USING ONLINE SOCIAL NETWORK TECHNOLOGY TO INCREASE SOCIAL
SUPPORT FOR PHYSICAL ACTIVITY: THE INTERNET SUPPORT FOR HEALTHY
ASSOCIATIONS PROMOTING EXERCISE (INSHAPE) STUDY

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ABSTRACT

DAVID CAVALLO: Using Online Social Network Technology To Increase Social Support
For Physical Activity: The Internet Support For Healthy Associations Promoting Exercise
(INSHAPE) Study
(Under the direction of Alice Ammerman)

Online social networks, such as Facebook, have extensive reach and possess
technology that could foster social support, an established determinant of physical
activity. The purpose of this study was to design and test the efficacy and feasibility of a
physical activity social support intervention primarily delivered through Facebook.

In aim 1 of this study, formative interviews (n=15) were conducted with female
undergraduates to inform the online social network intervention design and explore
behavior and perceptions related to the exchange of social support for physical activity
through Facebook. In aim 2, we conducted a randomized controlled intervention trial
comparing two groups of female undergraduates; education controls receiving access to
an exercise focused website (n=67) and intervention participants receiving access to the
same website with physical activity self-monitoring and enrollment in a physical activity
themed Facebook group (n=67). Physical activity, perceived social support for physical
activity, and psychosocial mediators were assessed using previously validated
questionnaires. Facebook interactions were recorded during the intervention. In Aim 3,
we conducted interviews (n=9) and a survey (n=120) with intervention participants to
assess the acceptability of the intervention and participants' perceptions of physical
activity social support exchanged through Facebook.

Results from the trial revealed no statistically significant differences between
groups over time on perceived social support or physical activity. More than half (55%)

of intervention participants indicated that they would recommend the program to friends. A path analysis examining the relationships between social support, psychosocial mediators, and physical activity among all participants found a significant indirect effect for companionship social support on physical activity mediated by intention (.09, p=.02). The majority of Facebook social support interactions collected during the intervention were classified as companionship. Qualitative analysis of formative and process interviews found that participants who received social support for physical activity through Facebook thought it was valuable.

       The results from this study indicate that participants will join and exchange important types of social support for physical activity using online social networks. More research is needed to determine if online social network interventions can effectively increase social support or physical activity.

To Olivia, my wonderful little girl

ACKNOWLEDGMENTS

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CHAPTER I

INTRODUCTION

I.A. OVERVIEW

The health benefits associated with adequate physical activity include improved mental health, reductions in cardiovascular disease, and decreased risk of certain cancers (Warburton, Nicol, & Bredin, 2006). Although these benefits are well known, the majority of Americans do not meet physical activity recommendations (CDC, 2007; Eaton, et al., 2008). This pattern of inactivity is evident as well in female college students (Douglas, et al., 1997).

Given the significant size of this population, increasing their physical activity could yield important public health benefits (Davis, 2008). Despite this, few randomized intervention studies have addressed methods to increase physical activity in this population.

Online social networks, such as Facebook, command significant time and attention from young adult females (Lenhart, 2010). As a technological platform, they include tools designed to foster interpersonal communication, the formation of social groups, and the ability to share personal goals and information. These tools lend themselves to enhancing social support, which is an established determinant of physical activity (Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2007). Establishing the efficacy of a social support intervention using this technology would provide a highly disseminative tool to address an important public health problem among young adult females.

The purpose of this study is to assess the feasibility and efficacy of a physical activity social support intervention that uses a popular, commercially available online social network service.

I.B. Specific Aims

Aim 1: to inform the design of a physical activity social support intervention delivered primarily through an online social network by conducting structured interviews with female undergraduate students.

Aim 2: to determine whether participation in an online social network intervention plus online self-monitoring increases perceived social support for physical activity vs. an education control group by conducting a randomized controlled trial with 100 female undergraduate students.

Aim 3: to assess participants' use of the online social network intervention and their perceptions of the exchange of social support for physical activity through Facebook.

CHAPTER II

CONCEPTUAL FRAMEWORK

II.A. Introduction

This intervention is guided by social network theory and individual behavior

change theory. Intervention components are designed to enhance social network

characteristics (e.g., increasing the size of a participant's network) and individual level

psychosocial determinants of physical activity behavior. Online social networks were

chosen as the primary delivery platform for this intervention because they possess

technological features that could facilitate both network and individual level change.

II.B. Theory of Social Networks and Social Support

Social networks and social support are distinct concepts that are often conflated

(Smith & Christakis, 2008). Social networks can be thought of as the delivery system for

a number of different psychosocial constructs that can affect health, only one of which is

social support. Health behavior change targets within social network theory include both

aspects of the social network itself as well as the psychosocial constructs that can be

influenced through the network.

II.C. Social Networks

Social networks are defined by the characteristics of their structure and network

ties. Structure characteristics most relevant to this study include "size (number of

network members), density (extent to which the members are connected to each other),

and homogeneity (the extent to which individuals are similar to each other in a network)"

(Berkman, Glass, Brissette, & Seeman, 2000, *p* 847). Network size and density are both

positively associated with the provision of support. There are competing theoretical

approaches to homogeneity. Similarity in the network can foster greater emotional intimacy but dissimilar networks may increase the likelihood of finding necessary services (Wasserman & Galaskiewicz, 1994). Characteristics of a tie, which can be thought of as a relationship between two individuals, include contact frequency, the heterogeneity of different types of support exchanged in the relationship (multiplexity), and reciprocity of support in the relationship (Berkman, et al., 2000). In a health context, attributes of network ties that increase their strength generally lead to greater support, especially in the domain of emotional and appraisal support. Tie strength, however, is less important in the provision of informational support, which benefits from diversity of contact. Social networks can deliver several health promoting mechanisms including social support and social influence.

II.D. Social Support

A common conceptualization of social support in the health domain includes four types: instrumental, informational, appraisal, and emotional. Instrumental support consists of the provision of tangible aid, such as financial assistance and transportation: emotional support consists of the provision of caring, love and sympathy; informational support is the exchange of relevant advice or information; and appraisal support is the provision of feedback important to making decisions (Berkman, et al., 2000). Changes in health as a result of social support are theorized to occur through buffering and direct effects (Uchino, 2006). Buffering effects of support are the result of a reduction in the stress experienced during a crisis; whereas improvements that result directly from the type of support received (e.g., increased physical activity as a result of information provided on where to exercise) are considered direct effects. The effects of social support in this intervention will be considered from the direct effects perspective.

