walking the kids to school, walking to a football game)</td>
<td>12</td>
<td>9.9</td>
<td>Traveling/Vacation</td>
<td>19</td>
<td>13.3</td>
</tr>
<tr>
<td>Goal setting</td>
<td>12</td>
<td>9.9</td>
<td>Too tired</td>
<td>13</td>
<td>9.1</td>
</tr>
<tr>
<td>Dog walking</td>
<td>8</td>
<td>6.6</td>
<td>Family commitments</td>
<td>10</td>
<td>6.9</td>
</tr>
<tr>
<td>Mini Trampoline</td>
<td>4</td>
<td>3.3</td>
<td>Personal (e.g., bad attitude, lack of motivation, emotionally down)</td>
<td>3</td>
<td>2.1</td>
</tr>
<tr>
<td>Treadmill</td>
<td>2</td>
<td>1.7</td>
<td>Dog pulls when walking</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Taking a day off</td>
<td>1</td>
<td>0.8</td>
<td>Set goal too high</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>TV</td>
<td>1</td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100</td>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
</tbody>
</table>

Note. N = number of times barrier and/or enabler was cited.

Table 4.13: Summary of enablers and barriers to increasing steps/day, final sample (N = 38)
The most frequently cited successful strategies for increasing steps/day were planning walks, making small lifestyle changes such as parking further away to walk or using the stairs rather than taking the elevator, and support for walking by planning walks with a friend, family member or other participant or by receiving encouragement for meeting step goals. Other enablers cited were goal setting and dog walking. One woman mentioned an innovative method of jumping on a mini-trampoline to accumulate steps, and another who took a day off once a week from meeting her goal. The three most frequently cited barriers to increasing steps/day were lack of time, sickness and/or injury, and inclement weather. Other common barriers cited were child care, and feeling too tired.
<table>
<thead>
<tr>
<th>Enablers</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedometer placement (e.g., next to make up bag, hairbrush, clothes, bathroom)</td>
<td>15</td>
<td>83.3</td>
</tr>
<tr>
<td>Write on calendar</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Increased awareness</td>
<td>1</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barriers</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forgot to put on</td>
<td>48</td>
<td>45.3</td>
</tr>
<tr>
<td>Inaccuracy (e.g., overestimated steps, underestimated steps)</td>
<td>19</td>
<td>17.9</td>
</tr>
<tr>
<td>Pedometer related (e.g., put pedometer next to makeup bag, put pedometer on clothing for next day)</td>
<td>18</td>
<td>16.9</td>
</tr>
<tr>
<td>Clothing related (e.g., wearing a dress and nowhere to attach pedometer)</td>
<td>7</td>
<td>6.6</td>
</tr>
<tr>
<td>Fell off</td>
<td>7</td>
<td>6.7</td>
</tr>
<tr>
<td>Reset itself</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Uncomfortable to wear</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Participated in other forms of PA (e.g., bike riding)</td>
<td>1</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Total | 18 | 100 |

**Note.** N = number of times barrier and/or enabler was cited.

Table 4.14: Summary of enablers and barriers to pedometer use, final sample (N = 38).

With regards to successful strategies with using the pedometer, placing the pedometer in a place where it could be seen was the most cited method. Women frequently mentioned placing the pedometer next to their make up bag, in the bathroom, and/or next to their glasses and clothes. The most frequent barrier cited for using the
pedometer was forgetting to put it on, in particular after a change of clothes. Another common limitation noted was having nowhere to place it when wearing a dress.

Social Ecological Model Variables

To determine whether the intervention had a significant impact on the social ecological variables, specifically, intrapersonal (SRSE, TSKSE, SRWLK), and interpersonal (SPPA, SNFF and SNCH), separate $3_{\text{time}} \times 2_{\text{group}}$ within-between ANOVA’s were conducted for each variable to compare change between groups (social ecological intervention group and self-monitoring only comparison group) over the three time points (pretest to posttest, pretest to follow up and posttest to follow up).

Self-Regulatory Self-Efficacy

Descriptive statistics for self-regulatory self-efficacy (SRSE) were computed by group and time, and are presented in Table 4.15, and illustrated in Figure 4.4.

<table>
<thead>
<tr>
<th>Group</th>
<th>SE intervention ($n = 20$)</th>
<th>SM comparison ($n = 18$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>PRE</td>
<td>59.85</td>
<td>19.01</td>
</tr>
<tr>
<td>POST</td>
<td>69.70</td>
<td>17.58</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>69.20</td>
<td>21.64</td>
</tr>
</tbody>
</table>

*Note. SE = social ecological intervention group, SM = self-monitoring only comparison group, $M$ = mean, $SD$ = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up*

Table 4.15: Descriptive statistics for SRSE by group over time, social ecological intervention group ($n = 20$), self-monitoring only comparison group ($n = 18$).
The analysis indicated that there was a significant interaction for time by group, \( F(2,36)=3.891, p < .05, \eta^2 = .098 \), however there were no significant main effects for time, \( F(2,36)=2.136, p > .05, \eta^2 = .056 \), or group, \( F(1,36)= 0.391, p > .05, \eta^2 = .011 \). Post hoc analysis was conducted in order to examine the interaction.

For time, separate paired t-tests were calculated for each group to determine change in SRSE from pretest to posttest, pretest to follow up, and posttest to follow up. For the social ecological intervention group, SRSE increased significantly from pretest to posttest and from pretest to follow up, \( t(19)=-3.333, p < .05 \), and \( t(19)=-2.475, p < .05 \).
respectively. However, change in SRSE from posttest to follow up was not significant for this group, \( t(19) = .152, p > .05 \). For the self-monitoring only comparison group there were no significant changes in SRSE between any time points, from pretest to posttest, \( t(17) = .551, p > .05 \), pretest to follow up, \( t(17) = .230, p > .05 \), and from posttest to follow up, \( t(17) = .660, p > .05 \).

With respect to differences between groups, results from independent t-tests indicated that there was a significant difference between groups for change in SRSE from pretest to posttest, \( t(36) = 2.546, p < .05 \), with the social ecological intervention increasing in SRSE, whereas the self-monitoring only comparison group did not change. There were no significant differences between the two groups from pretest to follow up, \( t(36) = 1.978, p > .05 \), or from posttest to follow up, \( t(36) = -0.443, p > .05 \). The latter finding suggests that the significant interaction was due to the social ecological intervention group significantly increasing their SRSE over time from pretest to posttest, while the self-monitoring only comparison group did not significantly change.

Cohen’s \( d \) was calculated to examine the magnitude of change in SRSE for each group at each time point and can be examined in Table 4.16. For the social ecological intervention group the magnitude of change from pretest to posttest was moderate \( (d = 0.54) \), small from pretest to follow up \( (d = 0.46) \), and negligible from posttest to follow up \( (d = 0.02) \). For the self-monitoring only comparison group, SRSE decreased from pretest to posttest and from pretest to follow up therefore Cohen’s \( d \) was not calculated for these time points. Although SRSE slightly increased from posttest to follow up, the effect size for the increase was negligible \( (d = 0.06) \).
Cohen’s $d$ was also calculated to determine the magnitude of the difference in SRSE between groups for change in SRSE over time. From pretest to posttest, with a mean difference of $\Delta = 11.87$, and $\sigma_{pooled} = 19.5$, the effect size between groups was moderate ($d = 0.6$). From pretest to follow up, with a mean difference of $\Delta = 10.13$ and $\sigma_{pooled} = 20.27$, again the effect size was moderate ($d = 0.49$). Finally, from posttest to follow up with $\Delta = 0.74$ and $\sigma_{pooled} = 19.79$, although the self-monitoring only comparison group had slightly greater SRSE, the effect size was negligible ($d = 0.04$).

**Task Self-Efficacy**

Descriptive statistics for task self-efficacy (TSKSE) were computed by group and time, and are presented in Table 4.17, and illustrated in Figure 4.5.
<table>
<thead>
<tr>
<th></th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>PRE</td>
<td>88.08</td>
<td>16.17</td>
</tr>
<tr>
<td>POST</td>
<td>87.88</td>
<td>17.99</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>87.92</td>
<td>17.70</td>
</tr>
</tbody>
</table>

**Note.** SE = social ecological intervention group, SM = self-monitoring only comparison group, M = mean, SD = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up

Table 4.17: Descriptive statistics for TSKSE by group over time, social ecological intervention group (n = 20), self-monitoring only comparison group (n = 18).

![Change in task self-efficacy](image)

**Figure 4.5:** Change in TSKSE by group over time (M and SD), social ecological intervention group (n = 20), self-monitoring only comparison group (n = 18).

The 3 time X 2 group Mixed Model ANOVA yielded no significant findings for the time by group interaction, $F(1, 36) = 0.142, p > .05$, $\eta^2 = .004$, for time, $F(2,36) = 0.109, p$
> .05, \( \eta^2 = .003 \) or group \( F(2,36)= 0.933, p > 0.05, \eta^2 = .025 \). As there were no significant findings for this variable, no further analysis was conducted.

**Self-Regulation for Walking**

Descriptive statistics for self-regulation for walking are presented in Table 4.18, and illustrated in Figure 4.6.

<table>
<thead>
<tr>
<th></th>
<th>SE intervention ((n = 20))</th>
<th>SM comparison ((n = 18))</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td>2.25</td>
<td>2.13</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>0.71</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td>2.82</td>
<td>2.64</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>0.68</td>
<td>0.51</td>
</tr>
<tr>
<td><strong>FOLLOW UP</strong></td>
<td>2.92</td>
<td>2.71</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>0.79</td>
<td>0.63</td>
</tr>
</tbody>
</table>

*Note.* SE = social ecological intervention group, SM = self-monitoring only comparison group, \( M \) = mean, \( SD \) = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up

Table 4.18: Descriptive statistics for SRWLK by group over time, social ecological intervention group \((n = 20)\), self-monitoring only comparison group \((n = 18)\).
The findings indicated that there was no significant interaction, $F(2, 36) = .070, p > .05, \eta^2 = .002$, or main effect for group $F(1, 36)=1.017, p > .05, \eta^2 = .027$, however there was a main effect for time, $F(2,36)=17.574, p < .001, \eta^2 = .328$. Therefore, paired t-tests were conducted for both groups combined to determine the difference in SRWLK at each time point; from pretest to posttest, pretest to follow up, and from posttest to follow up. Post hoc analysis indicated that SRWLK increased significantly from pretest to posttest, and from pretest to follow up, $t(37)=-5.197, p < .001, t(37)=-4.899, p < .001$. 

Figure 4.6: Change in SRWLK over time (M and SD), social ecological intervention group ($n = 20$), self-monitoring only comparison group ($n = 18$).
.001, respectively. SRWLK did not significantly change from posttest to follow up, t(37) = -0.827, p > .05.

Cohen’s d was calculated to determine the magnitude of change in SRWLK at each time point (see Table 4.19). The effect size was large from pretest to posttest (d = 0.86), and large from pretest to follow up (d = 0.93). For change in SRWLK from posttest to follow up the effect size was small (d = 0.14).

<table>
<thead>
<tr>
<th></th>
<th>Δ</th>
<th>σ\text{pooled}</th>
<th>Cohen’s d (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre to post</td>
<td>0.54</td>
<td>0.63</td>
<td>0.86</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>0.63</td>
<td>0.68</td>
<td>0.93</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>0.09</td>
<td>0.66</td>
<td>0.14</td>
</tr>
</tbody>
</table>

*Note. Δ = change in mean steps, Δ and σ\text{pooled} are rounded up to nearest whole number, and *** No effect size calculated as Δ is negative*

Table 4.19: Cohen’s d for change in SRWLK over time, final sample (N = 38).

**Social Support for Physical Activity:**

Descriptive statistics by group over time are presented in Table 4.20 for social support for Physical Activity (SSPA), and illustrated in Figure 4.7.

<table>
<thead>
<tr>
<th></th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>PRE</td>
<td>3.29</td>
<td>0.83</td>
</tr>
<tr>
<td>POST</td>
<td>3.58</td>
<td>0.67</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>3.69</td>
<td>0.73</td>
</tr>
</tbody>
</table>

*Note. SE = social ecological intervention group, SM = self-monitoring only comparison group, M = mean, SD = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up*

Table 4.20: Descriptive statistics for SSPA over time, social ecological intervention group (n = 20), self-monitoring only comparison group (n = 18).
The findings indicated that there was no significant group by time interaction,
\[ F(2, 36)=1.556, p > .05, \eta^2 = .041, \]
and no main effect for group, \[ F(1, 36)= 0.968, p > .05, \]
\[ \eta^2 = .000. \] However, the main effect for time yielded a significant \( F \) ratio of \[ F(2, 36)=7.890, p < .001, \eta^2 = .180. \] To determine where the significant difference lay for time, groups were combined and paired t-tests were conducted for change at each time point; pretest to posttest, pretest to follow up, and from posttest to follow up. The findings indicated that SSPA increased significantly from pretest to posttest, and from
pretest to follow up, \( t(37) = -2.133, p < .05 \), and \( t(37) = -3.916, p < .001 \) respectively, however there was no change from posttest to follow up, \( t(37) = -1.924, p > .05 \).

Cohen’s \( d \) for magnitude of change in SSPA between each time point are presented in Table 4.21. Examination of Table 4.21 indicates a small effect size from pretest to post test \( (d = 0.23) \), and from pretest to follow up \( (d = 0.40) \), and a small effect size from posttest to follow up \( (d = 0.18) \).

<table>
<thead>
<tr>
<th></th>
<th>( \Delta )</th>
<th>( \sigma_{pooled} )</th>
<th>Cohen’s ( d ) (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre to post</td>
<td>0.17</td>
<td>0.74</td>
<td>0.23</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>0.30</td>
<td>0.75</td>
<td>0.40</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>0.13</td>
<td>0.73</td>
<td>0.18</td>
</tr>
</tbody>
</table>

*Note. \( \Delta \) = change in mean steps, \( \sigma_{pooled} \) are rounded up to nearest whole number, *** No effect size calculated as \( \Delta \) is negative*  

Table 4.21: Cohen’s \( d \) for change SSPA over time, final sample \((N = 38)\).  

**Social Network Index: Friends/family/partner**

Descriptive statistics for the social network index friends/family/partner (SNFF) are presented in Table 4.22, and illustrated in Figure 4.8.

<table>
<thead>
<tr>
<th></th>
<th>SE intervention ((n = 20))</th>
<th>SM comparison ((n = 18))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
</tr>
<tr>
<td>PRE</td>
<td>2.69</td>
<td>0.77</td>
</tr>
<tr>
<td>POST</td>
<td>3.01</td>
<td>0.81</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>2.96</td>
<td>0.75</td>
</tr>
</tbody>
</table>

*Note. SE = social ecological intervention group, SM = self-monitoring only comparison group, \( M \) = mean, \( SD \) = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up*

Table 4.22: Descriptive statistics for SNFF over time, social ecological intervention group \((n = 20)\), self-monitoring only comparison group \((n = 18)\).
Figure 4.8: Change in SNFF over time, social ecological intervention group (n = 20), self-monitoring only comparison group (n = 18).

The 3\text{time} \times 2\text{group} Mixed Model ANOVA yielded no significant findings for time by group interaction, $F(2, 36) = 1.532, p > .05$. $\eta^2 = .041$, time, $F(2,36)=1.945, p > .05$, $\eta^2 = .051$ or group $F(1,36)= 0.412, p > .05$, $\eta^2 = .019$. As there were no significant findings for SNFF, no post hoc analysis was conducted.
**Social Network Index Church**

Descriptive statistics for the social network index church (SNCH) are presented in Table 4.23, and illustrated in Figure 4.9.

<table>
<thead>
<tr>
<th></th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>PRE</td>
<td>1.85</td>
<td>0.77</td>
</tr>
<tr>
<td>POST</td>
<td>2.52</td>
<td>0.71</td>
</tr>
<tr>
<td>FOLLOW UP</td>
<td>2.70</td>
<td>0.87</td>
</tr>
</tbody>
</table>

*Note.* SE = social ecological intervention group, SM = self-monitoring only comparison group, \(M\) = mean, \(SD\) = standard deviation, PRE = pretest, POST = posttest, FOLLOW UP = follow up.

Table 4.23: Descriptive statistics for SNCH by group over time, social ecological intervention group \(n = 20\), self-monitoring only comparison group \(n = 18\).
The 3\text{time} \times 2\text{group} mixed model ANOVA yielded a significant interaction effect for time by group, $F(2,36) = 10.420, p < .001, \eta^2 = .224$, and a significant main effect for time and group, $F(2,36) = 13.572, p < .001, \eta^2 = .274, F(1,36) = 8.527, p < .01, \eta^2 = .192$, respectively. Post hoc analysis was conducted to determine the pattern of significant findings.

Separate paired t-tests were conducted for each group to determine whether there was a significant difference between SNCH from pretest to posttest, pretest to follow up, and from posttest to follow up. For the social ecological intervention group, the findings
indicated that SNCH increased significantly from pretest to posttest, and from pretest to follow up, \( t(19)= -5.146, p < .001 \), \( t(19)= -4.754, p < .001 \), respectively. There was no significant change in scores from posttest to follow up for this group, \( t(19)= -1.329, p > .05 \). For the self-monitoring only comparison group there were no significant changes in SNCH between any time points, pre to posttest, \( t(17)= -2.015, p > .05 \), pretest to follow up, \( t(17)= 0.000, p > .05 \), and posttest to follow up, \( t(17) = 1.654, p > .05 \), respectively.

Separate independent t-tests were calculated to determine whether there were any significant differences for change in SNCH between the two groups over time. Results from the analysis indicated that there was a significant difference between the two groups for change in steps/day from pretest to posttest, \( t(36)=3.107, p < .01 \), and from pretest to follow up, \( t(36)= 3.863, p < .001 \), respectively, with the social ecological intervention group reporting significantly more support from their church than the self-monitoring only comparison group. There was no significant difference between the two groups from posttest to follow up, \( t(36) = 2.109, p > .05 \).

Cohen’s \( d \) for magnitude of change in SNCH for group between time points is presented in Table 4.24. Examination of Table 4.24 indicates a large effect size for change from pretest to posttest, and from pretest to follow up (\( d = 0.91 \), and \( d = 1.04 \), respectively), and a small effect size from posttest to follow up for the social ecological intervention group (\( d = 0.24 \)). For the self-monitoring only comparison group, the magnitude of change in SNCH was small from pre to posttest (\( d = 0.28 \). As SNCH

\[ ^{31} \text{Although the difference between the two groups from posttest to follow up was not significant, the difference was close to significant with } p = .051. \]
decreased from pretest to follow up and from posttest to follow up Cohen’s $d$ was not calculated for these time points.

With regards to the difference between the two groups, from pretest to posttest with $\Delta = 0.5$ and $\sigma_{\text{pooled}} = 0.68$, the effect size was moderate ($d = 0.74$), the effect size was large from pretest to follow up with $\Delta = 0.85$ and $\sigma_{\text{pooled}} = 1.23$ ($d = 1.38$), and moderate from posttest to follow up with $\Delta = 0.36$ and $\sigma_{\text{pooled}} = 0.69$ ($d = 0.52$).

<table>
<thead>
<tr>
<th></th>
<th>$\Delta$</th>
<th>$\sigma_{\text{pooled}}$</th>
<th>Cohen’s $d$ ($SD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social ecological</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre to post</td>
<td>0.67</td>
<td>0.74</td>
<td>0.91</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>0.85</td>
<td>0.82</td>
<td>1.04</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>0.19</td>
<td>0.79</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Self-monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre to post</td>
<td>0.17</td>
<td>0.62</td>
<td>0.28</td>
</tr>
<tr>
<td>Pre to follow up</td>
<td>0.00</td>
<td>0.52</td>
<td>0.00</td>
</tr>
<tr>
<td>Post to follow up</td>
<td>-0.17</td>
<td>0.58</td>
<td>***</td>
</tr>
</tbody>
</table>

*Note. $\Delta =$ change in mean steps, $\Delta$ and $\sigma_{\text{pooled}}$ are rounded up to nearest whole number, *** No effect size calculated as $\Delta$ is negative*

Table 4.24: Cohen’s $d$ for SNCH by group, final sample ($N = 38$).
CORRELATIONS

To identify possible mediators of change in the primary outcome variable steps/day, Pearson Product Moment Correlations (PPMC’s) were calculated to examine the relationship between steps/day and the social ecological variables that significantly changed with the intervention, namely self-regulatory self-efficacy (SRSE), self-regulation of walking (SRWLK), social support for physical activity (SSPA), and social network index church (SNCH). Relationships between the social ecological variables were also examined. Separate PPMC’s were examined for each time point, from pretest to posttest, pretest to follow up, and posttest to follow up. To describe how accurately one variable predicts the other, coefficients of determination were calculated ($R^2$).