II.E. The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) has been widely used in studies to predict physical activity across a variety of populations (Ajzen, 1991; Blue, 1995; Downs & Hausenblas, 2005; Hagger, Chatzisarantis, & Biddle, 2002). In the TPB, behavioral intention, which is an indication of a person's readiness to perform the behavior, is assumed to be the most important and proximal determinant of behavior. Perceived behavioral control, or one's belief in their control over performing the behavior, is predicted to have both a direct effect on behavior that is not completely volitional and an indirect effect through intention. The other constructs in the model, attitude and subjective norm, are thought to influence behavior only through intention. Attitude consists of the affective and instrumental beliefs individuals hold about the behavior and subjective norms are beliefs individuals have about what important others' think of their performing the behavior.

Subjective norm has exhibited a weak or non-significant relationship with physical activity intention when controlling for perceived behavioral control, leading some authors to suggest that this construct be dropped from the TPB in the physical activity domain (Courneya & McAuley, 1995; Courneya, Plotnikoff, Hotz, & Birkett, 2000; Rhodes & Nigg, 2011). In part to find a psychosocial construct that could augment or replace subjective norm in the TPB in the physical activity domain, several studies have examined the relationship between social support, TPB constructs, and physical activity. These studies have found support for the prediction of intention and several types of physical activity behavior by social support as well as a greater ability to predict physical activity than subjective norm (Courneya, Plotnikoff, Hotz, & Birkett, 2000; Okun, et al., 2003; Rhodes, Jones, & Courneya, 2002; Saunders, Motl, Dowda, Dishman, & Pate, 2004). There is also some evidence that the TPB is improved by replacing the injunctive

concept of subjective norm in the TPB with a more descriptive concept that captures the influence of physical activity that others are performing.(Okun, Karoly, & Lutz, 2002)

II.F. Explanation of Conceptual Model

Figure 2.1 depicts the relationship between intervention components, theoretical constructs and intervention effects in the proposed study design. In this model, enrollment in the online social network provides participants with an enhanced social network. Characteristics of this network and its ties provide opportunities for changes at the psychosocial level through social support and social influence.

Figure 2.1. Conceptual model

Primary Intervention Components	Theoretical Constructs	Causal Path

Online social network

→ Network characteristics– size, density, homogeneity

→ Tie characteristics – frequency of contact, reciprocity, muliplexity

Social network

Which provides opportunities for
⬇

Posts, links

Goal and activity sharing and reinforcement through wall posts, email

Support messages through wall posts, email, chat

Event postings

Social Support

Social Influence

→ Targeting Psychosocial Constructs

Leading to
⬇

Increased physical activity social support

Leading to
⬇

Increased physical activity

CHAPTER III

LITERATURE REVIEW

III.A. Health Benefits of Physical Activity

Achieving recommended levels of physical activity is a public health priority
(Healthy People 2010). The relationship between inadequate physical activity and all
cause mortality is well established. Individuals who engage in physical activity
significantly reduce their risk of premature death and this relationship behaves in a dose
responsive manner (Blair, et al., 1989). It follows that specific disease risk is also
reduced by physical activity. Risk of cardiovascular disease in particular declines as a
result of physical activity, both in primary and secondary prevention (Jolliffe, et al., 2000;
Myers, et al., 2004). Physical activity has also demonstrated effectiveness in the
management and prevention of Type II diabetes (Gregg, Gerzoff, Caspersen,
Williamson, & Narayan, 2003; Lynch, et al., 1996). Incidence of cancers, such as breast
and colon, decrease with physical activity (Thune & Furberg, 2001). Other debilitating
diseases, such as osteoporosis, can be improved or prevented by engaging in physical
activity (Kemmler, et al., 2004; Warburton, Gledhill, & Quinney, 2001). Physical activity
has also been examined in relation to mental health. Cross sectional and longitudinal
studies have shown a beneficial relationship between levels of physical activity and
depression, anxiety, and select mental disorders (Strohle, 2009).

III.B. Physical Activity Prevalence

Inadequate physical activity is the norm in the United States with less than one
third of adults and only 35 percent of children meeting national recommendations (CDC,
2007; D. K. Eaton, et al., 2008). College students, who account for over 20 million

individuals in the United States, are no exception (Davis, 2008). According to the National College Health Risk Behavior Survey, among college students 18-24 years old, only 42% participated in vigorous physical activity and 20% in moderate physical activity on three or more of the previous seven days (NHCRBS, 1995). This deficiency is more pronounced among females (35%, 21%) than males (49%, 20%) (NHCRBS, 1995). A more recent study of a large Southeastern campus population using accelerometers showed a much lower prevalence of vigorous physical activity (4.6%) and higher but inadequate levels of moderate physical activity (53%) among all students (Dinger & Behrens, 2006). Considering the stability of physical activity habits following young adulthood, increasing physical activity in the college population could lead to lifelong benefits for this group (Caspersen, Pereira, & Curran, 2000).

III.C. Physical Activity Interventions with College Students

Few intervention studies have targeted physical activity behaviors in college students (Ferrara, 2009). One of the more rigorous of these studies was project GRAD, a randomized controlled trial comparing students in a one-semester physical activity course and students in a more general health course (Calfas, et al., 2000; Sallis, Calfas, Nichols, et al., 1999). Although post intervention outcomes showed significant positive results for women, they did not remain after two years. Other studies have reported more positive results but have generally employed quasi-experimental designs and or had small sample sizes (D'Alonzo, Stevenson, & Davis, 2004; Leslie, 2001). Overall, there is limited evidence that existing interventions have had long-term effects on the outcome of interest (Keating, Guan, Pinero, & Bridges, 2005). Extant studies, however, have largely limited their interventions to curriculum-based programs (Ferrara, 2009). Other components, such as ways to increase social support, have been sparse. Studies that employ rigorous study designs and test more innovative strategies that go beyond curriculum are needed.

III.D. Determinants of Physical Activity

Physical activity is a complex behavior that is affected by factors at the personal and environmental level. As demonstrated previously, demographic factors such as age, gender, education and socioeconomic status are associated with levels of physical activity. Behavioral attributes are also associated with levels of physical activity including dietary quality and smoking (Sherwood & Jeffery, 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002). At the environmental level, there is growing evidence that issues of access and aspects of the built environment, such as sidewalk availability and neighborhood safety, have significant influence on physical activity behavior (Brownson, Baker, Housemann, Brennan, & Bacak, 2001). In addition to these determinants, two factors, social support and social influence, have shown a particularly strong and consistent relationship with physical activity behavior. These determinants are addressed in greater detail in the following sections.

III.E. Social Support and Physical Activity

A 2007 review of determinants of physical activity behavior for adults identified social support as one of only two factors with convincing evidence of a positive relationship with physical activity and several cross sectional studies have observed this relationship in women (Eyler, et al., 1999; Leslie, et al., 1999; Wendel-Vos, et al., 2007). Results from intervention research reinforce these observational findings. Based on a comprehensive review of good quality intervention studies, social support in community settings was recommended for increasing physical activity by the CDC's Task Force on Community Preventive Services (Katz, et al., 2005). Effective interventions that have targeted social support for physical activity have employed several strategies including: group meetings and activities, encouraging participants to elicit social support from their social network, and recruiting small groups of friends into interventions (Dunn, et al., 1998; Kohl, Dunn, Marcus, & Blair, 1998; Wing & Jeffery, 1999). There is also some

evidence that social support interventions for lifestyle change are more effective in women than men (Kelsey, Earp, & Kirkley, 1997; Sallis, Calfas, Alcaraz, Gehrman, & Johnson, 1999). In the domain of online social support, the overall evidence of a positive influence on health behaviors has not been established, but this is attributed largely to a lack of specificity in studies. Online support groups have mainly been grouped with other intervention components, which leaves their effectiveness ambiguous (Eysenbach, Powell, Englesakis, Rizo, & Stern, 2004). Despite this, several studies in the domain of weight loss and weight maintenance that have employed online social support components have shown positive results (Harvey-Berino, Pintauro, Buzzell, et al., 2002; Tate, Jackvony, & Wing, 2003; Tate, Wing, & Winett, 2001). This cross sectional and experimental evidence suggests that social support interventions in an online setting could be effective in increasing physical activity.

III.F. Social Influence and Physical Activity

Several prominent health behavior theories including Social Cognitive Theory (modeling) and the Theory of Planned Behavior (subjective norms) include constructs that address the influence of peers on behavior (Ajzen, 1991; Bandura, 1986). This influence is expressed through two main pathways: descriptive and injunctive norms. Injunctive norms are behaviors perceived by individuals to be approved by their peer group. Descriptive norms are behaviors that are perceived to be occurring among the peer group. Although normative beliefs have generally not been supported as a direct influence on physical activity behaviors, studies with adolescents have found a positive relationship between social influence scores, peer crowd affiliation, peer norms, and physical activity or its theoretical antecedents (Baker, Little, & Brownell, 2003; Mackey & La Greca, 2007; Strauss, Rodzilsky, Burack, & Colin, 2001; Trost, et al., 2002). Some intriguing results have also been found related to the influence of peer images on health behaviors. Several studies examining the experimental influence of health prototype

images (e.g., an individual smoking), have found that they influence smoking, drinking, safe sex and other risk behaviors for adolescents (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008). In the domain of physical activity, Ouellette et al.(2005) found significant increases between baseline and follow up physical activity levels for participants who were exposed to exerciser prototypes. Social network level studies of health outcomes and peer groups are another area of research that suggests an effect of social influence on health behaviors. Several recent publications have explored this idea of "social contagion" of health behaviors. Christakas and Fowler (2007) found obesity clusters, related to individual relationships, in a large cohort of adults from the Framingham Heart Study. They also found a longitudinal relationship between the development of obesity and peer relationships, which could indicate a causal relationship. Effects were also seen for long distance relationships, which suggests that they are not fully explained by shared environmental characteristics.

III.G. Online Social Networks

Online social networks are defined as "web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of others with whom they share a connection, and view and traverse their list of connections and those made by others within the system."(boyd & Ellison, 2007) User profiles can include a variety of different personal characteristics (e.g., age, sex, personal interests). Users may also include a profile photograph or other photographs and write status updates about themselves. These profile elements are displayed to different types of others based on the privacy settings of the user. In addition to self-generated information, others can post information or respond to user comments in a user's profile. Social networks also include synchronous and asynchronous communications directly between users and others through email or instant messaging. Users can also create and join groups related to common interest and activities. Finally,

online social networks allow for the development of applications, which are software tools embedded in social networking sites that integrate the functions of a software program (e.g., a physical activity tracker) with social network features such as sharing and commenting on personal information. This allows users to share individual and aggregate information that is created by the software program.

III.H. Popularity of Online Social Networks

Social networking websites command significant time and attention from college-aged individuals. In their report on the use of social networking sites, the Pew Internet and American Life Project reported that 72% of online adults, ages 18-29, use social networking sites and 45% use one on a typical day (Lenhart, 2009). Traditional disparities between racial groups in other types of internet use are also not observed in the use of online social networks, where among internet users, African Americans have a higher prevalence of online social network use (43%) than non-Hispanic whites (31%) (Chou, 2009). Young adults use social networking websites for various social tasks including making plans with friends (57%), staying in touch with close friends (89%) and organizing with others for an event, issue, or cause (43%) (Lenhart, 2007). Data from studies on teen users of social networking websites, who are close in age to the study population, show that more than 4 in 5 have posted messages to a friend's profile or page, 58% have sent messages, and 37% percent have joined a group (Lenhart, 2009). The popularity of online social networks indicates their potential to be readily adopted in the target population and specific patterns of use suggest they are important communication tools. They also could be used to target underserved groups that are traditionally more difficult to reach using online interventions.

III.I. Existing Commercial Physical Activity Programs Using Online Social Networks

Commercial versions of physical activity related applications are common for major social networking websites such as Facebook (e.g., MapMyRun, http://www.facebook.com/mapmyrun). These applications combine physical activity tracking tools with the ability to identify and share information with existing members of your online social network as well as other users of the application. There are also online social networks, such as SPARKPEOPLE (http://www.sparkpeople.com/), dedicated specifically to health and fitness. Aspects of online social networks are also being used by nationally recognized health promotion agencies. The American Heart Association has developed the MyStart community (http://startwalkingnow.org/mystart_tracker.jsp), an online social network for individuals interested in increasing their physical activity. Creating an evidence base for the development of these online social networks could improve and enhance their effectiveness.

III.J. Online Social Networks As Web Based Interventions

The use of online social networks for physical activity interventions can capitalize on several characteristics of web-based interventions that have made them appealing to researchers in the area of health behavior change. Web based interventions generally have high up-front costs but are easily disseminated, making them a potentially cost effective alternative to more intensive individual level counseling (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). Geographic and temporal constraints that are encountered with face-to-face interventions are obviated by the reach and on demand nature of the web. In addition, concerns about accessibility to the web are lessening as Internet penetration increases (Madden, 2006). One disadvantage of web-based interventions has been high rates of attrition (Vandelanotte, Spathonis, Eakin, & Owen, 2007). Concerns over attrition are substantiated by several studies that show a

relationship between the amount of time spent interacting with the intervention (e.g., logging onto a website or engaging in communication through email or a chat room or bulletin board) and effectiveness (McKay, King, Eakin, Seeley, & Glasgow, 2001; Tate, et al., 2001). This limitation may be mitigated by the use of online social networks as the platform for intervention delivery. Whereas traditional web based interventions have required participants to use stand-alone online tools, intervention components contained within online social networks could be included as a part of the user's customary Internet use.

To our knowledge, only one study has examined the use of online social networks to change physical activity behavior (Napolitano, Hayes, Bennett, Ives, & Foster, 2012). This study found that an intervention combining Facebook and text messaging produced greater short-term weight loss than Facebook alone or a wait list control but did not find a difference between Facebook alone and controls. This study did not find any significant differences in physical activity between groups.