To identify possible moderators of change in steps/day, Pearson Product Moment Correlations were also conducted to examine the relationship between change in steps/day at each time point and the participant demographics that were coded as continuous variables (i.e., age, BMI, education and frequency of church attendance). The remaining demographic characteristics were categorical (i.e. marital status, and race/ethnicity), however on account of the relative homogeneity across cells no analysis was conducted with these variables.
**Change in Steps/day and Change in Social Ecological Variables**

Correlation coefficients for relationships between change in social ecological variables from pretest to posttest and steps/day for each time point are presented in Table 4.25.

<table>
<thead>
<tr>
<th></th>
<th>Steps pre to post</th>
<th>Steps pre to FU</th>
<th>Steps post to FU</th>
<th>SRSE</th>
<th>SRWLK</th>
<th>SSPA</th>
<th>SN Church</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps pre to post</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps pre to FU</td>
<td>.828***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps post to FU</td>
<td>-.139</td>
<td>.440**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRSE</td>
<td>-.129</td>
<td>.059</td>
<td>.309</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRWLK</td>
<td>.165</td>
<td>.302</td>
<td>.270</td>
<td>.261</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSPA</td>
<td>.116</td>
<td>.212</td>
<td>.189</td>
<td>.178</td>
<td>.406*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>SN Church</td>
<td>.010</td>
<td>.054</td>
<td>.078</td>
<td>.164</td>
<td>.028</td>
<td>.086</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note. Steps pre to post = change in steps from pretest to posttest, Steps pre to FU = change in steps from pretest to follow up, Steps post to FU = change in steps from posttest to follow up, SRSE = self-regulation self-efficacy, SRWLK = self-regulation for walking, SSPA = social support for PA, SNChurch = social network index for church. Correlation coefficients in bold are ≥ .3 and considered to be meaningful; * = p < .05, ** = p < .01, *** = p < .001.

Table 4.25: Bivariate correlation matrix for change in steps/day with change in social ecological variables from pretest to posttest, final sample (N = 38).

Change in steps/day from pretest to posttest were significantly related to change in steps from pretest to follow up, r = + .828, p < .001. Change in steps/day from pretest to follow up were significantly related to change in steps/day from posttest to follow up, r = + .404, p < .05. The coefficients of determination for the relationships were $R^2 = .69$ and $R^2 = .16$, respectively suggesting that change in steps/day from pretest to posttest...
accounted for 69% of the variance for change in steps/day from pretest to follow up, and change in steps/day from pretest to follow up, accounted for 16% of the variance for change in steps from posttest to follow up.

For change in social ecological variables from pretest to posttest, PPMC’s for the data revealed that self-regulatory self-efficacy (SRSE) was positively associated with change in steps/day from posttest to follow up, \( r = + .309 \). The greater the change in SRSE from pretest to posttest, the greater the increase in steps/day from posttest to follow up. \( R^2 = .10 \), suggesting that change in SRSE from pretest to posttest accounted for 10% of the variance for change in steps/day from posttest to follow up.

Change in self-regulation of walking (SRWLK) from pretest to posttest was positively associated with change in steps/day from pretest to follow up, \( r = .302 \). A greater increase in self-regulation of walking from pretest to posttest was associated with a greater increase in steps/day throughout the study period. The coefficient of determination was equal to .09, suggesting that change in SRWLK from pretest to posttest explained 9% of the variance in change in steps/day from pretest to follow up. Although the relationships between SRSE, SRWLK and change in steps/day were not significant, the correlation coefficients were \( \geq .3 \) and were therefore deemed by the author to be meaningful.

With regards to associations between change in social ecological variables from pretest to posttest, social support for PA and self-regulation of walking were significantly positively correlated, \( r = + .406, p < .05 \). A greater change in self-regulation of walking from pretest to posttest was associated with a greater change in social support for PA
(SSPA) from pretest to posttest and vice versa. \(R^2 = .16\); the amount of variance shared by change in SRWLK and change in SSPA from pretest to posttest was 16%.

Correlation coefficients for relationships between change in social ecological variables from pretest to follow up with change in steps/day over time are presented in Table 4.26.

<table>
<thead>
<tr>
<th></th>
<th>Steps pre to post</th>
<th>Steps pre to FU</th>
<th>Steps post to FU</th>
<th>SRSE</th>
<th>SRWLK</th>
<th>SSPA</th>
<th>SN Church</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps pre to post</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps pre to FU</td>
<td>(.828^{***})</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps post to FU</td>
<td>-.139</td>
<td>(.440^{**})</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRSE</td>
<td>-.195</td>
<td>-.009</td>
<td>.296</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRWLK</td>
<td>-.067</td>
<td>.071</td>
<td>.232</td>
<td>(.478^{**})</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSPA</td>
<td>-.015</td>
<td>.114</td>
<td>.225</td>
<td>(.621^{***})</td>
<td>(.380^{*})</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>SN Church</td>
<td>.015</td>
<td>.167</td>
<td>.271</td>
<td>.123</td>
<td>-.080</td>
<td>.169</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note.* Steps pre to post = change in steps from pretest to posttest, Steps pre to FU = change in steps from pretest to follow up, Steps post to FU = change in steps from posttest to follow up, SRSE = self-regulation self-efficacy, SRWLK = self-regulation for walking, SSPA = social support for PA, SN Church = social network index for church. Correlation coefficients in bold are ≥ .3 and considered to be meaningful; * = \(p < .05\), ** = \(p < .01\), *** = \(p < .001\).

Table 4.26: Bivariate correlation matrix for change in steps/day with change in social ecological variables from pretest to follow up, final sample (\(N = 38\)).

Change in steps/day over any time point was not related to change in any social ecological variable from pretest to follow up. However, with respect to relationships between change in social ecological variables from pretest to follow up, self-regulatory
self-efficacy was positively associated with change in self-regulation of walking, $r = +.478, p < .01$. The coefficient of determination for this relationship was $R^2 = .23$, suggesting that change in SRSE from pretest to follow up and change in SRWLK from pretest to follow up shared 23% of the variance. The greater the increase in SRSE from pretest to follow up, the greater the increase in SRWLK from pretest to follow up and vice versa. SRSE was also positively associated with social support for Physical Activity, $r = +.621, p < .001$. Women who reported greater change in SRSE from pretest to follow up, also reported a greater change in SPPA. The coefficient of determination for this relationship was $R^2 = .39$, suggesting that change in SRSE from pretest to follow up and change in SSPA from pretest to follow up shared 39% of the variance. A greater increase in self-regulation of walking (SRWLK) from pretest to follow up was also associated with a greater increase in social support for PA from pretest to follow up, $r = +.380, p < .05$. $R^2 = .14$, again suggesting that change in SRWLK and change in SRWLK shared 14% of the variance.

Correlation coefficients for relationships between change in social ecological variables from posttest to follow up and change in steps/day for each time point are presented in Table 4.27.
### Table 4.27: Bivariate correlation matrix for change in steps/day with change in social ecological variables from posttest to follow up, final sample ($N = 38$).

<table>
<thead>
<tr>
<th></th>
<th>Steps pre to post</th>
<th>Steps pre to FU</th>
<th>Steps post to FU</th>
<th>SRSE</th>
<th>SRWLK</th>
<th>SSPA</th>
<th>SN Church</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps pre to post</td>
<td>1.00</td>
<td>.828***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps pre to FU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRSE</td>
<td>-.101</td>
<td>-.088</td>
<td>.007</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRWLK</td>
<td>-.246</td>
<td>-.214</td>
<td>.016</td>
<td>.533**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSPA</td>
<td>-.171</td>
<td>-.143</td>
<td>.022</td>
<td>-1.77</td>
<td>.036</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>SN Church</td>
<td>.011</td>
<td>.183</td>
<td>.305</td>
<td>.035</td>
<td>-.020</td>
<td>.035</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note.* Steps pre to post = Change in steps from pretest to posttest, Steps pre to FU = change in steps from pretest to follow up, Steps post to FU = change in steps from posttest to follow up, SRSE = self-regulation self-efficacy, SRWLK = self-regulation for walking, SSPA = social support for PA, SNChurch = social network index for church. Correlation coefficients in bold are $\geq .3$ and considered to be meaningful; * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Examination of Table 4.27 indicates that change in steps/day from posttest to follow up was associated with change in social network index church (SNCH) from posttest to follow up, $r = + .305$. The greater the increase in SNCH from posttest to follow up, the greater the increase in steps/day from posttest to follow up. Although the relationship was not significant, the correlation coefficient was greater than .30. The coefficient of determination was equal to .09, suggesting that change in SNCH from posttest to follow up accounted for 9% of change in steps/day from posttest to follow up.
With respect to relationships between the social ecological variables for change from posttest to follow up, PPMC’s for the data revealed that change in self-regulatory self-efficacy from posttest to follow up was positively associated with change in self-regulation of walking from posttest to follow up, \( r = + .533, p < .001 \). \( R^2 = .28 \), in that change in SRSE and change in SRWLK from posttest to follow up accounted for 28% of the variance. As SRSE increased, SRWLK increased also.

*Change in Steps/day and Participant Demographic Characteristics*

To examine the relationships between change in steps/day at the different time points with age, BMI, education and frequency of church attendance, Pearson Product Moment Correlation Coefficients were conducted and can be examined in Table 4.28.
Examination of Table 4.28 indicates that age was positively associated with change in steps/day from posttest to follow up, $r = +.453$, $p < .01$, indicating that the older the women the greater the increase in steps/day from posttest to follow up. The coefficient of determination was equal to .21, in that age explained 21% of the variance in steps/day from posttest to follow up. BMI was significantly negatively correlated with change in steps/day from pretest to posttest, $r = -.435$, $p < .01$. The relationship suggests that women with a larger BMI had a smaller change in steps from pretest to posttest. $R^2 = .19$, suggesting that BMI accounted for 19% of the variance for change in steps/day from pretest to posttest. For education, there was a significant positive correlation between

<table>
<thead>
<tr>
<th></th>
<th>Steps pre to post</th>
<th>Steps pre to FU</th>
<th>Steps post to FU</th>
<th>Age</th>
<th>BMI</th>
<th>EDU</th>
<th>Church ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps pre to post</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps pre to FU</td>
<td>.828**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps post to FU</td>
<td>-.139</td>
<td>.440**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.296</td>
<td>-.012</td>
<td>.453**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>-.435**</td>
<td>-.275</td>
<td>.210</td>
<td>.253</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDU</td>
<td>.391*</td>
<td>.263</td>
<td>-.162</td>
<td>-.147</td>
<td>-.435**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Church ATT</td>
<td>.056</td>
<td>.026</td>
<td>-.044</td>
<td>.153</td>
<td>.195</td>
<td>-.077</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note. Steps pre to post = Change in steps from pretest to posttest, Steps pre to FU = change in steps from pretest to follow up, Steps post to FU = change in steps from posttest to follow up, BMI = Body Mass Index, EDU = Education, Church ATT = Frequency of church attendance. Correlation coefficients in bold are $\geq .3$ and considered to be meaningful; * = $p < .05$, ** = $p < .01$, *** = $p < .001$. 

Table 4.28: Bivariate correlation matrix for change in steps/day with participant characteristics, final sample ($N = 38$).
education and change in steps/day from pretest to posttest, $r = + .391, p < .05$. Higher levels of education reported by participants were associated with a greater increase in steps/day from pretest to posttest. $R^2 = .15$, suggesting that education accounted for 15% of the variance for change in steps/day from pretest to posttest. There was no meaningful relationship between frequency of church attendance and change in steps/day for any time point.

PART III

Process Evaluation Results

Process evaluation is concerned with the fidelity of the program’s implementation, appropriateness, site, and recipient response to the program (Green & Lewis, 1986). Process evaluation is essential to determining what elements contribute to the success or failure of the program, and thus avoidance of a Type III error. Without process evaluation it is not possible to determine whether program failure was due to the program itself being inadequate or inappropriate for the target population, or whether the program components were not delivered as intended. In the current study, process evaluation measures included program implementation, group cohesion, program appropriateness and overall participant satisfaction.
Implementation

Implementation is concerned with whether or not the program is being implemented as intended. Variability in the implementation of the program can provide important information as to the dose of the program necessary to bring about behavior change. In the present study, program implementation was defined as dose of program received and was evaluated using participant attendance rates. Attendance was taken at each educational session for women in the social ecological intervention group. Women were categorized as “low dose” if they attended two or fewer sessions (≥ 25% and ≤ 50%), “medium dose” if they attended three sessions (75%), and “high dose” if they attended all four sessions (100%). Sixty percent (n = 12) of women in the social ecological intervention group attended 100% of the sessions, 25% (n = 5) attended 75% of the sessions, and 15% (n = 3) attended 50% or less. Descriptive statistics for program attendance and change in steps/day are presented in Table 4.29.

<table>
<thead>
<tr>
<th></th>
<th>Low dose (n = 3)</th>
<th>Medium dose (n = 5)</th>
<th>High dose (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Steps/day pre to post</td>
<td>1322.59</td>
<td>1999.37</td>
<td>1512.81</td>
</tr>
<tr>
<td>Steps/day pre to FU</td>
<td>2584.11</td>
<td>1932.67</td>
<td>2018.77</td>
</tr>
<tr>
<td>Steps/day post to FU</td>
<td>1261.49</td>
<td>323.53</td>
<td>505.97</td>
</tr>
</tbody>
</table>

*Note.* Low dose = ≥ 25% ≤ 50% of sessions attended, medium dose = 75%, and high dose = 100%. M = mean, SD = standard deviation.

Table 4.29: Descriptive statistics for change in steps/day and participant attendance, social ecological intervention group (n = 20).
To determine whether there were any differences between high, medium and low dose participants for the primary outcome variable steps/day, separate one-way ANOVA’s were calculated for change in steps/day from pretest to posttest, pretest to follow up, and posttest to follow up. Attendance served as the independent variable with three levels, high, medium and low dose. Findings from the analysis indicated that there was no significant differences between women who attended more or less educational sessions for change in steps/day from pretest to posttest, $F(2, 19) = 1.499, p > .05, \eta^2 = .150$, for change in steps/day from pretest to follow up, $F(2, 19) = 0.583, p > .05, \eta^2 = .064$, and for change in steps/day from posttest to follow up, $F(2, 19) = 1.259, p > .05, \eta^2 = .129$. As there were no significant differences between levels of program dose and change in steps/day over time, no post hoc analysis was conducted.

**Group Cohesion**

Group cohesion was included as a process measure by administering the Physical Activity Group Environment Scale (Estabrooks & Carron, 1999) to the social ecological intervention group at posttest only ($M = 6.6, SD = 1.19$, range 4.67 to 9.05). Group cohesion was coded as an interval level variable, therefore Pearson Product Moment Correlations were conducted to examine the relationships between group cohesion measured at posttest with change in steps/day at each time point. As attendance was considered to be of importance to enhancing group cohesion, the relationship between attendance and group cohesion was also examined. Examination of Table 4.30 indicates that there were no meaningful associations between group cohesion and change in
steps/day or group cohesion and attendance. However, examination of Table 4.30 indicates that attendance was positively related to change in steps/day from pretest to posttest, \( r = .366 \), and negatively related to change in steps/day from posttest to follow up, \( r = -.337 \). The former finding indicates that the more intervention sessions the women in the social ecological intervention group attended, the greater the increase in steps/day from pretest to posttest. The coefficient of determination was equal to .13, suggesting that attendance and change in steps/day from pretest to posttest account for 13% of the variance. With regards to the latter finding, the more intervention sessions the women attended, the smaller the change in steps/day from posttest to follow up; \( R^2 = .14 \), in that attendance and change in steps/day from posttest to follow up shared 14% of the variance.

<table>
<thead>
<tr>
<th></th>
<th>Steps Pre to Post</th>
<th>Steps Pre to FU</th>
<th>Steps Post to FU</th>
<th>Group Cohesion</th>
<th>Att</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps Pre to Post</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps Pre to FU</td>
<td></td>
<td>.828 ***</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps Post to FU</td>
<td>-.139</td>
<td>.440 **</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Cohesion</td>
<td>.199</td>
<td>.126</td>
<td>-.119</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Att</td>
<td>.366</td>
<td>.162</td>
<td>-.337</td>
<td>.156</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note.* Steps pre to post = Change in steps from pretest to posttest, Steps pre to FU = change in steps from pretest to follow up, Steps post to FU = change in steps from posttest to follow up, Att = attendance (program implementation). * = \( p < .05 \), ** = \( p < .01 \), *** = \( p < .001 \).

Table 4.30: Bivariate correlation matrix for process variables, group cohesion and attendance with change in steps/day, social ecological intervention group (\( n = 20 \)).
Participant Satisfaction

Participant satisfaction with the program can be evaluated through the use of qualitative methods, such as interviews, focus groups, and/or open ended questions. In the present study, program satisfaction was evaluated at the end of the last educational session with four open ended questions. Women in the social ecological intervention group were provided with an evaluation form and asked to provide answers to the following questions, 1) “were you satisfied with the program content?” 2) “were you satisfied with the amount of support you received?” 3) “were you satisfied with the pedometer?” And 4) “were there any aspects of the program you think should be added or dropped?” To keep the evaluation forms anonymous women were not required to provide their names. Eighteen women in the social ecological intervention group completed this evaluation. Responses to the questions are presented in Table 4.31.
<table>
<thead>
<tr>
<th>1. Were you satisfied with the program content?</th>
<th>2. Were you satisfied with the amount of support you received?</th>
<th>3. Were you satisfied with the pedometer?</th>
<th>4. Were there any aspects of the program you think should be added or dropped?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, just thinking about integrating more into my daily routine</td>
<td>Yes - friends were terrific, why didn't we do this sooner?</td>
<td>Somewhat, it really only works for long strides, splitting and stacking wood did not cut it</td>
<td>Can't think of any. I think it did what it was intended to do. We've really enjoyed our walks</td>
</tr>
<tr>
<td>Yes, articles were informative</td>
<td>Yes - it has been great fun to get walking with the ladies @ church and in some cases to get to know them</td>
<td>No - reading varied greatly for some activity and between people doing the same activity</td>
<td>Great Job!</td>
</tr>
<tr>
<td>I was satisfied with the program information on importance of physical activity for health benefits</td>
<td>Yes - having us form a group for walking was great. I enjoy out Saturday morning walks</td>
<td>Not entirely. Does not work well when walking on carpet or at a slow pace</td>
<td>No</td>
</tr>
<tr>
<td>I enjoyed the program content. The resources through websites were encouraging. I enjoyed the sheet with &quot;quick facts&quot; about health and walking</td>
<td>I thought the camaraderie of our group grew each meeting and each time we walked together. Amy was very knowledgeable, down to earth. She is very pleasant in her presentations</td>
<td>I really like the pedometer. Only a few times did I have trouble with it being inefficient i.e. if I tied a sweater around my waist then it kept it from registering steps</td>
<td>E-mail reminders are great for meeting and maintaining records. I wouldn't drop anything as the meeting weren't that frequent</td>
</tr>
<tr>
<td>The content was excellent, but seemed short. People (I include myself) are too busy, and our health is important</td>
<td>Yes, my sisters in Christ were a tremendous encouragement to me. They called, e-mailed and came over to walk. Several &quot;walking clubs&quot; were established.</td>
<td>Yes it was enlightening and helpful. It was a reality check.</td>
<td>No</td>
</tr>
<tr>
<td>Yes, I think I would have liked more written materials during the later classes rather than just discussions</td>
<td>Yes - it was great - we have planned specific times to walk each week and I feel like sisters are just as committed as I am, which is very encouraging</td>
<td>Yes it was helpful to see where I was at each day - I like to be able to measure my progress</td>
<td>Maybe more encouragement to set up times to meet and walk earlier on in the program - we seemed to do it eventually but it was probably week 5 or so before it happened.</td>
</tr>
</tbody>
</table>

Table 4.31: Participant satisfaction, social ecological intervention group (n = 18) (Continued on next page)
Table 4.31: Continued.