III.K. Social Support and Social Influence in Online Social Networks

Creating and Managing Social Networks Online.

Conceptually, online social networks provide an intriguing platform for increasing social network size and density. In addition to their communicative functions such as email and chat, unique features of online social networks, such as public profile information and groups, provide the ability to quickly search and identify others with similar interests, lowering the transaction costs associated with forming beneficial social connections within the network (N. Ellison, Lampe, & Steinfield, 2009). General research on the effect of internet use on social ties has been contradictory, but a recent study found a positive association between internet use and social support and a positive mediating role for social support between internet use and subjective health (Wangberg, et al., 2008;Kraut, et al., 2002; Kraut, et al., 1998; Wellman, Haase, Witte, & Hampton,

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2001). Another study that delineated more social types of internet use similar to those contained within online social networks found that individuals who use social forms of internet media, such as chat and email, have more social ties than those who use non social forms of internet media, such as web surfing (Zhao, 2006). In addition, a study by Ellison et al. (2007) found that the intensity of online social network use was positively associated with the amount of three forms of social capital: 1. bridging capital, which is made up of weak ties (acquaintances), 2. bonding capital, which is made up of strong ties (intimate relationships), and 3. maintained social capital, which is the ability for individuals to maintain ties from previous relationships. In addition to enhancements to network size and density, online social networks may strengthen tie characteristics such as the frequency and reciprocity of contacts. From a functional perspective, online social networks provide the ability to easily send messages to and receive messages from individuals or groups through a variety of different channels. Intervention studies suggest that communicative tools within web-based physical activity interventions, such as email, are preferred by participants, and have a positive effect on the number of social support contacts (Glasgow, Boles, McKay, Feil, & Barrere, 2003; Harvey-Berino, Pintauro, Buzzell, et al., 2002; Harvey-Berino, Pintauro, Buzzell, & Gold, 2004; Harvey-Berino, Pintauro, & Gold, 2002). In addition, the interface characteristics of online social networks (e.g., newsfeeds and friend lists) allow users to manage their social network efficiently, potentially allowing them to identify other users in need of social support or to indicate to users in their network that they are in need.

Social Support.

Specific types of social support messaging could also be enhanced in an online social network. Although early theories of computer mediated communication posited that non face-to-face interactions would be deficient in expressing emotion, recent experimental work supports the idea that these types of communications can express

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rich emotional content and may in fact be superior in some situations (Hancock, Gee, Ciaccio, & Lin, 2008; Hancock, Landrigan, & Silver, 2007; Walther, 1996). It is also evident that online social network users are willing to share large amounts of personal information with other individuals in their network (Gross, Acquisti, & Heinz, 2005). Other features of online social networks, such as the ability to share personal data that is recorded by applications (e.g., physical activity logs) and public data such as web links and blog posts, could provide another rich source of information for users to share either automatically or selectively (Bennett & Glasgow, 2009; Buis, 2011). These sources of information could provide a catalyst for support from friends in the network.

Social Influence.

Online social networks are fertile ground for social influence through behavioral modeling. Content analyses of online social networks have found a high prevalence of users who publicly display risk behaviors such as alcohol use and sexual activity (Moreno, Parks, Zimmerman, Brito, & Christakis, 2009). Users are afforded myriad opportunities to publicly present their behavior to other users through presentation of their personal profile information, posting of pictures and video, writing messages about their behavior on wall posts, information about their behavior provided by other users, and obtaining personal user information generated through applications. Feedback between users about the content of public behavioral displays is also facilitated by online social network functionality. Tools allow users to provide comments on a variety of different content in online social networks including pictures and comments. Because users can quickly scan their friends' content within the online social network via their newsfeed as well as see comments by others in relation to that content, online social networks could provide behavioral modeling and reinforcement across a large number of an individual's peer group.

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III.L. Summary

Despite the established benefits of physical activity, female college students are not meeting current recommendations. Interventions that go beyond curriculum and include social support mechanisms could address this inadequacy. Online social networks, which combine significant reach and unique technical capabilities, could increase physical activity through several psychosocial mechanisms including social support. This proposal outlines an innovative intervention strategy that uses online social networks to address an important public health problem.

CHAPTER IV

EFFICACY OF AN ONLINE SOCIAL NETWORK BASED PHYSICAL ACTIVITY
INTERVENTION: A RANDOMIZED CONTROLLED TRIAL

IV.A. Introduction

Successful interventions that increase physical activity could yield important
public health benefits given the relationship between inadequate physical activity and
increased disease risk (Gregg, et al., 2003; Jolliffe, et al., 2000; Thune & Furberg, 2001).
Social support is a well-established correlate with greater physical activity and is
recommended by the CDC's task force on Community Preventive Services for increasing
physical activity in community settings based on high quality intervention studies (Kahn,
et al., 2002; Sherwood & Jeffery, 2000; Trost, et al., 2002; Van Der Horst, Paw, Twisk, &
Van Mechelen, 2007). Interventions targeting social support for physical activity have
used several strategies including group meetings and activities, encouraging participants
to elicit support from their existing social network, and recruiting small groups of friends
into interventions (Avila & Hovell, 1994; Perry, Rosenfeld, Bennett, & Potempa, 2007;
Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005; Simmons, et al., 1998; Wing
& Jeffery, 1999). A growing number of e-health studies have applied these strategies
using online bulletin board services, group chats, and facilitating email communication
between participants (Glasgow, et al., 2003; Gold, Burke, Pintauro, Buzzell, & Harvey-
Berino, 2007; Harvey-Berino, Pintauro, Buzzell, et al., 2002; Harvey-Berino, et al., 2004;
Harvey-Berino, Pintauro, & Gold, 2002; Harvey-Berino, et al., 2010; Kim, Draska, Hess,
Wilson, & Richardson, 2011; Kosma, Cardinal, & McCubbin, 2005; McKay, Glasgow,
Feil, Boles, & Barrera, 2002; McKay, et al., 2001; Micco, et al., 2007; Richardson, et al.,

2010; Tate, et al., 2003; Tate, Jackvony, & Wing, 2006; Tate, et al., 2001). The overall efficacy of these strategies to increase social support is difficult to determine from these studies, however, because social support has rarely been included as a measure (Harvey-Berino, Pintauro, Buzzell, et al., 2002; Harvey-Berino, Pintauro, & Gold, 2002; Kim, et al., 2011; Kosma, et al., 2005; McKay, et al., 2002; McKay, et al., 2001; Tate, et al., 2003; Tate, et al., 2006; Tate, et al., 2001). It is also difficult to assess the direct effect of these strategies on health behavior change because these components were largely treated as adjunct to other more intensive behavior change strategies such as individual behavioral therapy.