<table>
<thead>
<tr>
<th>1. Were you satisfied with the program content?</th>
<th>2. Were you satisfied with the amount of support you received?</th>
<th>3. Were you satisfied with the pedometer?</th>
<th>4. Were there any aspects of the program you think should be added or dropped?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes it was encouraging and informative</td>
<td>I felt very satisfied, Amy was always encouraging even when I could not meet goals or attend meetings.</td>
<td>Yes it made me aware of how much I was/was not exercising</td>
<td>No very good</td>
</tr>
<tr>
<td>The program was very helpful in making me motivated towards physical activities and staying fit</td>
<td>Yes Amy was very helpful in providing information</td>
<td>Yes it was an encouraging way of measuring physical activity</td>
<td>It didn't work out as well as I had hoped because our home was scattered away from where others lived</td>
</tr>
<tr>
<td>I did learn some things, especially that I can fit extra steps into my day. I am glad to have the handouts we were given</td>
<td>I really did not seek any support outside the meetings we had, but those were helpful</td>
<td>Yes I plan to continue using it, as it gives me an idea of how I'm doing</td>
<td>e-mail reminders for wearing the meter would have been good but overall the program was good</td>
</tr>
<tr>
<td>Yes, there were some initial confusion about the amount of involvement required to meet with the group to do stuff together but the content was excellent</td>
<td>Yes I had support from a friend from the church that really helped</td>
<td>Yes</td>
<td>Was a good program. It was nice to receive handouts and encouragement from the facilitator. Would recommend it to others</td>
</tr>
<tr>
<td>I thought Amy did a good job of explaining and presenting the information. I learned a lot of new information</td>
<td>Although the program is focused on friends and people in your community...we (I) rarely walked with them, but I was encouraged when we met up</td>
<td>Yes! It really helped me see how physical (not physical) I was and it motivated me to do more</td>
<td>No the program is very good</td>
</tr>
<tr>
<td>Yes, they gave us information on how to proceed in our goals</td>
<td>I have been very satisfied with my support from family and friends</td>
<td>Yes it has helped me to want to walk more during a regular work day</td>
<td>Surveys! Just kidding! I know you need those</td>
</tr>
</tbody>
</table>
Examination of Table 4.31 suggests that overall the women were satisfied with the study. The written materials provided during the educational sessions were commented on positively by the women. Indeed, one woman recommended that the inclusion of more written materials would have been helpful. The most frequently cited source of support was the support provided from the other women who were participating in the study. Program implementers were also cited as a satisfactory source of support, whereas only one woman mentioned receiving support from family and being satisfied with the support she received from this source.

Overall, the women seemed satisfied with the pedometer as a method of monitoring physical activity. Nevertheless, several women commented on several limitations they observed when using the pedometer including inaccurate recordings for different walking speeds, inaccuracy when walking on different surfaces, and when participating in physical activities.

Participants seemed to be happy with the amount of contact and information they received and did not recommend that anything be dropped from the intervention. A number of women suggested that more e-mail reminders and support from other participants during the first part of the program would have been helpful. Other recommendations were the addition of information on how to increase physical activity, and the inclusion of dietary information. A detailed discussion of the findings relating to program satisfaction is presented in Chapter 5.
Process evaluation is also concerned with the appropriateness of the intervention, including appropriateness of the program components and materials and participant satisfaction. Appropriateness of program material was evaluated with a field test prior to program implementation, the results from which were discussed in Chapter 3.
Despite the known health benefits associated with regular physical activity (PA), less than half of American women across all race and ethnic groups engage in a sufficient amount to reduce their risk for chronic disease (BRFSS, 2005). The failure of current empirical research to address social and contextual variables in the physical activity field has been suggested by some authors to contribute to the lack of success in changing or sustaining physical activity behavior (Sallis & Owen, 1999). Likewise, the prevalence of physical inactivity has been attributed to the general conception that vigorous activity is the only alternative to gain sufficient health benefits and to the continuing promotion of structured and or planned physical activities as the main method to improve health (Porter, 2003). Current evidence emphasizes the importance of creating programs to increase the adoption and maintenance of physical activity for women that are feasible, effective and encompass multiple levels of the social environment. What is more, interventions are needed with evaluative components to establish how interventions produce behavior change (Flay, 1986).

The primary purpose of this study was to evaluate the efficacy of a social ecological intervention to increase daily walking among sedentary women compared
to a self-monitoring only condition. There were four secondary purposes. Firstly, we sought to evaluate the utility of the intervention to change the intrapersonal (self-efficacy and self-regulation) and interpersonal social ecological levels (social support and social network) on which the intervention was based. Secondly, we examined associations between change in the social ecological variables and change in steps/day, and participant demographic characteristics with change in steps/day to identify potential mediators and moderators of behavior change. Thirdly, we used process evaluation methods to examine other factors that may have contributed to the findings, including the relationship between fidelity of program implementation and group cohesion to daily walking. Finally, we used process evaluation methods to examine the appropriateness of the program content and overall participant satisfaction. The social ecological model proposed by McLeroy et al. (1988) served as a framework to evaluate the impact of the intervention on steps/day and different levels of the social environment, and to examine the relative influence of the social ecological variables to the increase in steps/day.

Conclusions from the study are presented in six sections. The first section discusses results pertaining to the primary research questions, the impact of the social ecological intervention on changing steps/day and in relation to a self-monitoring only comparison group. In this section, we also discuss qualitative data gathered from participants’ walking logs and their contribution to the interpretation
of the findings. The second section discusses findings pertaining to the impact of the intervention on the social ecological variables targeted in the study. In the third section we discuss the associations observed between change in social ecological variables and change in steps/day for each time point (pretest to posttest, pretest to follow up, and posttest to follow up), and associations between participant demographics and change in steps/day again for each time point. The fourth section discusses results from the process evaluation including the relationship between fidelity of program implementation and group cohesion to daily walking, and overall participant satisfaction with the study. Findings from the impact and process evaluation are discussed in the context of the current literature, and limitations of the study, which influence the interpretation of the findings. In addition, we give recommendations for future research in relation to the interpretation of each finding.

The fifth section provides a summary of the limitations of the study in the context of threats to the internal and external validity of the design and analysis and therefore the extent to which we can interpret and generalize from the findings. The sixth and final section presents a summary of the main conclusions drawn from the study and further recommendations for future research.
PART I

Impact Evaluation Steps/day

The purpose of an impact evaluation is to determine the short term immediate impact of a health program. We used impact evaluation methods to answer the primary research questions and determine the impact of the intervention on change in steps/day.

*Primary Hypotheses*

We hypothesized that change in pedometer measured steps/day would increase over time among women assigned to the social ecological intervention group and relative to women in the self-monitoring only comparison group. Findings from the impact evaluation indicated that steps/day increased significantly for both groups from pretest to posttest and from pretest to follow up. Women in the social ecological intervention group increased their steps on average by $2160 \pm 2029$ steps/day from pretest to posttest and by $2660 \pm 1969$ steps/day from pretest to follow up. Women in the self-monitoring only comparison group increased their steps/day by $1764 \pm 1939$ from pretest to posttest and by from pretest to follow up $1316 \pm 1925$. Though both groups increased their steps/day, a significant interaction indicated that women in the social ecological intervention group increased to a
significantly greater degree from pretest to follow up, and from posttest to follow up than women in the self-monitoring only comparison group. Over the 10 week period, women in the social ecological intervention group walked on average $1344 \pm 2031$ steps/day more than women in the self-monitoring only comparison group. Therefore, our findings from the impact evaluation provide support for the primary hypotheses that the social ecological church based intervention successfully increased steps/day over time and relative to women in the self-monitoring only comparison group. Moreover, during the four week period between posttest to follow up, women in the social ecological intervention group continued to significantly increase their steps/day an additional $500 \pm 2540$ steps/day, relative to women in the self-monitoring comparison group who had no change in steps/day from posttest to follow up. This finding suggests that both conditions were successful in promoting the short term maintenance of steps/day, however the social ecological intervention condition had an advantage in that this condition only resulted in a continued significant increase in steps/day for this short term follow up period.

The magnitude of the increase in steps/day among participants in the social ecological intervention group is consistent with the pedometer literature. In a review of pedometer based studies, Bravata et al. (2007) reported an average increase in steps/day of 2183 above baseline among non clinical populations, and an average
2004 steps/day increase among intervention participants above control or comparison
group’s steps/day. With respect to the church physical activity literature, the
findings are consistent with Winett et al. (2007). In their study “Guide to Health”
(GTH) participants in the intervention conditions GTH and GTH plus, increased
their steps/day above baseline, 1500 and 1400, respectively, compared to an increase
of only 400 steps/day above baseline among participants in the control group.

The study by Winett et al. (2007) was the only church physical activity study
identified in the literature review that operationalized PA in terms of pedometer
measured steps/day. With respect to the other church studies reviewed, it is difficult
to make direct comparisons with the present study owing to the relative
heterogeneity in design, population, outcome variables, and duration across the
church based literature. With respect to the efficacy of church PA interventions to
increase walking among non-Hispanic Caucasian women, the findings are consistent
with results from Jorna, Ball & Salmon (2006), who reported a significant increase in
time spent walking among women participating in a body, mind and spirit
intervention condition, relative to a comparison group. Likewise, Peterson et al.
(2005) reported a medium effect size for time spent in moderate intensity PA from
baseline to 12 weeks among intervention participants ($\eta^2 = .09$) relative to a control
group.
The magnitude of the increase over time observed in the current study is also comparable to the increase observed with African American congregations. In our study, the magnitude of increase from pretest to posttest for the social ecological intervention group, and between the two conditions (SE and SM) ranged from moderate to large (time $d = 1.31$; between groups, $d = 0.66$), similar to the magnitude of change reported by Campbell et al. (2004) in the WATCH project. They reported a large effect size for increase in MET hrs/week of recreational PA from pretest to follow up among intervention participants. Also, in the Healthy Body Healthy Spirit study, Resnicow et al., (2005) reported large effect sizes for change in weekly minutes of PA ($d = 1.98$), change in PA > 3 METS ($d = 3.2$) and change in intentional activities ($d = 2.3$) among intervention participants relative to a control group.

The findings from this study however are inconsistent with church studies conducted over a longer timeframe. Although Young & Stewart (2006) reported an increase in physical activity among African American congregations participating in their aerobic exercise condition over a 6 month period, the increase was not significant relative to the stretch and health comparison group. As well, findings reported by Wilcox and colleagues for Health-E-AME (2007) indicated that at two year follow up, their intervention had no significant impact on moderate intensity
PA, meeting recommendations for PA, or stage of change for intervention and comparison participants.

Despite differences across studies, findings from the impact evaluation add to the body of literature and support the efficacy of PA interventions conducted in churches to promote a large increase in steps/day maintained over the short term among a predominantly non African American sample of women. Nevertheless, the findings from the longer term studies warrant the examination of the impact of a social ecological intervention to sustain the increase in steps/day over a longer period.

Of practical significance, based on a calculation conducted by Sherman et al. (2007), the increase observed in steps/day from pretest to follow up for women in the social ecological intervention group is equivalent to walking an additional 1.13 miles per day from baseline, and an additional 0.57 miles compared to women in the self-monitoring only comparison group. According to Pate et al. (1995), we can equate walking briskly for two miles on most days of the week with thirty minutes of moderate intensity PA. Concomitantly, in this study, 35% of the women in the social ecological intervention group were accumulating on average ≥10,000 steps/day at follow up, as were 22% of women in the self-monitoring only comparison group, and La Masurier (2003) purported that 10,000 steps/day is equivalent to meeting

---

^32 2.25 ft per step is a widely accepted norm for women and 1 mile = 5280 ft. Therefore 2660 steps/day X 2.25/5280 = 1.13 miles per day
guidelines for moderate intensity PA. Although overall, women in the social ecological intervention group accumulated on average less than 10,000 steps/day (8549 ± 2481) at follow up, Sidman et al. (2004) asserted that for some individuals a minimum of 30 minutes per day of moderate intensity PA can be achieved without accumulating 10,000 steps/day (Sidman & Corbin 2003, Wilde et al., 2001).

Therefore, we could argue that the findings support the contention that a universal goal of 10,000 steps/day may be inappropriate for some populations, in particular for more sedentary women (Hall & Kerr, 2001; Sidman et al., 2004). As the 7DRE-Q (Petosa, 1995) was administered at screening only, we did not corroborate steps/day with PA levels at posttest and follow up, and thus cannot determine the proportion of women in the study meeting recommendations for PA. This addition may therefore be useful in future studies.

With regards to the clinical significance of the results, Hatano (1997) recommended a goal of 10,000 steps/day as a means of reducing risk for chronic disease. Yet, significant improvements in health have also been realized from increasing steps/day to a lesser degree, in particular among sedentary populations (Dwyer et al. 2007; Perna et al., 2005). According to Sherman et al. (2007), an increase of 2573 steps/day, similar to the magnitude of the increase for women in the social ecological intervention condition, is based on research by Perna et al. (2005), equivalent to a 5% improvement in cardiorespiratory fitness, and in turn a 9%
reduction in risk of mortality from chronic disease. Concomitantly, Bravata et al. (2007) reported that increases in steps/day to the magnitude of ± 2000 steps/day were associated with significant reductions in blood pressure and BMI, which again would result in a significant improvement in health. And, according to Tudor-Locke et al. (2004), an increment of 2500 steps/day classifies adults into the next higher level of PA (Tudor-Locke & Bassett, 2004). A dose response relationship has been established between physical activity and health (Haskell et al., 2007), therefore, one can logically assume that an increase of this magnitude would be associated with some improvement in health. And, according to Kahn et al. (2002), the largest public health benefit of PA interventions will result from small increases in PA among sedentary populations. Nevertheless, in the context of the present study, as no measures were included for health parameters or to corroborate step counts over time, we base this assumption on supposition only.

Walking Logs

A strength of the current study was the use of a multi-method approach in which qualitative methods were used to enrich the step count data gathered quantitatively. In addition to the pedometer, we provided women in both groups with walking logs to record their steps/day. We also encouraged participants to record any barriers they encountered when trying to increase their steps/day, and/or
any problems they encountered with using the pedometer. The information recorded
in the walking logs provides a method to help interpret and explain the quantitative
findings in light of the existing literature. Data in the walking logs can also aid our
understanding of barriers that sedentary women may encounter in pedometer
interventions, or alternatively successful strategies that could improve future
pedometer use and increase PA behavior among women.

Qualitative data gathered from the walking diaries indicated the importance
of planning a walk each day to meet goals for increasing steps/day. In particular, the
women frequently cited planning to walk with someone as a source of support.
Interestingly, a number of women reported in their logs that it was not possible for
them to accumulate 10,000 steps/day unless they incorporated a planned walk into
their day. This finding corroborates Hultquist et al., (2005) who found that
participants in their 10,000 steps/day took a planned, deliberate walk lasting between
10 to 75 minutes in order to meet their goal. Moreover, the updated
recommendations for PA (Haskell, et al. 2007) emphasize that 30 minutes of
moderate intensity aerobic PA should be performed in addition to routine activities
of daily living of light intensity (e.g., self-care, casual walking) or lasting less than
10 minutes in duration. Haskell et al. (2007) contend that this form of incidental,
light intensity PA is not sufficient to meet recommendations or to accrue significant
health benefits. Similarly, findings from this study imply that sedentary women need intentional activity to meet a goal of 10,000 steps/day.

Other successful strategies cited were goal setting and walking instead of driving. Similarly, in a longitudinal study by Tudor-Locke et al. (2004), data gathered from focus groups suggested that walking to get to places was potent for accumulating additional steps/day. In our study, a number of women mentioned walking while talking on the phone and one woman mentioned an innovative method of jumping on a mini-trampoline to accumulate steps.

Analogous to what has been reported within the PA literature, the most frequently cited barrier to meeting step goals was lack of time (Berg & Cromwell, 2002, Bopp et al., 2007). This supports the promotion of accumulating PA throughout the day as opposed to continuous moderate intensity PA. Still, with respect to the previous discussion, we should take care to emphasize accumulation in terms of bouts no less than 10 minutes in duration and of a moderate intensity.

Other common barriers cited were child care, feeling too tired, illness and inclement weather. In regards to weather as a barrier to meeting step goals, it is unlikely that a seasonal effect influenced the findings. In a prospective observational study, Tudor-Locke et al. (2004) collected 365 days of continuous self-monitored pedometer data from 23 men and women to explore the natural variability in physical activity. They reported that the difference between seasons in steps/day ranged from
200 steps/day (Summer > Spring) to 900 steps/day (Summer > Winter). On the basis of this latter finding, Tudor-Locke et al. (2004) recommended that studies collect pedometer data in the fall or spring. In the present study, implementation of the present study took place in Fall of 2007, therefore it is unlikely that weather conditions unduly influenced steps/day. Also related to the current study, Tudor-Locke et al. (2004) reported that significantly more steps were taken during sports and exercise days compared to non sports/exercise days (6000 steps/day). This latter finding again corresponds with the previous discussion and emphasizes that volitional, purposeful activities are potent strategies for increasing overall PA. Concomitantly, participants reported planned walks as the most successful strategy for reaching walking goals (Tudor-Locke et al., 2004).

The most frequent successful method reported for pedometer use was placing the pedometer in an obvious location. Women repeatedly mentioned placing the pedometer next to their make up bag, in the bathroom, and/or next to their glasses and clothes. In contrast, the most frequent barrier cited for pedometer use was forgetting to put the pedometer on, in particular after a change of clothes. Also related to clothing, a common limitation reported was having nowhere to place the pedometer when wearing certain types of clothing, in particular dresses. Designing a snug fitting belt or pouch worn underneath clothing to attach the pedometer, could perhaps overcome this barrier.
Despite the aforementioned barriers, adherence to pedometer use was good. Women in both groups wore the pedometer on average 5 to 6 days a week throughout the study period, suggesting that the pedometer is an acceptable and low effort method for monitoring PA behavior over a brief 10 week period. Still, the level of pedometer adherence reported in the present study is inconsistent with the literature relating to adherence for longer periods. Tudor-Locke et al. (2004) reported that pedometer use over a 24 week period dropped from 88% to 58% during the last few weeks of the adherence phase when there was no further contact with participants. Similarly, in their walking study Merom et al. (2007) documented that only 17% of participants in their pedometer condition were still wearing their pedometer at 6 months follow up. The findings merit examination of adherence to pedometer use in a social ecological PA intervention study over a longer duration.

In summary, findings from the impact evaluation support the primary hypotheses that the social ecological intervention increased steps/day and more than a self-monitoring only comparison group. The results confirm previous findings that the intervention was effective in producing a large statistically and practically significant increase in steps/day among a healthy inactive sample of women. Moreover, maintenance of the increase in steps/day above baseline for at least four weeks beyond formal interactions provide support for the impact of the intervention on short term maintenance of steps/day. The findings also support the promotion of
pedometers as a feasible and acceptable method to monitor physical activity in the short term.

It should be noted that although the social ecological intervention condition resulted in a significantly greater increase in steps/day from pretest to follow up and from posttest to follow up in comparison to participants in the self-monitoring only condition, the self-monitoring only condition also resulted in a statistically large increase in steps/day from pretest to posttest, which was likewise maintained over the short-term maintenance period between posttest and follow up. Therefore, to determine whether the inclusion of the social ecological intervention sessions is justified both practically and economically, future research is necessary to determine whether the social ecological intervention would continue to have an advantage over self-monitoring only over a longer time period.

PART II

Impact Evaluation of Social Ecological Variables

Impact evaluation not only shows if the intervention affected the target outcome variables, but also provides a systematic way of considering the role of theory in intervention by identifying what components of the intervention are successful and why (Baranowski, Anderson, & Carmack, 1998). Construct validity
involves using impact evaluation methods to determine the ability of the intervention to change the constructs on which it is based, and the importance of those constructs in supporting behavior change (Hallum & Petosa, 1998), thus providing an investment in theory testing (Green & Lewis, 1986). The next two sections discuss findings relating to the construct validity of the intervention.

Secondary Hypotheses 1 to 8

We used impact evaluation methods to examine the efficacy of the social ecological intervention to change the intrapersonal (self-efficacy, self-regulation) and interpersonal (social support and social network) levels of the social environment over time and in relation to the self-monitoring only comparison group.

Self-Efficacy

We hypothesized that the intervention would increase self-efficacy over time and relative to the self-monitoring comparison group. Based on recommendations by McAuley & Mihalko (1998) the present study distinguished between self-regulatory or coping efficacy, where efficacy is assessed relative to impediments or challenges to successful behavioral performance (e.g., carrying out a walking regime in the presence of foul weather), and task self-efficacy, where motor skills and capabilities are assessed (e.g., walking a certain distance). In this study we measured and analyzed the two domains of self-efficacy separately.
With respect to self-regulatory self-efficacy, the data indicated that there were no significant main effects for time or group. However there was a significant interaction between time and group ($\eta^2 = .098$), in that women in the social ecological intervention group only significantly increased their self-regulatory self-efficacy over time from pretest to posttest and from pretest to follow up, and the increase from pretest to posttest was significantly greater than the self-monitoring only comparison group. The findings provide support for the hypotheses and evidence for the efficacy of the social ecological intervention condition to increase self-regulatory self-efficacy and maintain this increase for the duration of the study.

With respect to task self-efficacy, there was no change for the social ecological intervention group over time ($\eta^2 = .003$) or relative to women in the self-monitoring only comparison group ($\eta^2 = .025$), indicating that the social ecological intervention did not successfully impact task self-efficacy.

In general, the physical activity literature suggests that interventions can change self-efficacy (Miller & Trost, 2002; Dishman et al., 2004). However, few studies distinguish between measurement of self-regulatory self-efficacy and task self-efficacy, therefore it is difficult to interpret the findings in light of the existing literature. There are however a number of possible explanations for the lack of change in task self-efficacy.
In this study, the instrument adopted for self-regulatory self-efficacy measured participants’ confidence to engage in walking in the face of barriers. On the other hand, the task self-efficacy instrument measured participants’ increasing confidence in their ability to walk at a moderate intensity for incremental periods of time, that is, to walk for 10 minutes, then 15 minutes, and so forth up to 30 minutes continuously. The focus of our intervention however was to promote accumulated as opposed to continuous PA, and therefore centered on strategies to accumulate steps throughout the day, as opposed to increasing steps/day in terms of frequency, intensity or duration. Consequently, we could argue that as the intervention did not specifically target task self-efficacy, this may account for the lack of change in the construct.

Alternatively, the lack of significant change in task self-efficacy may have been due to a ceiling effect, precluding the ability of this construct to increase further. Out of a possible maximum score of 100, at pretest women in the social ecological intervention group reported on average a score of 88.1%, and women in the self-monitoring only comparison group reported an average score of 91.53% on the task self-efficacy instrument. Consistent with this, Castro, Sallis, Hickman, Lee, and Chen (1999) reported that high levels of self-efficacy in a sample of women prior to intervention resulted in decreased self-efficacy over time, despite an increase
in walking. However, in the study by Castro et al. (1999), it is not clear whether the authors measured task self-efficacy or self-regulatory self-efficacy. Regardless of the reason for a lack of change in task self-efficacy, the findings support McAuley & Milhalko’s (1998) contention that task self-efficacy and self-regulatory self-efficacy are related but distinct constructs and should therefore be measured separately. Moreover, similar to limitations noted by Hogan et al. (2002) with respect to social support, the findings suggest that simply including any measure of self-efficacy within the design of an intervention is not sufficient, rather measures should correspond with the type of self-efficacy being addressed in the research hypothesis and being targeted in the intervention. In summary, the study provides partial support for the hypotheses, in that the social ecological intervention condition successfully increased self-regulatory self-efficacy but not task self-efficacy.

**Self-Regulation of Walking**

We hypothesized that the intervention would increase self-regulation of walking over time and in relation to the self-monitoring only comparison group. Findings from the impact evaluation indicated that self-regulation increased significantly for both groups over the duration of the 10 week study ($\eta^2 = .328$), from pretest to posttest. Although the increase remained significant from pretest to follow
up, there was no further change in self-regulation of walking from posttest to follow up. For this construct, there were no significant differences between groups for any time point, which precludes concluding that the social ecological intervention had an impact on promoting self-regulation of walking. Again, several possible explanations may account for the increase among both groups.

In this study, we defined self-regulation for walking as the use of methods to overcome barriers to walking and regulate walking behavior, including scheduling time for walking, monitoring walking, goal setting and planning for relapse. Based on this definition, the nature of the measurement of the primary dependent variable, pedometer measured steps/day, meant that both groups were primarily engaged in self-regulatory behaviors over the course of the study. Both groups monitored their steps/day with pedometers over the 10 week study period, and although we used pedometers primarily as an objective method to measure walking in the present study, intervention studies have also used pedometers as a motivational device (Swartz et al., 2003). Participants’ ability to receive immediate feedback on accumulated steps/day and goal attainment is an inherent motivational function of the pedometer (Matevey, Rogers, Dawson, & Tudor-Locke, 2006).

Another form of self-monitoring is using a diary to record steps/day, and again participants in both groups recorded their total steps each day in walking logs. Concomitantly, another defining feature of self-regulation is goal setting. Although
only women in the social ecological intervention group were specifically asked to select goals for increasing steps/day, and received information relative to setting appropriate goals, it is possible that women participating in the self-monitoring comparison group also self-selected goals to increase their steps/day. The walking logs given to both groups provided space to record weekly walking goals. The presence of this “goal” space could have prompted the women in the self-monitoring only comparison group to select a goal or, the fact that women were participating in a research study may have provided an incentive to set goals.

As both groups engaged in self-regulatory behaviors in this study, we cannot conclude definitively that the social ecological intervention changed self-regulation of walking or rule out the possibility that increase among participants was due to using the feedback received from the pedometers themselves and the act of monitoring and recording steps/day. It is possible that the addition of a third group in future studies who monitor steps/day only, perhaps using a sealed pedometer, could at least determine whether the social ecological intervention successfully impacted the other forms of self-regulatory behavior such as recording PA, goal setting and/or scheduling time to be active. In support of this, Winett et al. (2007) found a significant increase in self-regulation for both of their intervention groups, GTH only and GTH plus, whereas the control group did not change. However, in their church study, it is not clear whether participants in the control group also wore
pedometers over the course of the study or during assessment periods only. Winett et al. (2007) suggested that the increase in self-regulation among GTH participants, relative to the other social cognitive variables examined in their study may have been due to the use of pedometers, and due to other components of their intervention centering on self-regulatory strategies such as goal setting and planning.

To boot, the lack of significant change from posttest to follow up in the current study was likely due to the fact that both groups monitored their steps/day over the entire 10 week period. Therefore, the significant increase from pretest to posttest and from pretest to follow up was due to adoption of self-regulatory behaviors, and as the behaviors continued through follow up, there was no further change for this time.

Finally, although the difference between the two groups was not statistically significant, examination of the effect size for the difference between the two groups suggests the value was small ($\eta^2 = .027$). As few church based intervention report outcomes for self-regulation, it is difficult to determine whether this magnitude of difference between groups is meaningful. G*Power indicated that the power of this study to detect a significant difference was low ($\beta = .59$). According to G*power, to detect a difference of the above magnitude, with power set to .8, and alpha = .05, a sample of $N = 60$ is necessary (with 30 in each group). Therefore, we could argue that the lack of a statistical difference between the two groups was due to inadequate
power. This latter finding highlights the importance of reporting effect size along with statistical significance.

**Social Support for Physical Activity**

In the present study, we defined social support as the function of interpersonal relationships, according to the six functions outlined by Weiss (1974). We hypothesized that the social ecological intervention would increase social support over time, and over and above social support for physical activity reported by women in the self-monitoring only comparison group.

Similar to the previous construct, both groups increased in social support for physical activity over time ($\eta^2 = .180$), with a significant increase from pretest to posttest and from pretest to follow up, and the increase was maintained from posttest to follow up. Analogous to self-regulation of walking, as both groups increased in social support over time, it is not possible to conclude that the social ecological intervention was responsible for the increase among participants in this condition. As few physical activity studies conducted in churches report outcomes relating to social support, again it is not clear whether the findings are consistent with other studies. In contrast to self-regulation of walking, the effect size for the group

---

33 See chapter 1 for details of each function (Weiss, 1974).
difference in social support was negligible ($\eta^2 = .002$), precluding the suggestion that there was inadequate power to detect a meaningful difference.

Methods of data collection and participant recruitment are however possible explanations for the increase in both groups. Although the women in the self-monitoring only comparison group did not attend any sessions, they still met at the same time and location (church) to complete pretest, posttest and follow up measurements. Consequently, women in this group knew who else was participating in the study, and more often that not they knew each other since they attended the same church. Arguably, knowing the other participants were also monitoring their steps over the 10 week period may have served as a significant source of support.

The method by which we analyzed social support offers a different explanation. The Social Provisions Scale for Physical Activity (SPS-PA: Duncan & McAuley, 1993) has six subscales representing each of the six functions of support proposed by Weiss (1974). As this study was a preliminary pilot test, we analyzed social support using the total mean scale score as opposed to examining subscales separately. It is therefore possible that the intervention increased different functions of support relative to others and/or support functions may have differed between groups. Consistent with this supposition, Thrasher et al. (2004) reported that emotional and tangible support were more predictive of increased PA than informational support. Although only women in the social ecological intervention
group received informational support, it is possible that the interaction among participants within each condition provided tangible and emotional support. We recommend that future studies examine the impact of the intervention separately on each of the functions of support outlined by Weiss (1974), and in turn their impact on physical activity levels.

In summary, although social support increased over time, the increase was no greater than the social support for physical activity reported by women in the self-monitoring only comparison group. Thereby the findings provide only partial support for the hypotheses.

Social Network

Social network refers to the collective structure of social relationships that surround an individual, and provides information on how an individual is integrated with others (Institute of Medicine, 2001), including structural (e.g., number, type, density, proximity) and interactional (frequency, durability, and intensity) aspects of social relations. In the present study, we defined social network as the interaction (frequency of contact and degree of support received and provided to social network members) between the respondent and her social network. In this study we examined two types of social network members, which were friends/family/partner, and church. We hypothesized that the social ecological intervention would increase
social network support over time and more than demonstrated by the self-monitoring only comparison group.

For the social network index friends/family/partner, participants were asked to select only one of the following: 1) *Family*, operationalized as a relative (not including spouse); 2) *Friend*, defined as an individual with whom the participant has a close interpersonal relationships, but not including a romantic partner, or family member; and 3) *Partner*, defined as an individual with whom the participant has a close romantic relationship (including spouse). For the social ecological intervention participants the results indicated no change in this social network index over time and relative to the self-monitoring comparison group. Again effect size for the difference between groups was negligible ($\eta^2 = .019$), and small for time ($\eta^2 = .051$) and group by time ($\eta^2 = .041$). Examination of power for the latter two suggested that power was adequate ($\beta = .88$ and .79, respectively), again precluding the possibility that a larger sample size would detect a statistical difference.

As definition of the social network index “church” encompassed other participants in the study, to avoid overlap between the two social network indices, we asked women not to choose another participant for measurement of friends/family/partner. It is possible therefore, that women relied more on other participants to provide support for PA as opposed to friends and family. In support of this, findings from the process evaluation indicated that women cited other
participants as the main source of support in the study. The physical activity literature also suggests that support for physical activity from other participants is an important factor for PA. Gillette (1988) found that social interaction during exercise was an important determinant of exercise in women. Likewise, Mayo (1992) found that an exercise partner was the most predictive factor in maintaining a structured exercise program among African American women. Nevertheless, as the social ecological intervention did not influence the social network index friends/family/partner over time or in relation to women participating in the self-monitoring only comparison group, the findings do not support the hypotheses.

The second social network index measured was church. We defined church as members or attenders of the church in which women participated in the study, which therefore necessarily included other participants. We hypothesized that the social ecological intervention would have a significant impact on the social network index church over time, and in relation to women in the self-monitoring only comparison group.

In contrast to the findings for friends/family/partner, the results indicated a significant increase for the social network index church over time ($\eta^2 = .274$), in comparison to the self-monitoring only comparison group ($\eta^2 = .192$), and a significant interaction for time by group ($\eta^2 = .224$). Women in the social ecological intervention group reported a significant increase in the social network index church.
from pretest to posttest and from pretest to follow up, and the magnitude of the change was large for both time points ($d = .91$, and $d = 1.04$, respectively). Although for this group there was no further increase from posttest to follow up, the increase was maintained ($d = 0.24$), providing support for the success of the social ecological intervention to maintain short term change of the construct. Importantly, the self-monitoring only group reported no change for the social network index church at any time point, and the magnitude of the difference between the two groups was large from pretest to posttest ($d = 0.74$) and from pretest to follow up ($d = 1.23$). The findings provide support for the hypotheses that the social ecological intervention successfully increased the social network index church both over time and in comparison to the self-monitoring only comparison group.

No other studies identified in the literature review included a quantitative measure of church support, therefore this finding adds to the current body of literature and suggests that perceived support of the church can be influenced by intervention.

A limitation with the findings for the social network indices again stems from the method by which we measured and analyzed the constructs. Although each sub-scale of the adapted UCLA-SSI (Dunkel-Schetter, et al., 1986) consisted of items measuring support desired, received, and provided to and from the church and from friends/family/partner, and in addition items measuring informational, tangible and
emotional support, we used only the total mean scale score to represent each construct. Again, it is possible that some functions of support contributed more than others, and differed in importance between groups. Moreover, as we conducted the intervention over a brief timeframe, it is possible that reliance on different network members varies as a function of time. We recommend that future studies examine how reliance on social network members varies over time, and how interventions influence different types of social support.

PART III

Associations between Steps/day and Social Ecological Variables

The next stage of the impact evaluation was to identify possible mediators and moderators of change in the primary outcome variable steps/day. The first part of this section is concerned with associations between change in steps/day over time with change in the social ecological variables, and the second part is concerned with associations between participant demographics and change in steps/day, again for each time point.
Secondary Hypotheses 9 and 10

We hypothesized that change in the social ecological variables would be associated with change in steps/day. To meet the criteria for mediation outlined by Baron & Kenny (1986), the variable must be subject to change through intervention\(^ {34} \). Therefore, only associations between change in steps/day for each time point and the social ecological variables that significantly changed with the intervention were examined, namely self-regulatory self-efficacy, self-regulation of walking, social support for physical activity and the social network index church. To look at the pattern of relationships over time, we examined the association between change in steps/day for each time point, (pre to post, pre to follow up, and post to follow up) in relation to change in the social-ecological variables at each time point.

For change in the social ecological variables from pretest to posttest, a greater increase in self-regulatory self-efficacy was associated with a greater increase in steps/day from posttest to follow up. Change in this variable from pretest to posttest accounted for 10% of the variance in change in steps/day from posttest to follow up. As change in self-regulatory self-efficacy from pretest to posttest was associated with change in steps/day at a later time point, from posttest to follow up, we can say that a greater change in this construct predicted a greater change in steps/day from posttest to follow up. Additionally, change in self-regulation of walking from pretest

\(^ {34} \) It is not possible to conclude definitively that this intervention was responsible for the increase in self-regulation of walking and social support of physical activity, but owing to the preliminary nature of the study, these variables were included in the analysis.
to posttest was positively associated with change in steps/day throughout the study duration, from pretest to follow up. As there is overlap in the time in which change in both self-regulation of walking and steps/day occurred, it is not possible to determine directionality for this relationship, therefore we can only conclude that these variables shared 9% of the variance. We could argue that as change in self-regulation of walking from pretest to posttest was associated with change in steps/day from pretest to follow up, self-regulation of walking contributed to maintenance of the increase in steps/day throughout the posttest to follow up period.

Although few studies have examined the relationship between these variables and pedometer measured steps/day, the findings are consistent with the physical activity literature, and support Bandura’s (1986) contention that both self-efficacy and self-regulation are key variables in PA behavior change. With respect to self-efficacy, McAuley (1992) found self-efficacy to be important in the earlier stages of exercise adoption, and individuals with greater self-efficacy were more likely to adhere to an exercise program. In the current study, the pattern of the relationship observed implies that change in self-regulatory self-efficacy from pretest to posttest contributed to the short term maintenance of steps/day from posttest to follow up. The relationship between self-regulation of walking and steps/day is consistent with findings reported by Winett et al. (2007). In their church study, participants who
increased their use of self-regulatory methods were more likely to increase their steps/day at posttest and follow up.

In the current study, the finding that self-regulatory self-efficacy and self-regulation for walking were associated with change in steps/day at different time points, may be due to the definition of the two variables in this study. We defined self-regulatory self-efficacy as an individual’s confidence that she can be physically active in the face of personal, social and environmental barriers, and self-regulation for walking as the use of methods to overcome barriers to walking and regulate walking behavior, including scheduling time for walking, monitoring walking, goal setting and planning for relapse. Therefore, the increase in use of self-regulatory methods throughout the course of the study may have increased participants’ confidence in their ability to use such methods (i.e., self-regulatory self-efficacy) to maintain their steps/day from posttest to follow up.

Although we cannot determine causal relationships in the present study, and we cannot conclude definitively that the intervention increased self-regulation for walking, the findings imply that both self-regulatory self-efficacy and self-regulation of walking are important targets for future social ecological PA interventions.

We also examined associations among the social ecological variables in relation to change over time. From pretest to posttest, there was a positive association between social support for PA and self-regulation of walking, with both
variables sharing 16% of the variance. As change in both variables occurred over the same time point from pretest to posttest, again it is not possible to determine directionality.

With respect to change in the social ecological variables from pretest to follow up, there were no associations with change in steps/day for any time point, suggesting that something other than what was measured was responsible for the change in steps/day. Alternatively, we could argue that interaction between the social ecological variables influenced change in steps/day rather than their independent contribution. In support of this suggestion, we observed a positive association between change in self-regulation for walking and change in social support from pretest to follow up, accounting for 14% of the variance. And, change in self-regulation for walking and change in social support were positively associated with change in self-regulatory self-efficacy from pretest to follow up. The relationship between self-regulatory self-efficacy and self-regulation of walking, and between self-regulatory self-efficacy and social support shared 23% and 39% of the variance, respectively.

Although we cannot assume directionality between these variables or an additive influence of the social ecological variables on change in steps/day, the relationships observed among the variables is consistent with the assumptions of social cognitive theory (Bandura, 1986) and reports in the existing literature.
According to Bandura (1997), the influence of social support on exercise adherence is largely indirect through self-efficacy beliefs. In support, Duncan & McAuley (1993) found that social support predicted adherence in middle aged adults and the relationship was mediated by self-efficacy, and Blanchard et al. (2005) found that as social support increased, the number of days individuals were physically active increased. This latter relationship was greater for those who had higher self-efficacy compared to those with lower values. It is worth noting that in the Blanchard et al. (2005) study, weight status moderated the influence of self-efficacy on PA, but did not influence social support. Due to the preliminary nature of the present study and the small sample, we did not examine relationships between the social ecological variables and BMI. However, this may be an interesting avenue for future research.

Similarly, McNeill et al. (2006) found that self-efficacy explained the greatest proportion of variance in walking, and self-efficacy mediated the relationship between social support and walking indirectly through intrinsic motivation. Intrinsic motivation was not included in the current study, however cross-sectional studies implicate a positive relationship between this construct and PA (Trost et al., 2002, Bauman et al., 2002), suggesting that it would be worthwhile to include this construct in future research.