Online social networks, like Myspace™ and Facebook™, possess a number of useful features that could enhance e-health social support interventions (Bennett & Glasgow, 2009; Buis). These networks are defined as "web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of others with whom they share a connection, and view and traverse their list of connections and those made by others within the system."(boyd & Ellison, 2007) Within these networks, users can post comments; photographs and video; and links to information. This content is then aggregated and displayed to other users in real time through a "newsfeed". Users exert control over how and with whom they share content, based on their settings and social connections, which they can increase by forming or joining groups based on their specific interests. This creates a potential mechanism in which users can share support and social influence with others, including individuals who may not be a part of their existing social network but share common interests. In addition, more than seventy percent of young adults and teens and more than one third of adults have online social network accounts and use these accounts frequently to engage in social interactions (Lenhart, 2010). This combination of reach and functionality

makes online social networks a potentially effective means of delivering social support interventions.

The purpose of this study was to test an intervention that was partly administered through a popular, commercially available online social network service in which the primary mechanism for behavior change was encouraging peer-to-peer online support. The resulting Internet Support for Healthy Associations Promoting Exercise (INSHAPE) intervention combined a physical activity themed Facebook group with a dedicated INSHAPE educational and self-monitoring website. The primary hypothesis was that individuals randomized to the intervention would exhibit greater increases in perceived social support for physical activity than individuals in an education-only control group. A secondary hypothesis was that the intervention group would report greater physical activity at the end of the intervention compared with the education-only control group.

IV.B. Methods

Participants.

Female undergraduate students (n=134) at a large Southeastern public university were recruited through flyers, university listserv emails, Facebook and Twitter™ accounts affiliated with the university, and advertisements in the college newspaper. Interested participants completed an online screener to determine their eligibility. Participants were deemed eligible if they were currently enrolled female undergraduates at the University under the age of 25 years, reported less than 30 minutes of daily physical activity, and more than 30 minutes of daily use of Facebook. Participants were excluded if they answered yes to two or more questions on the SCOFF disordered eating questionnaire (Perry, et al., 2002). To identify participants with contraindications to an unstructured exercise program, participants were required to submit physician approval if they answered yes to one or more questions on the Physical Activity Readiness Questionnaire (Thomas, Reading, & Shephard, 1992). None of the 19

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individuals who screened positive on the PARQ submitted physician clearance, so they were ineligible to participate. A full description of participant recruitment is included in Figure 4.1. All study participants provided informed consent.

Design.

Computer generated permuted-block randomization was used to randomize participants into two groups, online social network plus self-monitoring (n=67) and education only control (n=67). Perceived social support for physical activity was assessed at baseline and ten weeks. Physical activity was assessed at baseline and 12 weeks. These measures were separated due to the need to establish an appropriate timeframe among variables for a separate mediation analysis. Participants received $30 for completing all study measures. Recruitment and data collection for this study occurred in 2010 and 2011 and all data analysis was performed in 2011. The Institutional Review Board at the participating university approved this study.

Study Procedures.

Intervention participant and moderator activities are outlined in Table 4.1. Intervention participants had access to the INSHAPE website, which included educational materials related to physical activity safety, recommendations, and types of physical activity, as well as strategies for overcoming barriers to physical activity. The website also featured a self monitoring tool adapted from a successful paper-based protocol where participants could set a weekly goal and log the frequency, duration, and intensity of their daily physical activity (Dishman, DeJoy, Wilson, & Vandenberg, 2009). Participants could also view a chart depicting their progress relative to their weekly goal and to national recommendations for physical activity. Self-monitoring was included in the intervention group to provide structure and give participants a basis for exchanging social support by discussing their experiences and progress in the program. Although all of the functions of the web site could be integrated into an online social network platform

to provide a seamless experience for users, development costs necessitated having a separate website.

Participants were invited to join a Facebook group, whose purpose was to provide participants with a mechanism to exchange social support. Facebook is a widely used social networking website service that includes the ability to: maintain a public profile that includes personal information; post comments, web links, photos and video; communicate with other members via email and chat; indicate approval of content by hitting a "like" button; and create and manage groups based on topics of interest. (www.facebook.com) In the case of the INSHAPE Facebook group, only participants in the study were allowed to join and the study moderator controlled the group. The group allowed the moderator and members to post comments to a common area (e.g., the group wall); respond to others' posts; create and post to discussion boards; and post web links, photographs, and videos. To encourage participation, participants received a maximum of one entry per week into a biweekly drawing for a $40 gift card for any number of posts made to the Facebook group in a given week. Participants were also asked upon joining the group to answer icebreaker questions on a discussion board including the types of exercise they were interested in and when and where they preferred to exercise. To allow participants to leverage their existing network of Facebook friends in addition to other study group members, participants were encouraged to post information related to their physical activity efforts to their own Facebook wall or set up a group of friends in Facebook with whom they could share their experience in the program.

The moderator's role in the group included answering technical questions about the study or responding to physical activity related questions from participants posted on the group wall or received through email, but did not include direct social support to individual group members. For example, the moderator's role was not to congratulate or

encourage individual posters. Every week (n= 12), the moderator posted a physical activity related news article to the Facebook group. The moderator also calculated weekly minutes of participant physical activity stratified by college class from self-monitoring data and posted it to the Facebook group to encourage competition and provide positive modeling of physical activity behavior. In addition, the study moderator sent Facebook messages to participants over the course of the intervention reminding them to engage in Facebook activities and alerting them to items posted to the Facebook group. Several discussion boards were created with different physical activity topics based on information provided in the icebreaker activity to facilitate members' participation with each other in physical activity. All communications within the group and discussion boards were monitored for harmful or erroneous content. No posts required removal or correction during the intervention.

Control group participants were provided access to a limited version of the INSHAPE website, which included only the educational materials described previously, such as physical activity safety and recommendations. The study moderator also sent weekly emails to participants over the 12-week period with links to the same news stories related to physical activity that were used in the Facebook group to promote discussion.

Study Measures.

Participants completed all self-report study measures by online survey using Qualtrics (Qualtrics Research Suite, version 2009).

Perceived social support for physical activity was measured using an adapted version of the positive subscales from Chogahara's Social Influence on Physical Activity questionnaire, which was designed to assess social influences on physical activity in an elderly population. In the original validation study, confirmatory factor analysis of the scale supported three distinct positive social support dimensions; informational support,

esteem support, and companionship support, and these subscales exhibited good internal reliability (α =.84 to .90) and test-retest reliability (r=.75 to .88) (Chogahara, 1999). In the current study, a small number of scale items from the original instrument were dropped based on changes made in a previous study that adapted the instrument for a college aged population, which reported good internal reliability (α=. 85 to .89) for these modified subscales (Okun, et al., 2003). In addition, language used to assess instances of social support was modified to explicitly include support experienced through online forms of communication. Specifically, the questionnaire asked participants how often over the past six weeks they had experienced certain social interactions with friends (e.g. made plans for exercising) including 'friends on Facebook or other members of groups you have joined on Facebook'. Each subscale consisted of 4 items and 5 response levels ranging from 'never' to 'very often'. Subscales scores were calculated by taking the mean of the individual items with higher scores indicating greater perceived social support.