Of interest, McNeill et al. (2006) developed different models for walking, moderate, and vigorous PA. Their findings indicated a similar pattern in the
relationship among the variables, yet the different variables were more or less important for the different types of PA. This supports Baranowski et al.’s. (1998) recommendations that we should not assume the intersubstitutability of different physical activities, but instead we should focus separately on identifying important contributors to limited domains of PA, such as walking, jogging, gardening, and in this instance pedometer measured steps/day.

With respect to the interrelations between the three variables, self-efficacy, self-regulation and social support, Rovniak (2002) found that social support influenced PA indirectly through self-efficacy, and self-efficacy influenced PA both directly and indirectly through self-regulation. Also, in the Anderson et al. (2006) model, social support and self-efficacy were associated with greater PA levels, however the impact of social support on PA was largely indirect through both self-efficacy and self-regulation, whereas the effect of both self-efficacy and self-regulation were largely direct. Finally, Winett et al. (2007) reported that analysis of pretest variables in their study indicated that self-regulation had the strongest effect on PA, however social support influenced PA as a direct precursor to both self-efficacy and self-regulation, and self-efficacy had little effect on PA independently from self-regulation.

Owing to the small sample size in the present study, we did not conduct multivariate analysis. However, the findings from our study and the existing
literature support the importance of considering both intrapersonal and interpersonal constructs as important influences on PA.

Finally, in relation to change in the social ecological variables from posttest to follow up, only change in the social network index church was directly associated with change in steps/day from posttest to follow, and the two variables shared 9% of the variance. Although we cannot determine directionality, this finding suggests that the relationship between the two variables at this time point contributed to the short term maintenance of the increase in steps/day.

The finding that the social network index church and not overall social support was related to change in steps/day, is inconsistent with the literature. Bull et al. (2006) reported that overall support rather than support from a particular source was a more important contributor to an active lifestyle. And, Anderson et al. (2006) found no differences between support from friends or family for any measure of PA. Nevertheless, the result is consistent with findings by Barrera et al. (2006) from the Mediterranean lifestyle intervention. In their study, both the CIRS and social network index mediated PA, whereas perceived social support did not change with the intervention. Barrera et al. (2006) concluded that the measurement they used for perceived social support was not sensitive to the impact of the intervention. This explanation however is unlikely for the present study, as the instrument detected a significant change in social support for both groups over time. Interestingly, change
in the social network index church was not associated with the overall measure of social support at any time point, suggesting that these the two instruments were measuring distinct constructs.

Although few studies have included a quantitative measure of the social network index church, Winett et al (2007) provided an indirect measure of church support through comparison of the difference between steps/day between participants in the GTH only and the GTH plus support condition. However, in their study, the difference between the two groups for steps/day was not significant, suggesting that the addition of church support did not add anything to the increase in steps/day. Nevertheless, we could argue that the positive relationship between the social network index church and increase in steps/day in this study is consistent with reports for indirect measures of church support (when indeed it is reported) from other church based studies. Wilcox et al. (2007) reported a significant relationship between pastor support for PA and participation in moderate intensity PA. Likewise, Yanek et al. (2001) reported that greater attendance predicted increased PA, and churches reporting the greatest support from the pastor’s wife had the best attendance. In this study, we did not differentiate between pastor, other participants or the entire congregation in the social network index church, therefore it is not possible to determine whether one source of church support or combined sources contributed to the increase in this construct.
With respect to relationships among change in the social ecological variables from posttest to follow up, only the positive relationship between self-regulatory self-efficacy and self-regulation of walking remained. Change in both variables from posttest to follow up shared 28% of the variance. This latter finding again supports the literature pertaining to the relationship between the two variables (Bandura, 1997; Anderson et al., 2006).

In summary, although we cannot determine causal relationships in the present study, the findings from the impact evaluation suggest that self-regulatory self-efficacy and social network index church are possible mediators of the social ecological intervention, and supports their inclusion in future multi-level interventions conducted within a church setting. The intervention resulted in a significant increase in self-regulatory self-efficacy and the social network index church. In addition, changes in self-regulatory self-efficacy from pretest to posttest and change in the social network index church from posttest to follow up had a direct relationship with change in steps/day from posttest to follow up. Self-regulation of walking was also associated with an increase in steps/day, however, the increase in this construct was not significantly different from that reported by women in the self-monitoring only comparison group, which means that the variable does not meet criterion for mediation (Barron & Kenny, 1986). Nevertheless, the relationships observed between self-regulatory self-efficacy, self-regulation of walking and social
support in the present study implies a possible indirect or additive effect of the variables, and supports their inclusion in future church based studies.

**Participant Demographics and Change in Steps/day**

Correlation research can help to identify not only potential mediators, but also moderating variables. A moderator is equivalent to a statistical interaction, and can affect the direction and strength of the relation between the intervention (IV) and the dependent variables (Baron & Kenny, 1986). In the present study, we examined the demographic correlates BMI, education, age and frequency of church attendance in relation to change in steps/day as they can provide insight into characteristics of the population that may moderate the impact of the intervention. Race/ethnicity and marital status were not included in the analysis owing to the relative homogeneity in the sample for these variables.

With respect to BMI, we found a negative relationship between BMI and change in steps/day from pretest to posttest, in that women with a lower BMI had a greater increase in steps/day from pretest to posttest and vice versa. BMI accounted for 19% of the variance for change in steps/day from pretest to posttest. This finding is consistent with Thompson et al. (2004), who found that higher volumes of steps/day were associated with a lower BMI. In contrast, Bravata et al. (2007) reported that BMI was not a significant predictor of steps/day. Interestingly, in the
current study, BMI was not related to change in steps/day from pretest to follow up or from posttest to follow up, suggesting that this variable was related to the initial increase but did not contribute to the maintenance of the increase in steps/day over the follow up period.

We found a positive association for education with change in steps/day from pretest to posttest. Education accounted for 15% of the variance for change in steps/day from pretest to posttest. The positive relationship between education levels and physical activity has been well documented in the physical activity literature (Trost et al., 2002; Bauman et al., 2002) and the relationship appears to be independent from other variables such as income and age (Clark et al., 1995). With respect to interpretation of this finding in the context of the pedometer literature, no other studies were identified that examined the association between steps/day and education.

With respect to age, the relationship between age and steps/day from posttest to follow up was positive. Older age was associated with a greater increase in steps/day from posttest to follow up and age explained 21% of the variance of change in steps/day from posttest to follow up. This finding is in contrast to Tudor-Locke et al. (2004), who reported an inverse relationship between age and steps/day. Similarly, in their review, Bravata et al. (2007) reported a trend for younger pedometer users to have a larger increase in steps/day.
Inconsistency within the literature in regards to the relationship between BMI and age with steps/day may be due to the heterogeneity of the design, duration and population across pedometer studies and/or the differing contribution of the variables overtime (Bravata et al., 2007). Whereas BMI and education explained some of the variance in steps/day from pretest to posttest, age accounted for some of the variance in steps/day from posttest to follow up, suggesting different roles of the demographic variables over time. The findings suggest that BMI and education influenced the initial adoption of the PA behavior (i.e., initial increase in steps), whereas age was more important for the short term maintenance of the increase in steps/day. A literature review by Martin & Sinden (2001) reported that in the general population, older adults are generally more adherent to exercise prescriptions than younger adults. Likewise, Dornelas et al. (2007) examined predictors for adherence to a 10 week aerobic fitness program among middle aged Hispanic and African American women at high risk for CVD, and found age was the only significant factor related to attendance. Dornelas et al. (2007) suggested that women in the highest age category had fewer people living at home and therefore possibly experienced fewer barriers to exercise posed by caretaking responsibilities. In support, examination of the walking logs in the present study indicated that one of the most frequently cited barriers to accumulating steps/day was child care, which may have been more of an issue for younger women. Another plausible explanation is that older women are more
concerned about their health. Despite the inconsistency across studies, the finding of a positive association between age and steps/day suggests that pedometers may be a feasible method of increasing PA among older sedentary women.

In this study, frequency of attendance to church was not associated with change in steps/day for any time point. Again, we did not locate any other studies that examined this variable in relation to change in steps/day. However, the finding is consistent with reports within the physical activity literature in general. Merrill & Thygerson (2001) found no association between frequency of church attendance and vigorous intensity PA after adjusting for smoking, age, education, and general health. Similarly, Gillum (2006) found that after accounting for socio-demographic variables and health status, there was no consistent difference between frequent and non frequent attenders in the prevalence of participation in walking or moderate and vigorous leisure time PA, except for women over the age of 60. Based on the findings within this study and current literature, the relationship between physical activity and church attendance is still equivocal. It may be that frequency of church attendance is less important than the support of the church towards physical activity.

In summary, the findings provide support for the hypothesis that the participant’s demographic variables, specifically BMI, education and age, are associated with change in steps/day, and suggest that these variables should be
considered in the design of social ecological interventions conducted within churches to increase steps/day among sedentary women.

PART IV
Process Evaluation

Process evaluation is concerned with the fidelity of the program’s implementation, appropriateness, site and recipient response to the program (Green & Lewis, 1986). Process evaluation is essential to determine what elements contribute to the success or failure of the program, and thus avoidance of a Type III error. In this section, we discuss the findings relating to fidelity of the social ecological intervention’s implementation, and associations between the process variables, program implementation and group cohesion with change in steps/day. Finally, we present a qualitative summary of participants’ satisfaction with the church based walking study and discuss the content in the context of findings from the impact evaluation and the current literature.

Implementation, Secondary Hypothesis 11

Implementation is concerned with whether or not the program is delivered as intended. In the present study, we defined program implementation as dose of
program received and evaluated dose using participant attendance rates. We
categorized women in the social ecological intervention condition into “low dose,”
“medium dose,” or high dose” in accordance with the number of intervention
sessions they attended to determine whether different doses of the intervention
influenced change in steps/day over time. Overall, attendance was good, with 60%
of women in the social ecological intervention group attending all of the sessions,
25% attending 3 out of 4 the sessions, and 15% attending 2 out of 4 sessions. It is
possible that good attendance in the present study was related to the limited contact
and brevity of the intervention. The literature suggests that interventions that are
more intensive produce better outcomes, but consequently have lower participation
rates, especially for women (Haskell, et al. 1994). Alternatively, good attendance
was perhaps due to walking being an acceptable method of physical activity for
sedentary populations (Siegel, 1995).

Analysis indicated that dose did not influence change in steps/day for any
time point, pretest to posttest, pretest to follow up, and posttest to follow up.
Although we could conclude that attendance to the intervention sessions had no
influence on steps/day, examination of the effect sizes for each time point suggests
otherwise. The magnitude of partial Eta squared was large for change in steps/day
from pretest to posttest ($\eta^2 = .150$), moderate for change from pretest to follow up ($\eta^2$
$= .064$), and large from change in steps/day from posttest to follow up ($\eta^2 = .129$).
Therefore, we could argue that dose or fidelity of program implementation did influence change in steps/day, but there were too few women in each category to determine a statistical difference. Using G*Power, calculation of sample size post hoc with power set to .8 and alpha .05, a sample of $N = 50$ women in the social ecological intervention group would be necessary to detect the smallest effect size found in this study ($\eta^2 = .064$).

We also calculated correlation coefficients to examine the relationship between dose of the intervention and change in steps/day for each time point, pretest to posttest, pretest to follow up, and posttest to follow up. Interestingly, the relationship between attendance and change in steps/day from pretest to posttest was positive, whereas the relationship was reversed for change in steps/day from posttest to follow up. Attendance accounted for 13% of the variance for change in steps/day from pretest to posttest, and 11% of the variance for change in steps/day from posttest to follow up. Interpretation of the findings suggest that women who attended more intervention sessions had greater increases in steps/day from pretest to posttest, but smaller increases in steps/day from posttest to follow up compared to women who attended fewer sessions. The positive relationship is consistent with Yanek et al. (2001), who reported that the number of sessions attended in their intervention was a significant independent predictor of increasing PA. With respect to the negative relationship, it is possible that women who attended fewer sessions
relied on supports besides the intervention to increase their steps/day, and therefore, their steps/day were not influenced when the intervention sessions ended and there was no further contact with participants until follow up. Concomitantly, women with greater attendance were more dependent on the intervention sessions to increase their steps/day and thus the intervention sessions influenced steps/day when the sessions ended.

Group cohesion, Secondary Hypothesis 12

A second part of the process evaluation was to examine the relationship between group cohesion and change in steps/day. In the present study, we defined group cohesion as the tendency of the walking group to stick together and remain united in the pursuit of walking goals and objectives, and we measured the construct using the PAGEQ (Estabrooks & Carron, 1999). As outlined in the methods section, group cohesion was included as a process variable as it is a group property, therefore prior to the program implementation the physical activity group did not exist (Carron & Spink, 1993). Similarly, examining differences in group cohesion between groups was not possible, as the comparison group was not a physical activity group either. Thus, we examined the relationship between group cohesion and steps/day among women in the social ecological intervention condition only for change in steps/day from pretest to posttest, pretest to follow up, and from posttest to follow up.
However, examination of the association between group cohesion and change in steps/day for each time point indicated no meaningful relationships between the variables.

In addition, we examined the relationship between attendance and group cohesion. The literature suggests that cohesiveness facilitates adherence and maintenance of an exercise program (Toliver & Banks-Scott, 1990; King & Frederickson, 1994). In contrast, we found no meaningful associations between group cohesion and attendance. There are several possible explanations for this discrepant finding. Similar to task self-efficacy, scores on the PAGEQ (Estabrooks & Carron, 1999) in this study suggested that women in the social ecological intervention group were relatively cohesive. Possible scores for each item on the instrument range from 1 to 9, yielding a possible mean score of $M = 4.5$. The average mean score for women in the intervention was $M = 6.6$, $SD = 1.19$ (range 4.67 to 9.05), indicating that even the minimum score was above the mean. Again, as this is the first study to examine the role of group cohesion in a physical activity church based study, it is not possible to compare this finding with other studies. It is possible that the relatively high score for group cohesion was due to women within the same intervention groups attending the same church and knowing one another, and was unrelated to being part of a physical activity group. Finally, a different explanation for the lack of relationship is the size of the sample, that is, 20 in the
social ecological intervention condition. According to Gliem (2005), correlation coefficients are stable if $n \geq 25$. Therefore, we should interpret the results from this analysis with caution.

**Participant Satisfaction**

A final part of the process evaluation was to examine participants’ satisfaction with the program. We evaluated satisfaction with four open ended questions. Eighteen women in the social ecological intervention group responded to the following questions: 1) Were you satisfied with the program content? 2) Were you satisfied with the amount of support you received? 3) Were you satisfied with the pedometer? And 4) Were there any aspects of the program you think should be added or dropped? Responses to the questions indicated that overall, women in the social ecological intervention group were satisfied with the study. The women commented favorably on written materials, and even suggested that we provide more written materials if we repeat the study in the future. In contrast, Thrasher et al. (2004) found that informational support was unrelated to PA. They suggested that participants may already be aware of the benefits of physical activity and therefore may perceive this type of support to be irrelevant. Nevertheless, in relation to the present study, the comments imply the importance of providing women with written
material to reinforce verbal presentation when discussing the benefits of physical activity and methods to increase physical activity.

The most frequently cited source of support was the support provided from the other women who were participating in the study. Despite encouraging participants to seek support from friends and family, only one woman mentioned receiving support from family, and in turn being satisfied with the support she received from this source. This finding may have contributed to the lack of change in the social network index friends/family/partner. Women in the social ecological intervention group also cited program implementers as a satisfactory source of support. Similarly, Anderson et al. (1997) reported that healthcare providers play an important role in providing support for the adoption and maintenance of physical activity. For example, Patrick, Long & Sallis (1994) developed Project PACE to provide guidelines for physicians to counsel patients on the benefits of physical activity, which has led to increased physical activity among patients. Interestingly, similar to the present study, PACE was ineffective in increasing social support from friends and family. Findings from cross-sectional research consistently suggest that support from friends and family has a strong positive association with physical activity (Trost, et al., 2002; Bauman et al., 2002), in particular for women (Sallis et al., 1999; Berg, Cromwell & Arnett, 2002). Therefore, it appears that we need to find new and innovative ways to foster or tap into support for physical activity from
this source. In the present study, the program implementer was a graduate student in the field of sport and exercise science, and therefore may have been perceived by the women as a credible source to impart information relative to health and increasing physical activity. Findings from the church based literature suggest that interventions delivered by Lay Health Workers who are themselves members of the congregation are an ineffective method to implement physical interventions in churches (Yanek, et al., 2001; Campbell, et al., 2004). In order to sustain physical activity programs in churches, an effective method may be for churches to partner with health care organizations rather than train members of the congregation to take over.

Overall, the women seemed satisfied with the pedometer as a method of monitoring physical activity. Nevertheless, similar to what was reported in participants’ walking logs, several women commented on a number of limitations they observed when using the pedometer, including inaccurate recordings for different walking speeds, and inaccuracy when walking on different surfaces and when participating in physical activities. Such limitations are recognized and acknowledged within the pedometer literature (Bassett, et al., 1996; Welk, 2002; Tudor-Locke et al., 2004). Future studies should ensure that researchers elucidate limitations inherent to pedometer usage to participants prior to study implementation.
Participants seemed to be happy with the amount of contact and information they received and did not recommend that we drop anything from the intervention. This latter finding suggests that a brief, low contact walking intervention is effective in changing pedometer measured steps/day and perceived as satisfactory by participants. A number of women suggested that more e-mail reminders and support from other participants during the first part of the program would have been helpful. In defense, the purpose of the first two sessions was to foster intrapersonal support and interpersonal support from friends and family rather than support from other women in the study. Only in the latter two sessions did we encourage the women to support one another in different ways such as setting up a time to walk together.

Other recommendations were the addition of information on how to increase physical activity, and the inclusion of dietary information. Against this, Baranowski et al. (1998) asserted that physical activity interventions may be more effective when they focus on one specific behavior. In support, Prochaska (2002) compared the effectiveness of a computer intervention targeting PA only or PA and diet to change PA and diet behavior among adolescents. Her findings suggested greater efficacy for interventions that target a single behavior for change. The majority of church based interventions reviewed targeted more than one health behavior. We did not identify any studies that compared the effectiveness of a church based intervention to target multiple health behaviors concurrently, as opposed to individually. As this is still a
topic of debate, an interesting line of inquiry for future church based studies may be
to compare the impact of interventions that focus on changing one versus multiple
health behaviors.

Process evaluation is also concerned with the appropriateness of the
intervention, including appropriateness of the program components and materials.
To evaluate the appropriateness of program material, prior to program
implementation we asked a sub sample of women to comment on written materials
and measurement instruments for understanding and ease of completion. On the
basis of their comments, we made changes accordingly. This aspect of the
intervention helps to strengthen the internal validity of the current study, as it enables
us to rule out the option that change or lack of change in the outcome variables were
due to issues with materials or instruments as opposed to the intervention itself.

In summary, findings from the process evaluation enrich findings from the
impact evaluation and support the acceptability and efficacy of the social ecological
intervention to increase steps/day and provide support for the acceptability and
efficacy of pedometers to measure physical activity. Although program dose and
group cohesion did not influence change in steps/day for any time point, a plausible
explanation is due to the small sample size, and does not indicate that they should be
excluded from consideration in future church based studies.
External validity is concerned with the extent to which we can generalize from our findings, to subjects and settings beyond those in the study, whereas internal validity is concerned with the extent to which we can attribute change in the dependent variables to the intervention itself (Vogt, 1999). The purpose of this section is to provide the reader with information as to whom we can generalize the results from this study, and the extent to which we can attribute our findings to the intervention itself.

External Validity

The nature of the design of the study in terms of recruitment of both churches and participants posed a number of threats to the external validity of the study. The present study was a pre and posttest quasi-experimental non equivalent control group design (Campbell & Stanley, 1963) with follow up conducted at 10 weeks, or 4 weeks after the intervention phase was over. As it was not possible to study all the churches in the greater Columbus area, a convenience35 sample of $N = 7$ Christian

---

35 By convenience, we selected churches on the basis of the author having direct or indirect contacts with a church member.
churches in the Greater Columbus area volunteered to participate in the study. Therefore, it is possible that the churches who did not participate in the intervention were different on important characteristics to those who did participate. Likewise, volunteer women ($N = 44$) within each church were recruited to participate in the study, and volunteers may differ from those who do not volunteer on variables such as attitude and interest in health and PA along with socio-demographic differences, thus the sample may not be representative of the population of church going women at large.

Generalizing from a non-probabilistic sample to the broader population constitutes a major threat to external validity. We based justification for this method of recruitment on the premise that the study was a preliminary pilot test of a brief social ecological church based intervention and in the early stages of program development. Moreover, our primary purpose was to evaluate the efficacy of the intervention to increase daily walking, and according to Flay’s (1986) developmental stages of research, our primary concern was to control for the internal validity of the study. Therefore, we acknowledge that our findings are limited to individuals and churches that participated in this study and we cannot generalize to the population of females who attend churches in Ohio, or church goers in general. Concomitantly, we cannot generalize results from the study to other non-Christian religious groups or racial ethnic groups outside of the mid-western United States.
A unique aspect of the current study was that we delivered the intervention to small cohesive groups rather than a whole congregation. Nonetheless, based on the size of the congregations participating in this study, the proportion of women in the congregation volunteering to take part in the study was at best small. Likewise, Winett et al. (2007) noted that only about one third of congregants in treatment churches were directly involved in GTH as evidenced by computer logins. These findings raise the question of the feasibility of using churches as a setting to deliver PA intervention studies if we are only reaching a small proportion of their members. It is also likely that the women who participated differed from those who did not, and it is likely that the more motivated individuals volunteer to take part in research studies. Again, this is a factor for consideration in the interpretation and generalization of the findings. We recommend that future studies compare participants with non participants within congregations to determine how we can tailor interventions to reach the hard to reach members of the church and whether indeed churches are a practical and economically feasible setting in which to conduct PA interventions if we are seeking large scale behavior change.

A further consideration in the generalization of our findings is the unit of analysis we adopted for the present study. Although we delivered the intervention to intact groups (churches), we examined the individual as the unit of analysis. As a result, the inherent correlation between members of the same church may have
underestimated variance and increased the possibility of a type I error (Murray & Wolfginger, 1994). Again, we justified this decision due to the fact that the study was an exploratory pilot test to determine the efficacy of a brief church based intervention to increase walking among sedentary females. Nevertheless, we acknowledge this violation as a limitation in the interpretation and generalization of the study findings.

A further threat to the external validity in the present study is reactivity. This is also known as the Hawthorne effect, and can be a threat when individuals change the way they behave when they know their behavior is being evaluated (Bannigan & Zwerman, 2002). Beets (2006) argued that the immediate feedback provided by the pedometer in and of itself may be sufficient to intrinsically motivate some individuals to increase their steps/day. In the current study, we controlled for the threat posed by this effect by including a self-monitoring only comparison group. The extent to which reactivity to pedometers then occurred should have occurred to the similar degree in both groups. Moreover, the finding of a significant difference between the two groups for steps/day suggests that the social ecological intervention had an impact on steps/day above reactivity to wearing a pedometer and the self-monitoring of behavior.

A strength of this study was that the only incentives provided to churches and participants for taking part in the study were the pedometers, whereas a number
of larger scale church based studies have provided churches and participants with monetary incentives for taking part. For instance, Winett et al. (2007) provided participants with cash incentives for completion of each assessment. In addition, they provided monetary incentives to each church for participating, and for higher return rates of participants at follow up. Therefore, it is not clear to what extent participation in their church program would continue once the monetary or extrinsic rewards for participation were terminated. This study however, suggests that although the sample was small, churches and women are willing to participate in a brief physical activity intervention for free and for intrinsic rewards. Concomitantly, they may be more likely to sustain their behavior change subsequent to program termination.

**Internal Validity**

The greater control we have over the study’s internal validity, the greater our confidence that the change in the outcome variables was due to the efficacy of the social ecological intervention itself, and not due to other extraneous variables. Selection is a threat when differential selection of participants occurs into the different conditions of the study, and would be a threat to internal validity in this study because we allocated churches on a first response basis to the social ecological intervention group or a self-monitoring only comparison group, rather than random
assignment. To control for the threat of selection, we examined all dependent variables at pretest to ensure that the two groups, social ecological intervention and self-monitoring only, were similar, and determined that selection was not a threat to the internal validity of the study.

Mortality is a threat if participants who drop out are different from participants who remain in a study. And, differential mortality is a threat when participants from one conditions drop out more frequently than participants from the other condition. Again, we controlled for these threats by the addition of a self-monitoring only comparison group. We compared pretest values for all variables, between completers and non completers, and non completers between groups, and found no evidence for mortality or differential mortality in the current study.

Of note, the attrition rate in the present study was low in comparison to other pedometer based interventions. The review by Bravata et al. (2007) reported an average attrition rate of 20% across pedometer studies, whereas in this study, there was an overall attrition rate of 13.36% across both groups from pretest to follow up. It is possible that adherence was enhanced because the intervention was delivered through participants’ churches and tapped the existing support network of the church. Or, other possible factors that may have contributed to adherence were the brevity of the intervention and minimal effort required from participants. Moreover, pedometer adherence was also good. The findings implicate that the church is an
acceptable setting for participants to conduct physical activity interventions and provide support for pedometers as an acceptable method to monitor PA behavior. Nevertheless, owing to the brevity of the intervention, we recommend further research to examine longer term maintenance both to increasing steps/day following a brief contact intervention and longer term pedometer use.

Regression to the mean can occur when participants who have extreme scores on dependent variables at pretest then regress closer to the group mean on subsequent testing (Gliem, 2005). We controlled for regression to the mean by the inclusion of a comparison group. As the two groups were similar on all variables at pretest, we expected that regression would be the same for both groups. Other threats to the internal validity of the study that we outlined in Chapter 3 include history, testing, maturation, and instrumentation. Once again, we controlled for these threats by the addition of a self-monitoring only comparison group, which provides us with a measure of whether the increase in the intervention group was over and above the increase from history, testing or maturation. Finally, instrumentation is a threat when the interviewer(s) or instrument(s) changes over time. In the present study, we conducted a pilot study prior to implementation of the intervention and established reliability and validity for all instruments in the population of interest, sedentary women. In addition, all instruments were self-administered, therefore change in interviewer was not a threat to internal validity.
The current study was a preliminary pilot test of a brief social ecological intervention conducted in churches and in the early stages of program development. We acknowledge that the findings from the study are limited to individuals and churches that participated in the study and we cannot generalize our findings to the wider church community. Regardless, the primary purpose of the study was to evaluate the efficacy of a social ecological intervention to increase daily walking, and thus the primary concern was controlling the internal validity of the study. We achieved this through examination of pretest variables and the addition of a self-monitoring only comparison group. Concomitantly, we can have more confidence that the impact of the intervention was responsible for the change in the dependent variables.

**Limitations with Correlations**

Despite the evidence to suggest the role of possible mediators and moderators in the present study, we cannot interpret a correlation as proof of a cause and effect relationship between variables (Bauman et al. 2002). Although we can say that the social ecological variables changed as a result of the intervention, we do not know whether change in the variables occurred prior to the change in steps/day, which would be necessary for mediation. Likewise, for a variable to meet the criteria for a moderator it must occur prior to behavior change. In physical activity behavioral
research there is the possibility of *reciprocal determinism*, which makes the relationship between variables more complex (Bauman et al., 2002).

In general statistical usage, correlation or co-relation refers to the departure of *two* variables from independence. Therefore, a limitation with using bivariate correlations is that we can only examine relationships between two variables at one time. In the context of the present study, the use of bivariate correlation coefficients prohibited us from examining the interactions between different levels of the social ecological model, and indeed between variables within one level of the social environment (i.e., self-efficacy and self-regulation). It may be that each level has an additive effect and the interaction among variables contributed to the change in steps/day. Baranowksi et al. (1998) argued for cascading sequences of mediators that intervene and causally relate to one another in sequence between the program and outcome. Due to the small sample size in this study, we did not conduct a mediational analysis, which would have painted a clearer picture of the relationship between the social ecological variables, and their independent and or additive influence on steps/day. Thus, in the present study it was not possible to determine how the social ecological variables work together to influence PA. Nonetheless, the findings provide support for including both intrapersonal and interpersonal variables in church based PA interventions and examining the interaction among the different levels and their additive influence on behavior change.
Finally, but importantly, the shared variance between steps/day and the social ecological variables, and steps/day and participant demographics we observed was small. Therefore, it is more than likely that variables other than those considered in the present study influenced the increase in steps/day. Baranowski et al (1998) argued that PA is a complex behavior with behavioral, environmental, biological and even genetic factors that come in to play, and suggested that we can explain at best 30% of the variance in PA behavior. Even so, values for correlation coefficients can be affected greatly by the range of scores presented in the data, which is especially true for small samples (Gliem, 2005). Concomitantly, the effect sizes reported in this study in the form of both $R^2$ and $\eta^2$ can overestimate population effects as they capitalize on the variance of the sample, which is exacerbated with smaller sample sizes (Newton & Rudestam, 1999). Thus, owing to the size of the sample in the present study, we should interpret the magnitude of the findings for the correlation coefficients with caution. We recommend further investigation with a larger sample size so that a more appropriate method of mediation analysis can be conducted to provide a more accurate description of the relationship between the social ecological variables, participant demographics and steps/day.
Overall, findings from the impact evaluation support the primary hypotheses that the social ecological intervention increased steps/day over time and to a greater extent than a self-monitoring only comparison condition. The results confirm previous findings that the intervention was effective in producing a large statistically and practically significant increase in steps/day among a healthy inactive sample of women, which was maintained for four weeks beyond formal interaction. Moreover, participants were primarily non-Hispanic Caucasian, which adds to the body of literature by suggesting that church based physical activity interventions are appropriate for populations other than African American women.

Although we cannot determine causal relationships in the present study, the findings from the impact evaluation suggest that self-regulatory self-efficacy and social network index church are possible mediators of the intervention, and support their inclusion in future interventions set in churches. In addition, the relationships observed between the social ecological variables in the present study imply a possible indirect or additive effect of the variables, and support their inclusion in future studies in churches. With respect to participant demographics, the findings from this study support the possible moderating role of age, BMI and education, and
warrant their consideration in the design of church interventions. Moreover, Rothman (2000) suggested that the lack of success in physical activity maintenance reflects the dearth of theoretical conceptualizations and corresponding empirical research on how variables influence PA over time, from behavior onset to behavior maintenance. The findings from this study that self-efficacy, self-regulation, the social network index church, and participant age and BMI were associated with change in steps/day at different times warrant consideration of the different roles of these variables in the adoption and maintenance of behavior change over a longer duration.

The findings from our study and the existing literature support the importance of considering both intrapersonal and interpersonal constructs as important influences on PA. This study targeted only two levels of the model proposed by McLeroy et al. (1988) and did not measure effects of the intervention on the church environment or the rest of the congregation. Therefore, the extent to which we can influence the church environment by intervention would be an important inquiry for future research.

Finally, evidence from other studies suggests that for African Americans, especially women, spirituality is often closely tied with health and should be considered when developing interventions targeting health behaviors, in particular when the interventions are being conducted within churches (Holt & McClure,
Therefore, future research using a social ecological intervention in a church setting to increase steps/day may be strengthened through the addition of a spiritual component.

The current study was a preliminary pilot test of a brief social ecological intervention and is in the early stages of program development. We acknowledge that the findings from the study are limited to individuals and churches that participated in the study and cannot be generalized to the wider church community. Nevertheless, this study extends the physical activity literature by providing an in depth evaluation of the efficacy of a social ecological intervention to increase physical activity in a volunteer sample of 38 predominantly non–Hispanic Caucasian women recruited from churches in the Greater Columbus area. In addition, the study adds to existing pedometer based research by providing an evaluation of the different levels of the social environment that influence steps/day. Overall, the findings highlight the importance of using impact evaluation to report outcomes relating not only to the behavior itself, but also to theoretical constructs, if advances are to be made in this field.

To conclude and facilitate clarity, we reiterate an overall summary of our conclusions and component recommendations discussed throughout this final chapter. We present conclusions and recommendations in the order of the research
questions addressed, the church setting in which the intervention was conducted and methodological considerations pertaining to pedometer use and sample size.

Based on the limitations recognized and acknowledged within this study, we make the following conclusions and component recommendations pertaining to the research questions:

- Findings from the impact evaluation support the efficacy of a brief, social ecological intervention to increase steps/day and promote the short term maintenance of steps/day among a predominantly non African American sample of women and more than a self-monitoring only comparison group.

- The self-monitoring condition likewise resulted in a significant increase in steps/day, albeit to a lesser degree, warranting the examination of the longer term maintenance in steps/day to justify practically and economically the inclusion of the social ecological intervention sessions as opposed to promoting self-monitoring only.

- Findings from the impact evaluation provide partial support for the hypotheses relating to the intervention’s efficacy to impact the social ecological variables on which it was based:
  - The social ecological intervention condition successfully increased self-regulatory self-efficacy but not task self-efficacy. We recommend that researchers measure the different types of self-efficacy separately and that the measures selected correspond with the type of self-efficacy targeted in the intervention.
  - Self-regulation of walking significantly increased over time for both groups. We recommend the inclusion of a third condition in which participants monitor their steps/day using a sealed pedometer. We could then determine whether increase in steps/day was due to reactivity to the pedometer itself, and/or examine the relative contribution of different types of self-regulation to the increase in steps/day (e.g., pedometer use, walking logs, goal setting, scheduling time for PA).
Social support significantly increased over time. The increase was no greater than the social support for physical activity reported by women in the self-monitoring only comparison group. We recommend that future studies examine the impact of social ecological interventions separately on each of the functions of support outlined by Weiss (1974), and in turn their impact on physical activity levels.

The social ecological intervention had a significant impact on the social network index church over time and in relation to the self-monitoring only condition, but the intervention had no impact on the social network index friends/family/partner. We recommend future studies examine how reliance on social network members varies over time, and that investigation is directed to identify new and innovative ways to foster support for physical activity from friends/family/partners.

Several significant associations were observed between change in the social ecological variables with change in steps/day:

- Change in self-regulatory self-efficacy from pretest to posttest was directly associated with change in steps/day from posttest to follow up.
- Change in self-regulation of walking from pretest to posttest was directly associated with change in steps/day from pretest to follow up. Although we cannot conclude definitively that the social ecological intervention increased self-regulation of walking, the construct’s positive association with change in steps/day implies that self-regulation of walking is an important target for future social ecological PA interventions.
- Change in the social network index church from posttest to follow up was associated directly with change in steps/day from posttest to follow up.

These correlations suggest that self-regulatory self-efficacy and social network index church are possible mediators of the social ecological intervention, and support their inclusion in future multi-level interventions conducted within a church setting.

Several significant associations were found among the social ecological variables themselves:
From pretest to posttest, social support for PA was positively associated with self-regulation of walking. Change in self-regulation for walking and change in social support were positively associated with change in self-regulatory self-efficacy from pretest to follow up.

- We recommend that the interaction between the social ecological variables and there additive influence on change in steps/day is investigated in future studies.

- The findings from this study that self-efficacy, self-regulation, and the social network index church were associated with change in steps/day at different times warrants consideration of the different roles of these variables in the adoption and maintenance of behavior change over a longer duration.

- Several significant associations were observed between participant characteristics and change in steps/day (e.g., BMI, education, and age, were associated with change in steps/day at different time points) and we recommend the consideration of participant characteristics in the design of future social ecological interventions to increase steps/day among sedentary women.

- Process variables, such as program dose and group cohesion were examined in the current study, but owing to the small sample size, we should interpret these results with caution and analyze program dose and group cohesion in future social ecological studies in respect to change in steps/day with a larger sample.

- Responses to the questions indicated that overall, women in the social ecological intervention group were satisfied with the study. The women suggested provision of more written materials in the future and the inclusion of a dietary component. An interesting line of inquiry for future social ecological studies may be to compare the impact of interventions that focus on changing one versus multiple health behaviors.

The following conclusions and recommendations concern the implementation of the social ecological intervention in a church setting:

- Low attrition among participants in both conditions suggests the church is an acceptable setting to conduct physical activity interventions.

- Churches and women are willing to participate in a brief physical activity intervention for free and for intrinsic rewards.
• Based on the size of the congregations participating in this study, the proportion of women in the congregation volunteering to take part in the study was at best small. These findings raise the question of the feasibility of using churches as a setting to deliver PA intervention studies if we are only reaching a small proportion of their members.

• We recommend that future studies compare participants with non participants within congregations to determine how we can tailor interventions to reach the hard to reach members of the church and whether indeed churches are a practical and economically feasible setting in which to conduct PA interventions.

• The extent to which we can influence the church environment by intervention would be an important inquiry for future research.

• We recommend examination of the addition of a spiritual component to a social ecological intervention conducted in a church setting to increase steps/day.

The final conclusions and recommendations focus on methodological considerations:

• Adherence to pedometer use was good, providing support for the promotion of pedometers as a feasible and acceptable method to monitor PA in the short term. We recommend examination of adherence to pedometer use in PA intervention studies over a longer duration.

• We recommend the addition of self-report measurements of PA at each assessment time point to corroborate change in steps/day with change in meeting guidelines for PA.

• Future studies should ensure that researchers elucidate limitations inherent to pedometer usage to participants prior to study implementation.

• We recommend further investigation with a larger sample size so that a more appropriate method of mediation analysis can be conducted to examine relationships between the social ecological variables and their independent and additive influence on change in steps/day.
LIST OF REFERENCES


332


342


APPENDIX A

Introductory Letter
My name is Amy Speed-Andrews, and I am a third year doctoral student in the school of Physical Activity and Educational Services at the Ohio State University working with Dr. Janet Buckworth. I am conducting a study to increase physical activity among women. Making small increases in physical activity can improve women’s health and reduce their risk for chronic disease, like heart disease. Church based health promotion programs have been successful in improving health behaviors, like diet, smoking cessation, mammography screening, and weight loss.

I am writing to you to invite your church to participate in this study. Your participation is entirely voluntary and the participation of women in your church will also be voluntary. To make sure that the study will not cause any harm or put any participants at risk, to participate in the study women must be between 18-69 years old, not currently engaged in an exercise program, not pregnant or intending to become pregnant within the next three months, and not planning to move away from the area within the next three months. Also, women who have any medical condition that may prevent them from being physically active will not be eligible to participate. Eligible women will be invited to attend four, 60-90 minute educational sessions. The educational sessions will provide women with the knowledge and skills to help them to be physically active. Walking will be promoted in this study and women will be provided with free step counters for them to monitor and measure the number of steps they take every day. Women will be asked to increase their daily walking during their own time, and will not be required to exercise during any educational session. The educational sessions will address walking and health issues only and will not include any doctrine or spiritual content. The four educational sessions will take place over a 10 week period and each session will be scheduled around the church and participants availability.

The only support that would be required from the church would be the use of the church facilities for recruitment and the educational sessions, but all other means of communication, training and resources will be completed at my own expense. Participation will be free for all eligible women.

I would like to begin the study at the start of September 2007. I would be very grateful for your consideration of participating in the educational program. I am very happy to meet with you in person to address any questions or concerns about the program. I thank you for your time, and I will be in contact at the beginning of the next month to discuss the project further.

Sincerely,
APPENDIX B

Recruitment Flyer
If you are interested in participating in a **FREE** 10 week educational walking program in your church
Please contact: Amy Speed-Andrews or Dr. Janet Buckworth
Call: (614) 208-5478 or E-mail: speed-andrews.1@osu.edu or buckworth.1@osu.edu

Regular walking can....
Make you feel and look good
Give you more energy
Reduce your risk for chronic disease such as heart disease

If you are:
Female
Between the age of 18 to 69
Not currently engaged in an exercise program
Then.......
APPENDIX C

Physical Activity Readiness Questionnaire
PAR-Q & YOU

Physical Activity Readiness Questionnaire - PAR-Q (revised 2002)

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES  NO

□  □  1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
□  □  2. Do you feel pain in your chest when you do physical activity?
□  □  3. In the past month, have you had chest pain when you were not doing physical activity?
□  □  4. Do you lose your balance because of dizziness or do you ever lose consciousness?
□  □  5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?
□  □  6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
□  □  7. Do you have any mobility limitations that would prohibit you from walking briskly for a minimal continuous duration of 10 minutes on most days of the week?
□  □  8. Do you know of any other reason why you should not do physical activity?