Physical activity was measured using a version of the Paffenbarger activity questionnaire adapted for online use (Paffenbarger, Wing, & Hyde, 1995). This measure asks participants to report the amount of time spent in a variety of physical activities over the past week. This scale has demonstrated adequate reliability and predictive validity in previous studies (Pereira, et al., 1997).

The Facebook Intensity Scale was used to measure participants' overall engagement in Facebook activities prior to the intervention (Ellison, et al., 2007). This instrument asks participants questions about their Facebook use and a series of Likert-type questions assessing their attitudes toward Facebook (e.g. "I am proud to tell people that I am on Facebook").

The study administrator recorded Facebook interactions manually on a daily basis during the intervention including all comments and web links, discussion board posts, and instances where participants hit the "like" button in response to content. At enrollment, all participants were asked to "friend" a dedicated study administrator Facebook account, which was established specifically for the study. This allowed the administrator to record posts related to physical activity found on the individual Facebook walls of both intervention and control participants. Facebook behavior in the intervention group that was not observable, such as visiting but not posting to the group, was measured by a self-report questionnaire administered at the end of the study. This questionnaire also assessed intervention participants' attitudes toward the Facebook component of the intervention and factors affecting their participation.

INSHAPE website use for both groups was tracked using participants' unique login credentials. Total logins included all instances of a participant logging in to the website. For the intervention group, data on the number of physical activity bouts logged over the course of the intervention were also collected.

Statistical Analysis.

Based on effect sizes from similar studies, it was estimated that 110 participants were necessary to give 80% power to detect a significant difference between groups in perceived social support assuming 20% attrition and $\alpha = .05$ (Collins, et al., 2010; Perry, et al., 2007; Rovniak, et al., 2005). Differences in perceived social support and physical activity were assessed using linear mixed models including a random intercept to account for missing data. Differential attrition and differences between completers and non-completers on baseline measures were examined using non-parametric tests and independent t-tests. All data analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 19).

IV.C. Results

Participant characteristics at baseline are detailed in Table 4.2. No significant differences were found at baseline between groups with the exception of the Facebook Intensity Scale, $t(132)=-2.03$, $p=.04$, where those in the control group showed higher scores than the intervention group. Participants were predominately white, non-Hispanic, whose parents had attained college or higher-level education. Attrition was 13% in the intervention group and 3% in the education control group at 10 weeks. At 12 weeks, attrition was 16% (n=11) and 4% (n=3) for those groups respectively. Attrition was significantly different between groups at 10 and 12 weeks ($p=.05$, $p=.02$). There were no significant differences between the baseline characteristics of participants who completed all study measures vs. those who did not with the exception of Facebook Intensity, with completers having a higher score than non-completers, $t(132)=-2.43$, $p=.02$.

INSHAPE Website Use.

Study participants logged into the INSHAPE website 584 times over twelve weeks. Intervention participants logged in a mean of 7.0 times (SD=8.23, range 0-43) and control participants 1.7 times (SD=1.45, range 0-11). Logins to the website declined over the first six weeks but leveled out over the last six weeks (Figure 4.2). Intervention participants logged 1,016 bouts of physical activity in the self-monitoring system (M=15.16, SD=20.65, range 0-107). Physical activity bouts logged over time trended similarly to overall logins but showed further decline toward the end of the study (Figure 4.2).

Facebook Group Use.

Sixty-four intervention group participants (96%) accepted the Facebook group invitation. Because almost all intervention group participants posted at least once to the Facebook group at the beginning of the intervention as an icebreaker activity, they were

dichotomized into two groups, one or fewer contributions (non-contributors, n=37) and more than one contribution (contributors, n=30). There were a total of 319 interactions within the Facebook group (259 from study participants). Contributors averaged 8.0 interactions (SD=7.45) with a range of 2-38. Contributions to the group were highest in the beginning, declined to a low point at the midpoint of the intervention coinciding with Spring Break, and then recovered modestly before declining at the end of the intervention (Figure 4.2). More than half (63%) of intervention participants who completed the post survey (n=56) reported visiting the Facebook group at least 2-3 times per month with only one participant reporting having never visited the group. More than one-third (39%) of survey respondents reported adding other group members as Facebook friends during the study and 13% reported participating in physical activity with other group members at least 2-3 times per month. Thirteen percent of survey respondents reported setting up a group of Facebook friends to share with during the intervention. A within group analysis to explore the relationship between Facebook group contributions and study outcomes showed no significant group x time interaction between contributors and non-contributors for social support or physical activity.

Individual Facebook Use.

Individual Facebook data were collected for the 130 participants who accepted the Facebook friend invitation from the study moderator. These participants posted 187 non-group Facebook interactions related to physical activity during the intervention (107 by control group participants). Non-group posts declined during Spring Break but were otherwise steady. (Figure 4.2) There was no statistical difference in the number of physical activity related posts on individuals' Facebook accounts between the online social network and control groups, $t(132)=-1.03$, $p=.31$.

Perceived Social Support and Physical Activity.

Means and tests of significance for main effects and interactions related to changes in perceived social support and physical activity are included in Table 4.3. Two cases exhibited extreme total physical activity values exceeding 12,000 kcals per week and were excluded from the analysis for all physical activity outcomes. Comparison of analyses of physical activity outcomes with and without these cases did not reveal any differences in statistical significance. There were no significant group x time interactions for perceived social support or physical activity. With the exception of informational social support, there were significant, positive main effects for time, with both groups reporting increases for physical activity and esteem and companionship social support. Additional linear mixed models were used to determine if baseline values of social support or Facebook intensity moderated intervention effects. There were no significant interactions for any of these analyses.

Participant Satisfaction With Facebook Group.

Survey respondents in the online social network plus self-monitoring group (n=56) rated visiting the group as the most important Facebook element of the intervention followed by receiving comments and posting comments. The participants did not, however, find posting pictures or video as very important activities. (Table 4.4) When asked to report barriers to participation in the group, most respondents chose "time" (77%) and "forgetfulness" (71%) with fewer choosing "not wanting to meet up with strangers" (38%) or "not wanting to share personal information" (18%). Overall, two thirds (66%) of the online social network group participants indicated that they would recommend the program to their friends.

IV.D. Discussion

This study provides important lessons about conducting a health intervention using an online social network. Participant satisfaction with and use of the Facebook

group suggest that online social networks are a feasible platform for intervention delivery. This study did not find evidence that enrollment in a Facebook group coupled with web based education and self-monitoring significantly increased levels of perceived social support for physical activity or physical activity compared to web based education controls but did find significant increases over time in perceived social support and physical activity among all participants.