If you answered YES to one or more questions

- Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.
You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.

Find out which community programs are safe and helpful for you.

If you answered NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME ____________________________________________________________

SIGNATURE ________________

DATE _______________________

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.
APPENDIX D

Pedometer Instructions
Pedometer Instructions

- Please set your pedometer to zero
- Please close your pedometer and seal it with the sticker provided
- Attach your pedometer to the waist, midline of the thigh and over the dominant foot.
- Wear the pedometer for **FOUR CONSECUTIVE** days during waking hours and all normal activities, except bathing.
- Please do not open the pedometer
- Please bring the pedometer with you to the next meeting Tuesday September 4th @ 4:30pm
- At the bottom of this sheet please include the days and time you wore the pedometer
- If you have any problems with the pedometer please contact Amy (614) 208 5478, or e-mail: speed-andrews.1@osu.edu

Day 1: Date: _________ Time: from _________ to _________
Day 2: Date: _________ Time: from _________ to _________
Day 3: Date: _________ Time: from _________ to _________
Day 4: Date: _________ Time: from _________ to _________
APPENDIX E

Walking Log
Walking Log

Goal:

<table>
<thead>
<tr>
<th>Time</th>
<th>Day of the Week</th>
<th>Start</th>
<th>End</th>
<th>Time Worn</th>
<th># Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wednesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sunday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Time Per Week:          Total Steps Per Week:

Successes: Strategies that were successful, e.g. reminder on fridge door to wear pedometer, or strategies to achieve goal, e.g. planned walk with family after dinner, or parked car further away

Problems: Did you have any problems with the pedometer? E.g., forgot to wear it/reset/fell off:

Barriers: Did you have any problems that kept you from meeting your step goals for this week? E.g., lack of time, bad weather.
APPENDIX F

Demographic Information
We would like to know more about you. Please complete the items listed below. All information reported is confidential, and is for the sole purpose of the study in which you are participating. Thank you for your time!

Please complete the following.

Name: _________________________ (Please Print)     E-Mail: _______________________

Date of Birth: _______________ (MM/DD/YYYY)

Height: ______________ (Ft, inches)

Weight: _____________(Pounds)

Are you currently pregnant or planning to become pregnant within the next three months? (please circle one response)

Yes   No   Unsure

If NO or Unsure please indicate the date of your last menstrual period:   __________

Marital Status: Please tick one circle.

2. Widowed   O  4. Partner   O

Race/Ethnicity: Please check all that apply

1. Non Hispanic Caucasian   O  6. Pacific Islander   O
2. Non Hispanic African American   O  7. Other ____________O
3. Asian   O
4. Hispanic   O
5. Native American   O

Level of Educational Attainment: Please check the highest level of education completed.

1. High School   O  4. Post college degree   O
2. Technical College   O  5. Other   O
3. College degree   O

Please indicate your frequency of attendance at the Church in which you are attending this program. Please check one option, which best describes your attendance in the past year.

1. More than once a week   O  5. Less than monthly   O
2. Once per week   O  6. Other ________________O
3. Biweekly   O  (please specify)
4. Monthly

367
APPENDIX G

Seven Day Recall of Physical Activity Questionnaire
Seven Day Recall of Physical Activity Questionnaire

Part 1 Moderate

During the **LAST 7 DAYS** how much **TIME** did you spend doing **MODERATE** physical activity?

**MODERATE PHYSICAL ACTIVITY (planned or unplanned):**
1. Physical activity that is continuous for 10 minutes or more
2. Mildly elevates heart rate
3. Mildly elevates breathing rate
4. Activity during which you can hold a conversation

**Moderate Examples:** yard work, low impact aerobic classes, hiking or brisk walking

1. **In the Day column**, mark a “0” for no physical activity and an "X for each day you participated in **MODERATE** physical activity
2. **In the ACTIVITY columns**, list the moderate physical activities you did e.g. walking
3. **In the MINUTES column**, write in the amount of time you did MODERATE exercise that day.
4. **In the PLANNED/UNPLANNED column**, specify whether the activity is part of a regular planned, exercise program. Mark "P" is activity was planned or "U" if the activity was unplanned.

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
<th>Minutes</th>
<th>Planned/Unplanned</th>
<th>Activity</th>
<th>Minutes</th>
<th>Planned/Unplanned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Yard Work</td>
<td>20</td>
<td><em>P</em></td>
<td>Walking</td>
<td>10</td>
<td><em>U</em></td>
</tr>
<tr>
<td>Sun:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tue:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wed:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thu:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fri:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sat:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

369
Seven Day Recall of Physical Activity Questionnaire

Part 2 Vigorous

During the **LAST 7 DAYS** how much **TIME** did you spend doing **VIGOROUS** physical activity?

**VIGOROUS PHYSICAL ACTIVITY (planned or unplanned):**
1. Physical activity that is continuous for 10 minutes or more
2. Rapidly elevates heart rate
3. Activity that makes breathing rapid and deep
4. Activity during which you can NOT hold a conversation

**Vigorous Examples:** running/jogging, high impact aerobics, competitive sports, heavy manual labor.

1. **In the Day column,** mark a "0" for no physical activity and an "X for each day you participated in **VIGOROUS** physical activity
2. **In the ACTIVITY columns,** list the moderate physical activities you did e.g. walking
3. **In the MINUTES column,** write in the amount of time you did **MODERATE** exercise that day.
4. **In the PLANNED/UNPLANNED column,** specify whether the activity is part of a regular planned, exercise program. Mark "P" is activity was planned or "U" if the activity was unplanned.

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
<th>Minutes</th>
<th>Planned/Unplanned</th>
<th>Activity</th>
<th>Minutes</th>
<th>Planned/Unplanned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Running</td>
<td>15</td>
<td><strong>U</strong></td>
<td>Tennis</td>
<td>40</td>
<td><strong>P</strong></td>
</tr>
<tr>
<td>Sun:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tue:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wed:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thu:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fri:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sat:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

Self-Regulatory Self-Efficacy Questionnaire
Self-Regulatory Self-Efficacy Questionnaire

Please answer the following: How confident are you that you could walk under each of the following conditions over the next month?

For example, if you have complete confidence you could walk during bad weather, you would write 100% on the line next to the statement. If you are sure that you could not walk during bad weather, you would write 0% on the line.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I cannot do it at all
moderately certain that I can do it
certain that can do it

Confidence rating 0-100%

Over the next month I could walk

1. when tired. ___
2. during or following a personal crisis. ___
3. when feeling depressed. ___
4. when feeling anxious. ___
5. during bad weather (hot, humid, rainy, cold, snow) ___
6. if I felt pain or discomfort following walking ___
7. when on vacation. ___
8. when there are competing interests (like my favorite TV show). ___
9. when I have a lot of work to do. ___
10. when I have not reached my walking goals. ___
11. when I do not receive support from my family/friends. ___
12. when I have not been walking for a prolonged period of time. ___
13. when I have no one to walk with. ___
14. when my schedule is hectic. ___
15. when walking is not enjoyable. ___
APPENDIX I

Task Self-Efficacy for Walking Questionnaire
Task Self-Efficacy for Walking Questionnaire

Please indicate how confident you are that you can successfully carry out each of the walking activities listed below over the next month?

For example, if you have complete confidence that you can walk for 5 minutes at a moderate intensity you would write 100% on the line next to the statement. However, if you are not very confident you would write a number closer to the 0% end of the scale.

Remember: Moderate intensity walking is
1. Walking that is continuous for 10 minutes or more
2. Mildly elevates heart rate
3. Mildly elevates breathing rate
4. Walking during which you can hold a conversation

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I cannot do it at all moderately certain that I can do it certain that I can do it

Confidence rating 0-100%

Over the next month, I believe that I can walk
1. for 5 minutes at a moderate intensity without stopping
2. for 10 minutes at a moderate intensity without stopping
3. for 15 minutes at a moderate intensity without stopping
4. for 20 minutes at a moderate intensity without stopping
5. for 25 minutes at a moderate intensity without stopping
6. for 30 minutes at a moderate intensity without stopping
APPENDIX J

Self-Regulation for Walking Questionnaire
Self-Regulation for Walking Questionnaire

Please read each carefully each statement listed below, and then rate the extent to which you use each of the listed strategies.

<table>
<thead>
<tr>
<th>Never</th>
<th>All the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Plan time for walking
2. Set goals for walking (e.g. distance, time, frequency)
3. Get together with someone else for walking
4. Walk instead of drive
5. Choose a parking spot further away to walk
6. Write down on a calendar walking plans
7. Write down in a diary walking plans
8. Make alternative walking plans for bad weather (e.g. indoor walking)
APPENDIX K

Social Provisions for Physical Activity Scale
Social Provisions for Physical Activity Scale

PART I

This questionnaire asks you about support for physical activity. Physical activity is any moderate or vigorous activity, for example, walking, yard work, running, and or sports that is continuous for 10 minutes or more.

Please read each carefully each statement listed below, and then rate the extent to which you agree or disagree with each statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There are people I can count on to be physically active with me.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I do not have any friends or relatives who are physically active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. There is no one I can turn to for advice about physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. There are people who depend on me to help them be physically active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I know people who enjoy the same physical activities that I do.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Other people think of me as being physically active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I feel personally responsible for helping another person be physically active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I am part of a group of people who have the same attitudes about physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Other people do not respect my physical skills and abilities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. There is no one to take over chores for me so I have time to be physically active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I am good friends with at least one person who values physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. There is someone I can talk to about physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. There are people who recognize my skills and abilities at physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. There is no one who shares my interests about physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. No one relies on me for help with their physical activity.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Social Provisions for Physical Activity Scale

Part II

Please read each carefully each statement listed below, and then rate the extent to which you agree or disagree with each statement.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16. There is a person I can turn to for advice if I have problems with physical activity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. I have close relationships with people who make me feel good about myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. There is no one who rewards me for being physically active.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. There is no one who I feel comfortable talking about physical activity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. There are people who admire my talents and abilities regarding physical activity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. I am not close to anyone who values physical activity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. There is no one who likes the same physical activities I do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. There are people who will change their schedule to be physically active with me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. No one counts on me to be physically active with them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX L

UCLA Social Support Inventory for Physical Activity
UCLA Social Support Inventory for Physical Activity

This survey is concerned with key interpersonal relationships and their dynamics. We are interested in many aspects of the support for physical activity you give and get from these relationships. The instrument will ask you questions regarding your friends/family/partner.

1. Please choose one of the following:
   
i. **Family**: Relative (not including spouse)
   
ii. **Friend**: an individual with whom you have a close interpersonal relationships, but not including a romantic partner or family member.
   
iii. **Partner**: an individual with whom the participant has a close romantic relationship (including spouse)

   When the survey refers to “family/friend/partner” from here on, please answer concerning this and only this person whom you have indicated above.

   Please indicate this person’s initials:____

   a. **Within the past month, how often have you talked with this person either in person or on the phone?**

<table>
<thead>
<tr>
<th>Choice</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyday</td>
<td>O</td>
</tr>
<tr>
<td>Several times a week</td>
<td>O</td>
</tr>
<tr>
<td>About once a week</td>
<td>O</td>
</tr>
<tr>
<td>2 or 3 times a month</td>
<td>O</td>
</tr>
<tr>
<td>Once a month</td>
<td>O</td>
</tr>
<tr>
<td>Less than once a month</td>
<td>O</td>
</tr>
</tbody>
</table>

2a. Within the past month, how often have you desired information or advice from friends/family/partner concerning physical activity?

<table>
<thead>
<tr>
<th>Choice</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1</td>
</tr>
<tr>
<td>Rarely</td>
<td>2</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3</td>
</tr>
<tr>
<td>Often</td>
<td>4</td>
</tr>
<tr>
<td>Very often</td>
<td>5</td>
</tr>
</tbody>
</table>

b. Within the past month, how often did your family/friend/partner provide information or advice about physical activity (whether you wanted it or not)?

<table>
<thead>
<tr>
<th>Choice</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1</td>
</tr>
<tr>
<td>Rarely</td>
<td>2</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3</td>
</tr>
<tr>
<td>Often</td>
<td>4</td>
</tr>
<tr>
<td>Very often</td>
<td>5</td>
</tr>
</tbody>
</table>
c. Within the past month how often have you provided information and advice about physical activity to your family/friend/partner?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

3a. At certain times, we want minor assistance to enable us to be physically active, like a ride to a physical activity facility, company, or a child-minder. Within the past month, how often have you desired assistance for physical activity from friends/family/partner?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

b. Within the past month, how often did your family/friend/partner provide minor assistance for physical activity? (whether you wanted it or not)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

c. Within the past month, how often have you given minor assistance for physical activity to your family/friend/partner?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

4a. At certain times, we want encouragement and reassurance to help us be physically active. For example, sometimes we want to be encouraged to be active when we are tired or busy. Within the past month, how often have you desired this from friends/family/partner?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

b. Within the past month, how often did your family/friend/partner convey encouragement and reassurance for physical activity (whether you wanted it or not)?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>

c. Within the past month, how often have you given encouragement and reassurance for physical activity to your family/friend/partner?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>rarely</td>
<td>sometimes</td>
<td>often</td>
<td>very often</td>
</tr>
</tbody>
</table>
5. Whenever the survey refers to “church” please answer with regard to church members or attenders of the church in which you are participating in this walking program. Please do not choose the same person that you selected as a friend, family member or partner.

   a. Within the past month, how often have you talked with members of your church either in person or on the phone?

   Everyday    O
   Several times a week    O
   About once a week    O
   2 or 3 times a month    O
   Once a month    O
   Less than once a month    O

6a. Within the past month, how often have you desired information or advice from your church concerning physical activity?

   1  2  3  4  5
   Never rarely sometimes often very often

   b. Within the past month, how often did your church provide information or advice about physical activity (whether you wanted it or not)?

   1  2  3  4  5
   Never rarely sometimes often very often

   c. Within the past month how often have you provided information and advice about physical activity to your church?

   1  2  3  4  5
   Never rarely sometimes often very often

7a. At certain times, we want minor assistance to enable us to be physically active, like a ride to a physical activity facility, company, or a child-minder. Within the past month, how often have you desired assistance for physical activity from your church?

   1  2  3  4  5
   Never rarely sometimes often very often

   b. Within the past month, how often did your church provide minor assistance for physical activity? (whether you wanted it or not)

   1  2  3  4  5
   Never rarely sometimes often very often
c. Within the past month how often have you given minor assistance for physical activity to your church?

1  2  3  4  5
Never rarely sometimes often very often

8a. At certain times, we want encouragement and reassurance to help us be physically active. For example, sometimes we want to be encouraged to be active when we are tired or busy. Within the past month, how often have you desired this from your church?

1  2  3  4  5
Never rarely sometimes often very often

b. Within the past month, how often did your church convey encouragement and reassurance for physical activity (whether you wanted it or not)?

1  2  3  4  5
Never rarely sometimes often very often

c. Within the past month, how often have you given encouragement and reassurance for physical activity to your church?

1  2  3  4  5
Never rarely sometimes often very often
APPENDIX M

Walking Group Environment Questionnaire
Walking Group Environment Questionnaire 1

Please read carefully each statement listed below, and then rate on a scale from 1 to 9, the extent to which you agree or disagree with each statement.

1 = Very Strongly Disagree   5 = neither Agree or Disagree   9 = Very Strongly Agree

1. I like the amount of walking I get with this group.
2. This group provides me with a good opportunity to improve in areas of fitness I consider important
3. I am happy with the intensity of walking in this program
4. I like the activities performed with this group
5. This walking group provides me with a good opportunity to improve my personal health
6. The walking group is an important social unit for me
7. I enjoy my social interactions within this walking group
8. I like meeting the people who come to this walking group
9. If the program was to end, I would miss my contact with the other participants
10. In terms of the social experiences in my life, this walking group is very important
11. The social interactions I have in this walking group are important to me
12. Our group is united in its beliefs about the benefits of walking
13. Members of our walking group enjoy sharing information

386
Walking Group Environment Questionnaire II

Please read carefully each statement listed below, and then rate on a scale from 1 to 9, the extent to which you agree or disagree with each statement.

1 = Very Strongly Disagree    5 = neither Agree or Disagree    9 = Very Strongly Agree

15. We help each other develop new skills in our walking group.

16. We encourage each other in order to get the most out of the program.

17. Members of our walking group often socialize during walking.

18. Members of our walking group would likely spend time together if the program were to end.

19. Members of our walking group sometimes socialize together outside of activity time.

20. We spend time socializing with each other before and after our activity sessions.

21. I know people who enjoy the same physical activities that I do.

Thank you for your time and participation!
APPENDIX N

Eligibility Screening Telephone Script
Eligibility Screening Telephone Script

A church based social ecological approach to increase walking among sedentary women
Janet Buckworth, PI, Amy Speed-Andrews, Co-I
Pre-Screening Form / Telephone Script
(Comments and instructions are in bold.)

Hello, this is Amy Speed-Andrews, and I’m a PhD student from the College of Education and Human Ecology at The Ohio State University. I’m calling about a research study for women that you indicated you may be interested in participating in. I was wondering if this is a good time to talk about the study.

If NO:
Is there a good time I may call you back? (If YES, Arrange time to call again. If she is not interest in the study, thank her for her time.)

If YES:
Thank you. I would like to tell you about the study and get some information from you so that we can find out if you can take part in the study. These questions will take about 10 minutes. I won’t be able to determine your eligibility until we’ve gone through all of the questions. One or more of your answers may mean that you may not be able to be in the study. Your answers will be kept confidential and will be used for research purposes only. You can refuse to answer any question or you may stop me at any time. Is this all right with you?*

If YES, the interview will continue. If during the interview the individual refuses to answer a particular question, “REFUSED” will be written beside the question.

If NO, the interviewer will ask the reason(s) and thank her for her time.

(Reason for refusal:________________________________________________________________________)

Before I ask you some questions, I am going to take a few moments to tell you about the study.

To enter this study, you must be:

• 18-69 years old
• Sedentary defined as participation in less than 30 minutes per day of moderate intensity physical activity. Physical activity can be accumulated over the course of the day or continuous. Moderate intensity physical activity is any activity that mildly elevates your heart and breathing rate.
• Have a body mass index (BMI) between 18.5 and 34.9 kg/m\(^2\) (inclusive). BMI is a calculated from weight and height measurements.
• Not be currently pregnant of planning to become pregnant within the next 3 months
• Willing to participate in a wellness program that lasts for 10 weeks and involves attending one informational session, four educational sessions and one follow up session. Each session will last approximately 60 to 90 minutes.
• Able and willing to wear a step counter, which is a small mechanical devise to count your steps, and record your daily steps for 10 weeks during the intervention
• Have no physical reason that would prevent you from walking regularly, such as heart disease or chest pain.

389
This study is a physical activity intervention study where the major objective is to increase the number of steps you take each day. For 10 weeks, you will be asked to wear a step counter and attend four educational sessions that will help you to increase the number of steps you take each day.

In this study, you will be asked to attend four educational sessions that will provide you with information and support for increasing the number of steps you take each day. Each educational session will be conducted within your church. During this study, you will be asked to record the number of steps you take each day. You will not be asked to exercise or walk during any educational session, but you will be encouraged to walk in your own time. Women who enroll in the study will be instructed to gradually increase their steps per day to reach a personal goal that we will set together at the start of the study.

There will be approximately 88 women participating in this research study.