It is difficult to compare the results of this study to others in the literature as most studies using online peer-to-peer support that include physical activity outcomes have not measured perceived social support or isolated these components. One exception is the Stepping Up to Health Study, which compared a walking program group with a walking program plus online community group (Richardson, et al., 2010). This study did not find differences in perceived social support, which was measured with a single item, at baseline or post intervention between groups. In contrast, other randomized studies using online peer-to-peer mechanisms such as chat rooms and bulletin boards have reported increases in diabetes management support and general social support (Barrera, Glasgow, McKay, Boles, & Feil, 2002; Glasgow, et al., 2003; Micco, et al., 2007). The current findings related to physical activity are similar to Stepping Up to Health, where both groups' physical activity increased significantly over time but there was not a significant difference between groups (Richardson, et al., 2010). This pattern has also been found in other studies comparing multicomponent interventions with internet peer-to-peer support to those with in person peer support or no peer support (Harvey-Berino, Pintauro, Buzzell, et al., 2002; McKay, et al., 2001; D. F. Tate, et al., 2001).

In the current study, it is possible that the significant main effects are the result of the demand characteristics of the measures or the effect of seasonal differences considering that baseline measures were taken during a less favorable time period for

participating in outdoor activities than post-intervention measures. In addition, the selection of participants who were motivated to join a physical activity program may have led to participants soliciting and providing social support offline in both groups. The failure of this study to detect increases in social support above and beyond education controls may be explained by a relatively low dose of social support from online interaction relative to that which occurred offline naturally.

Levels of participation in the Facebook group during this study were higher than those documented in most previous studies employing online peer-to-peer support, which have averaged less than one to 1.1 posts per participant (Kim, et al., 2011; Kosma, et al., 2005; McKay, et al., 2001). Participation rates similar to those in the current study were reported in the Stepping Up to Health Study, where participants who posted at least once averaged 5 posts per person.(Resnick, Janney, Buis, & Richardson, 2010) Like the current study, Stepping Up to Health had a study arm specifically designed to foster online peer-to-peer support, as opposed to most other studies that have included peer support only as part of a larger intervention. This suggests that studies with more carefully designed online peer support components with elements such as contests, incentives, and moderator provided content may be more successful in encouraging participant interaction.

Overall attrition in this study was considerably lower than average rates in other web based physical activity studies perhaps because the entire study including data collection was conducted online and was convenient for participants (Vandelanotte, et al., 2007). The significantly greater attrition in the intervention group may be the result of displeasure at the greater number of moderator messages or that intervention participants were discouraged by the act of self-monitoring.

Due to design considerations, existing social groups were not enrolled in this study. Such groups were found in a previous social support intervention to increase

effectiveness.(Wing & Jeffery, 1999) Although participants were encouraged to solicit support from their existing Facebook friends, there was no difference between online social network and control group participants in the number of physical activity related posts to their own Facebook walls. Future iterations of this research might effectively employ application technology that would enroll individuals and provide them automated prompts and tools to include a subset of their existing friends as study participants. These applications could also automatically match participants on physical activity related criteria such as exercise preferences to encourage group participation. Data collected by an application could also be used to provide real time group and individual behavioral information to participants.

Study Strengths.

This is one of the first studies attempting to change health behavior using a commercially available, widely used online social networking service, which increases its potential for dissemination and implementation (Bennett & Glasgow, 2009). This study also employed a randomized design and, unlike previous online intervention studies, used a multi-item social support measure specific to physical activity.

Study Limitations.

The physical activity measure used in this study was self-report, which is subject to greater bias than more objective measures. Some measures of participation, such as Facebook messaging, could be assessed only by self-report. It was also impossible to determine the number of participants who viewed content on the Facebook group but did not post, i.e. "lurkers." It has been estimated that this type of behavior occurs in roughly half of participants in discussion lists for health topics (Nonnecke & Preece, 2000).

To more accurately assess participation in future studies using commercial online social networks, additional objective data collection measures should be pursued. Considering that control group participants were Facebook friends with an average 1.6

intervention participants during the intervention, contamination was another possible threat to validity in this study. The design of this study also did not allow for the isolation of effects from enrollment in the online social network versus self-monitoring.

Conclusion.

This study does not provide evidence that the use of online social networks plus self-monitoring is an effective way to increase physical activity social support or physical activity compared to only providing physical activity educational materials. It does demonstrate that participants will join an online social network group and share social support related to physical activity with other participants. Given their technical features and potential reach, efforts to further understand how online social networks can be used in health promotion should be pursued.

Table 4.1. Participant and moderator activities for the online social networking plus self-monitoring group

Intervention component	Participant/moderator activities

INSHAPE website	Participant activities
	
	• Self-monitoring (daily)
	
	• Review study expectations and procedures (at the beginning and as needed)
	
	• Review physical activity related content (at the beginning and as needed)
	
	   - Exercise safety
	
	   - Exercise recommendations
	
	   - Exercise benefits
	
	   - Aerobic, strengthening, and flexibility exercises
	
	   - Exercise barriers

Email (Facebook messaging and traditional email)	Moderator activities • Communicate Facebook group policies (beginning and midpoint of intervention) • Notify participants of new discussion question posts (weekly)

	• Notify participants of aggregate exercise posts (weekly)
	• Announce drawing winner (bi-weekly)
	• Send Facebook group activities reminder (bi-weekly)
Facebook group	Participant activities:
	• Post answers to icebreaker questions on the Facebook discussion board (beginning of the intervention)
	• Connect with other participants to exercise on the Facebook wall and in Facebook discussion boards dedicated to specific exercises (ongoing)
	• Share their goals, progress, and setbacks related to exercise (ongoing)
	• Provide messages of support to other participants (ongoing)
	• Share relevant information about exercise
	• Post pictures and videos related to exercise
	Moderator activities:
	• Post exercise totals (weekly, weeks 2-12)

- Post drawing winner (bi-weekly, weeks 5-12)

- Post discussion question (weeks 3,4,5,7,8,10)

- Post exercise related articles (weekly)

- Respond to participant questions and technical issues (as needed)

Individual Facebook wall   Participant activities:

- Share their goals, progress, and setbacks related to exercise (ongoing)

Table 4.2. Demographic characteristics of study sample at baseline

	Education Control		Facebook/Self Monitoring		
	(n=67)		(n=67)		*p*
Parent Education College or More No. (%)	52	(78)	54	(81)	.83
Age, y M(SD)	20.45	(1.09)	20.35	(1.32)	.64
BMI, kg/m^2 (SD)	24.34	(5.59)	24.32	(5.08)	.99
Not Hispanic or Latino, No. (%)	61	(91)	62	(93)	1.00
White, No. (%)	52	(78)	46	(69)	.33
Facebook Intensity Score M(SD)	4.07	(.58)	3.88	(.46)	.04