Do you have any questions? *(Any questions or concerns will be answered.)*

1. Now, I would like to ask you a few questions to help me be able to contact you about this research study.

2. Please spell your full legal name?

<table>
<thead>
<tr>
<th>First</th>
<th>Middle</th>
<th>Last</th>
<th>Maiden</th>
</tr>
</thead>
</table>

3. Is there a name you would prefer to be called? ___Yes ___No

*If No go to Number 4*

What do you like to be called? ________________

Preferred Name

4. How old are you? ________________

5. What is your birth date? ________________

   Month   Day   Year

6. Are you currently pregnant or planning to become pregnant within the next three months?

   ___Yes   ___No   ___Unsure  *If no, the person is ineligible*

*(If no or unsure)* When was your last menstrual period? ________________

8. How tall are you? _____ Ft. _____ in.  {Calculate the BMI:___________}

9. Have you ever had or do you currently have any of the following medical conditions?
   _____ Blood Clots  _____ Stroke  _____ Heartbeat irregularities
   _____ High Blood Pressure  _____ Diabetes(type I or type II)  _____ Chest pain
   _____ Mobility limitations (cannot walk for a continuous 10 minutes).

10. Are you planning on moving out of the area in the next 3 months?
    _____ Yes  _____ No  _____ Do not know  **If no, the person is ineligible.**

11. Do you currently take part in any physical activity?
    _____ Yes  _____ No

    If yes, how often (days per week) ________ Times per day ________
    For how long? (minutes) _____ What type(s) of activity?________________
    ________________________________

    Does this physical activity mildly elevate your heart rate and breathing?
    _____ Yes  _____ No

---

**Notes and Eligibility**

That was my last question. I want to thank you for your time and interest in the study. Do you have any additional questions for me?
The woman’s responses will be reviewed and her eligibility to participate in the study will be determined.

IF ELIGIBLE: Based upon your responses you may be eligible to participate in the study. I would like to invite you to attend an informational session at your church for you to talk with our study staff. Is it possible for you to come in on _____________________________. Yes _______ No _______

IF INELIGIBLE: I am sorry Ms. ________, but based upon some of your answers you may not be eligible for the study. However, I would recommend that if you would like to begin an exercise program to talk with your doctor about beginning an exercise program. Once again, thank you for your interest in this study.
APPENDIX O

Intervention Plan
Week 0: Informational Session (60 minutes)

Objectives

- **Introduction**
  - Outline of the study’s objectives
    - Increase physical activity through walking
    - Increase support environment for physical activity
  - Explanation of the program requirements (study time line, dates and sessions that participants will be asked to attend), eligibility criteria, and confidentiality

- **Administration of consent forms**
  - Opportunity for questions

- **Administration of screening instruments and verification of eligibility**
  - Pretest assessments.
  - Introductions
  - Pedometer distribution and instructions
  - Opportunity for questions

- **Brief outline of next meeting, date and topic**

---

**Lesson 1: Personal Support for PA (Self-Efficacy & Self-Regulation) – 60 minutes**

The investigator sought to enhance participant’s self-efficacy for walking through verbal persuasion, participant vicarious, and mastery experience, problem solving strategies for overcoming barriers to physical activity and instructing participants how to monitor physiological cues. Self-regulation for walking was targeted through scheduling time for walking, realistic goal setting, and monitoring walking by recording steps/day.

- **Introduction**
  - Attendance
  - Opportunity for questions
  - Outline of the studies objectives
    - Benefits of physical activity
    - What is physical activity, and how much physical activity do we need?
    - Types of physical activity (emphasis on walking)
    - Monitoring intensity of walking (physiological cues)
    - Scheduling time for walking (Self-regulation)
Goal setting (Self-regulation)
- Homework assignment (vicarious and mastery experience).

- Monitoring walking intensity
  - The talk test will be described

- Overcoming barriers to walking
  - Self-regulation self-efficacy questionnaire will be reviewed
  - Identify ways to overcome barriers

- Scheduling time for physical activity
  - Identify free times to walk

- Goal setting
  - Select short term goals to increase steps/day
  - Select long term goals to increase steps/day

- Walking log instruction
  - Walking log distribution and instruction

- Pedometer instruction

- Homework assignment
  - Participants were asked to identify another adult who is physically active.
  - Find out how often the person is active, what types of activities they perform, and how they schedule their physical activities (e.g. set aside 30 minutes for physical activity, or three 10 minute bouts of activity).
  - Participants were asked to record their findings

- Closing
  - Brief outline of next meeting, date and topic

Lesson 2: Enlisting and Providing Support for Physical Activity with Friends/Family/Partner

The investigator sought to enhance social-support for walking by providing participants with the skills to request and provide informational, emotional and tangible support walking with Friends/Family/partners.

- Introduction
  - Attendance
  - Opportunity for questions
  - Outline of the lesson and the lessons objectives.
What are the different types of support that would help us to walk regularly?
What are the different types of support that we could provide to others to walk regularly?
- Entering into contracts with friends/family/partners
- Scheduling walking with friends/family/partners
- Goal setting for walking with friends/family/partners

Homework assignments

- Types of social support
  - Informational support
  - Tangible support
  - Emotional support
  - Identify ways to provide support
  - Identify support friends/family/partners can provide
  - Support contracts

- Scheduling Time for Walking with Friends/Family/Partner
  - Select times to walk with friends/family/

- Goal Setting with Friends/Family/Partner
  - Select short and long term walking goals to be achieved with friend/family/partner

- Homework assignment
  - Participants were asked to select a friend/family/partner and make arrangements to walk together at least once prior to the next lesson.
  - Participants were asked to make arrangements to meet with their friends/family/partner and or “exercise buddy” socially, for a meal, a movie, coffee, at least once prior to the next lesson

- Closing
  - Brief outline of next meeting, date and topic

Lesson 3: Being Active with a Group (Group Cohesion) – 60 minutes

The investigator sought to enhance group cohesion, using a protocol delineated by Spink & Carron (1994). Carron & Spink (1993) presented a conceptual model in which group structure, group environment and group norms are the two main inputs, and cohesiveness is the output. Under group
structure, the authors purported that as group norms and expectations develop within a group, the group structure becomes more stable, which ultimately leads to greater cohesiveness. Group environment has one factor, distinctiveness. Group norms were described as collective goal setting. When individuals can readily identify themselves as a group and distinguish themselves from non-group members, the greater the perception of cohesiveness. Under group process, two factors were included, which were individual sacrifices (defined as reciprocal support and interaction) and community. The latter factor was emphasized through group discussion, group problem solving and group goal setting.

- **Introduction**
  - Attendance
  - Opportunity for questions
  - Outline of study objectives
    - Identify a group name (Group distinctiveness)
    - Identify opportunities to be active as a group (Group-Task)
    - Identify opportunities to be social as a group (Group-Social)
    - Providing support to one another as a group (Group norms, and Group Process)
    - Collective goal setting to increase step/day as a group (Group norms)

- **Identify a group name**
  - Participants were asked to brainstorm together to come up with a group name
  - Participants were asked to think of ways to identify themselves as a group and to encourage others to join their group

- **Opportunities to be active as a group**
  - Identify times they could walk as a group

- **Opportunities to be social as a group**
  - Identify times to be social as a group

- **Providing support to one another as a group**
  - Identify ways to provide support to group members

- **Collective goal setting to increase step/day as a group**
  - Goal for how many steps they would walk as a group per week
  - Goal to walk across the State (by adding all steps)
Goal to take part in a walking event as a group

Homework Assignment

- Women were asked to arrange a time to meet with one another to walk as a group or in sub-groups
- Women were asked to arrange a time to meet with one another socially as a group or as a sub-group.

Closing

- Brief outline of next meeting, date and topic

Lesson 4: Enhancing Church Support for an Active Lifestyle & Posttest (Organization Support) 90-minutes

The investigator encouraged participants to think of ways they could use existing church facilities and resources to enhance support for physical activity, increase visibility of the walking group, and find ways to encourage the rest of the congregation to adopt a healthy lifestyle through increased physical activity.

Introduction

- Attendance
- Opportunity for questions
- Outline of the lesson and the lessons objectives
  - Identify existing church resources that can be used to increase physical activity
  - Identify ways to increase visibility of the walking group
  - Identify ways to encourage the church to be “physically active”
  - Contingency plan to continue walking
  - Posttest Administration

Identify existing church resources

- Identify possible church resources that could be used for walking

Increase visibility of the walking group

- Identify ways to promote walking group

Increasing walking in the congregation

- Identify ways to incorporate walking into church events and activities

Contingency plan

- Identify ways to maintain walking
Posttest Measures
  ○ Posttest measures instruction and distribution

Closing
  ○ Brief outline of next meeting, date and topic

Follow Up – 60 minutes

Introduction
  ○ Attendance
  ○ Follow up measures instruction and distribution
  ○ Opportunity for questions
  ○ Social time
APPENDIX P

Participant Satisfaction: Process Evaluation
Participant Satisfaction: Process Evaluation

I would like to take this time to thank you for your participation in this physical activity program and to congratulate you on completing! In order to gather feedback about the program to lead to future improvements, please answer the following questions with as much detail as possible.

1. Were you satisfied with the program content? Please comment on content of program sessions:

2. Please comment on whether you were satisfied with the amount of support you received throughout the program:

3. Please comment on whether you were satisfied with the pedometer as a method to monitor walking?

4. Were there any aspects of the program you think should be added or dropped?
APPENDIX Q

Data Coding
<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>Nominal</td>
<td>RACE</td>
</tr>
<tr>
<td>1 = Non-Hispanic Caucasian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = Non Hispanic African American</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = Asian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = Hispanic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = Native American</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 = Pacific Islander</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 = Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Nominal</td>
<td>EDU</td>
</tr>
<tr>
<td>0 = Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = High school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = Technical college</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = College degree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = Post college</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td>Nominal</td>
<td>MARST</td>
</tr>
<tr>
<td>1 = Single</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = Widowed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = Married</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = Partner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = Divorced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Church Attendance</td>
<td>Nominal</td>
<td>CHATT</td>
</tr>
<tr>
<td>1 = Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = Less than monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = Bi-weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 = More than weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>Nominal</td>
<td>GROUP</td>
</tr>
<tr>
<td>0 = SM comparison group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = SE intervention group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attendance</td>
<td>Nominal</td>
<td>ATT</td>
</tr>
<tr>
<td>1 = $ \leq $ 50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = 75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Interval</td>
<td>AGE</td>
</tr>
<tr>
<td>BMI</td>
<td>Interval</td>
<td>BMI</td>
</tr>
<tr>
<td>Variable</td>
<td>Level</td>
<td>Code</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>7-DRE-Q Moderate Minutes Planned PA</td>
<td>Interval</td>
<td>MMINPPA</td>
</tr>
<tr>
<td>7-DRE-Q Moderate Minutes Unplanned PA</td>
<td>Interval</td>
<td>MMINUPA</td>
</tr>
<tr>
<td>7-DRE-Q Vigorous Minutes Planned PA</td>
<td>Interval</td>
<td>VMINPPA</td>
</tr>
<tr>
<td>7-DRE-Q Vigorous Minutes Planned PA</td>
<td>Interval</td>
<td>VMINUPA</td>
</tr>
<tr>
<td>Walking Baseline</td>
<td>Interval</td>
<td>STEPPRE</td>
</tr>
<tr>
<td>Walking Posttest</td>
<td>Interval</td>
<td>STEPPPOST</td>
</tr>
<tr>
<td>Walking Follow Up</td>
<td>Interval</td>
<td>STEPFU</td>
</tr>
<tr>
<td>Self-Regulatory Self-Efficacy Pretest</td>
<td>Interval</td>
<td>SRSEPRE</td>
</tr>
<tr>
<td>Self-Regulatory Self-Efficacy Posttest</td>
<td>Interval</td>
<td>SRSEPOST</td>
</tr>
<tr>
<td>Self-Regulatory Self-Efficacy Follow up</td>
<td>Interval</td>
<td>SRSEFU</td>
</tr>
<tr>
<td>Task Self-Efficacy Pretest</td>
<td>Interval</td>
<td>TSKSEPRE</td>
</tr>
<tr>
<td>Task Self-Efficacy Posttest</td>
<td>Interval</td>
<td>TSKSEPOST</td>
</tr>
<tr>
<td>Task Self-Efficacy Follow up</td>
<td>Interval</td>
<td>TSKSEFU</td>
</tr>
<tr>
<td>Self-Regulatory for Walking Pretest</td>
<td>Interval</td>
<td>SRWLKPRE</td>
</tr>
<tr>
<td>Self-Regulatory for Walking Posttest</td>
<td>Interval</td>
<td>SRWLKPOST</td>
</tr>
<tr>
<td>Self-Regulatory for Walking Follow up</td>
<td>Interval</td>
<td>SRWLKFU</td>
</tr>
<tr>
<td>Social Support for Physical Activity Pretest</td>
<td>Interval</td>
<td>SSPAPRE</td>
</tr>
<tr>
<td>Social Support for Physical Activity Posttest</td>
<td>Interval</td>
<td>SSPAPOST</td>
</tr>
<tr>
<td>Social Support for Physical Activity Follow Up</td>
<td>Interval</td>
<td>SSPAFU</td>
</tr>
<tr>
<td>Social Network Friend/Family/Partner Pretest</td>
<td>Interval</td>
<td>SNFFP PRE</td>
</tr>
<tr>
<td>Social Network Friend/Family/Partner Posttest</td>
<td>Interval</td>
<td>SNFFPOST</td>
</tr>
<tr>
<td>Social Network Friend/Family/Partner Follow up</td>
<td>Interval</td>
<td>SNFFFU</td>
</tr>
<tr>
<td>Social Network Church Pretest</td>
<td>Interval</td>
<td>SNCHPRE</td>
</tr>
<tr>
<td>Social Network Church Posttest</td>
<td>Interval</td>
<td>SNCHPOST</td>
</tr>
<tr>
<td>Social Network Church Follow up</td>
<td>Interval</td>
<td>SNCHFU</td>
</tr>
<tr>
<td>Group Cohesion</td>
<td>Interval</td>
<td>GRPCSN</td>
</tr>
</tbody>
</table>
APPENDIX R

Subject Mortality
### Table 4.6: Comparison of dependent variables at pretest, completers versus non-completers (N = 44)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steps/day</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>91543.33</td>
<td>91543.33</td>
<td>0.047</td>
</tr>
<tr>
<td>Within</td>
<td>82459195.79</td>
<td>1963314.19</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Regulatory Self-Efficacy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>300.49</td>
<td>300.49</td>
<td>0.735</td>
</tr>
<tr>
<td>Within</td>
<td>17161.18</td>
<td>408.59</td>
<td></td>
</tr>
<tr>
<td><strong>Task Self-Efficacy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.56</td>
<td>1.56</td>
<td>0.005</td>
</tr>
<tr>
<td>Within</td>
<td>12349.11</td>
<td>294.03</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Regulation for Walking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.28</td>
<td>0.28</td>
<td>0.613</td>
</tr>
<tr>
<td>Within</td>
<td>19.23</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td><strong>Social Support for Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.002</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td>Within</td>
<td>26.04</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td><strong>Social Network Friends/Family/Partner</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Within</td>
<td>28.71</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td><strong>Social Network Church</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.25</td>
<td>0.25</td>
<td>0.545</td>
</tr>
<tr>
<td>Within</td>
<td>18.904</td>
<td>0.450</td>
<td></td>
</tr>
</tbody>
</table>

*Note.  * = p < .05
APPENDIX S

Differential Mortality
<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>2234307</td>
<td>2234307</td>
<td>0.972</td>
</tr>
<tr>
<td>Within</td>
<td>9192234.5</td>
<td>2298058.63</td>
<td></td>
</tr>
<tr>
<td>Self-Regulatory Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>104.02</td>
<td>104.02</td>
<td>0.259</td>
</tr>
<tr>
<td>Within</td>
<td>1604.02</td>
<td>401.01</td>
<td></td>
</tr>
<tr>
<td>Task Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>74.95</td>
<td>74.95</td>
<td>0.225</td>
</tr>
<tr>
<td>Within</td>
<td>1334.56</td>
<td>333.64</td>
<td></td>
</tr>
<tr>
<td>Self-Regulation for Walking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>2.083</td>
<td>2.083</td>
<td>7.018</td>
</tr>
<tr>
<td>Within</td>
<td>1.188</td>
<td>.297</td>
<td></td>
</tr>
<tr>
<td>Social Support for Physical Activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.754</td>
<td>0.75</td>
<td>0.777</td>
</tr>
<tr>
<td>Within</td>
<td>3.88</td>
<td>0.971</td>
<td></td>
</tr>
<tr>
<td>Social Network Friends/Family/Partner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.40</td>
<td>1.40</td>
<td>1.232</td>
</tr>
<tr>
<td>Within</td>
<td>4.55</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>Social Network Church</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>0.14</td>
<td>0.14</td>
<td>0.646</td>
</tr>
<tr>
<td>Within</td>
<td>0.88</td>
<td>0.22</td>
<td></td>
</tr>
</tbody>
</table>

Note. * = p < .05

Table 4.7: Comparison of dependent variables at pretest by group, non completers (N = 6).
APPENDIX T

Descriptive statistics for steps/day by group
<table>
<thead>
<tr>
<th></th>
<th>SE intervention ( n = 20 )</th>
<th>SM comparison ( n = 18 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
</tr>
<tr>
<td>Baseline</td>
<td>5943</td>
<td>1531.75</td>
</tr>
<tr>
<td>Week 1</td>
<td>7651</td>
<td>2824.50</td>
</tr>
<tr>
<td>Week 2</td>
<td>7695</td>
<td>2407.73</td>
</tr>
<tr>
<td>Week 3</td>
<td>8509</td>
<td>2766.18</td>
</tr>
<tr>
<td>Week 4</td>
<td>8265</td>
<td>2716.11</td>
</tr>
<tr>
<td>Week 5</td>
<td>8449</td>
<td>3072.54</td>
</tr>
<tr>
<td>Week 6</td>
<td>8728</td>
<td>2796.94</td>
</tr>
<tr>
<td>Week 7</td>
<td>8325</td>
<td>2549.92</td>
</tr>
<tr>
<td>Week 8</td>
<td>8616</td>
<td>2695.13</td>
</tr>
<tr>
<td>Week 9</td>
<td>8708</td>
<td>2318.90</td>
</tr>
<tr>
<td>Week 10</td>
<td>8808</td>
<td>2388.36</td>
</tr>
</tbody>
</table>

*Note.* SE = social ecological intervention group, SM = self-monitoring only comparison group, \( M \) = mean, \( SD \) = standard deviation. Steps are rounded up to nearest whole number.

Table 4.11: Descriptive statistics for steps/day by group, social ecological intervention group \( n = 20 \), self-monitoring only comparison group \( n = 18 \)

![Change in steps/day over 10 weeks](image)

*Note.* 0 = baseline

*Figure 4.3:* Descriptive statistics for change per week in steps/day, social ecological intervention group \( n = 20 \), self-monitoring only comparison group \( n = 18 \).
APPENDIX U

Descriptive statistics for days the pedometer was worn by group
<table>
<thead>
<tr>
<th>Week</th>
<th>SE intervention (n = 20)</th>
<th>SM comparison (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Week 1</td>
<td>5.90</td>
<td>0.85</td>
</tr>
<tr>
<td>Week 2</td>
<td>6.40</td>
<td>0.88</td>
</tr>
<tr>
<td>Week 3</td>
<td>6.38</td>
<td>0.84</td>
</tr>
<tr>
<td>Week 4</td>
<td>6.35</td>
<td>0.88</td>
</tr>
<tr>
<td>Week 5</td>
<td>6.33</td>
<td>0.86</td>
</tr>
<tr>
<td>Week 6</td>
<td>6.55</td>
<td>0.99</td>
</tr>
<tr>
<td>Week 7</td>
<td>6.35</td>
<td>1.04</td>
</tr>
<tr>
<td>Week 8</td>
<td>6.25</td>
<td>0.91</td>
</tr>
<tr>
<td>Week 9</td>
<td>6.05</td>
<td>1.27</td>
</tr>
<tr>
<td>Week 10</td>
<td>6.15</td>
<td>1.18</td>
</tr>
<tr>
<td>Overall</td>
<td>6.27</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Note. SE = social ecological intervention group, SM = self-monitoring only comparison group, M = mean, SD = standard deviation.

Table 4.12: Descriptive statistics for days the pedometer was worn by group, social ecological intervention group (n = 20), self-monitoring only comparison group (n = 18).