Table 4.3. Means and intervention effects on perceived social support and physical activity

Dependent Variable	Treatment Group	Baseline Means (SD)	Post Survey Means (SD)	Group x Time Interaction Effect	Time Effect
Informational Support	Control	1.79 (.77)	1.85 (.73)		
	Intervention	1.74 (.90)	1.92 (.86)	$F(1,123.23) = .48$, $p = .49$	$F(1,123.23) = 2.27$, $p=.13$
Esteem Support	Control	1.84 (.70)	2.27 (.89)		
	Intervention	1.85 (.87)	2.19 (.94)	$F(1,127.62) = .34$, $p=.56$	$F(1,127.62) = 19.87$, $p<.001$
Companionship Support	Control	2.10 (.90)	2.55 (1.12)		
	Intervention	2.25 (.99)	2.49 (.99)	$F(1,127.28) = 1.57$, $p=.21$	$F(1,127.28) = 12.13$, $p<.01$
Physical Activity (total kcal)	Control	1706.23 (1315.44)	2248.98 (1541.19)		
	Intervention	1646.39 (973.68)	2394.75 (1448.00)	$F(1,127.75) = .42$, $p=.52$	$F(1,127.75) = 23.59$, $p<.001$

Physical Activity (Vigorous kcal)	Control	155.97 (347.70)	378.23 (731.36)		
	Intervention	151.79 (333.57)	298.21 (575.32)	F(1,129.58) = .35, *p*=.55	F(1,129.58) = 9.19, *p*<.01
Physical Activity (Moderate kcal)	Control	166.69 (343.15)	272.78 (604.52)		
	Intervention	81.03 (215.81)	253.79 (646.08)	F(1,128.75) = .26, *p*=.61	F(1,128.75) = 6.80, *p*=.01
Physical Activity (Light kcal)	Control	25.89 (72.60)	61.69 (134.95)		
	Intervention	76.79 (177.79)	81.25 (182.55)	F(1,128.84) = .69, *p*=.41	F(1,128.84) = 2.54, *p*=.11

Table 4.4. Perceived importance of participation in Facebook group elements

Question (n=56)	Not at All Important	Slightly Important	Somewhat Important	Very Important	Extremely Important	I Never Did This
Posting a status, comment, link, or event to the INSHAPE group wall or discussion board.	28.57%	23.21%	23.21%	7.14%	5.36%	12.50%
Posting a video or picture to the INSHAPE group wall.	51.79%	8.93%	10.71%	1.79%	1.79%	25.00%
Receiving a comment on the INSHAPE group wall or discussion board.	35.71%	17.86%	14.29%	14.29%	7.14%	10.71%
Visiting the INSHAPE Group Wall	28.57%	17.86%	25.00%	16.07%	10.71%	1.79%

Figure 4.1. CONSORT diagram showing flow of participants through trial
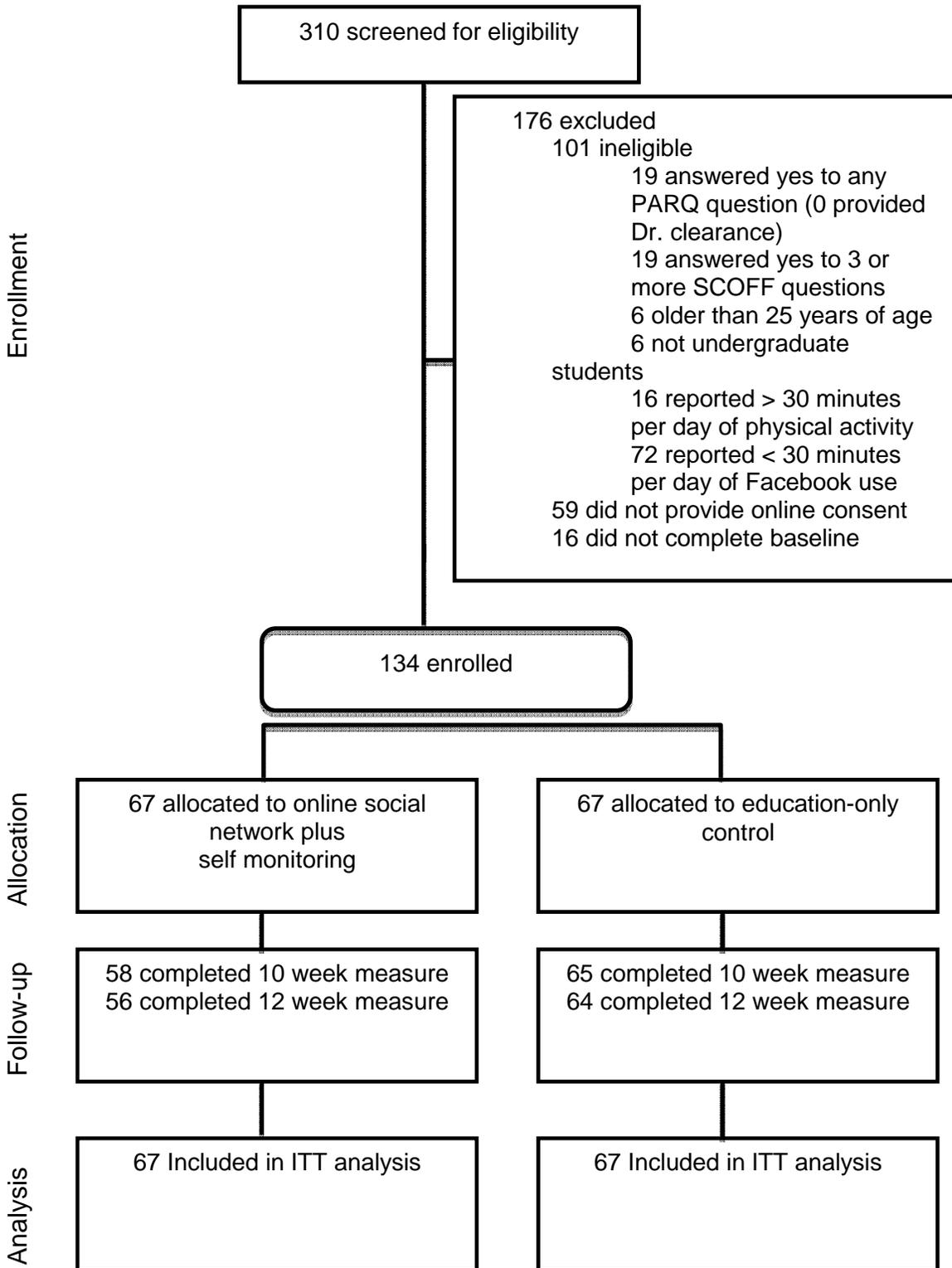
Figure 4.2. Frequency of participation in online activities during the intervention
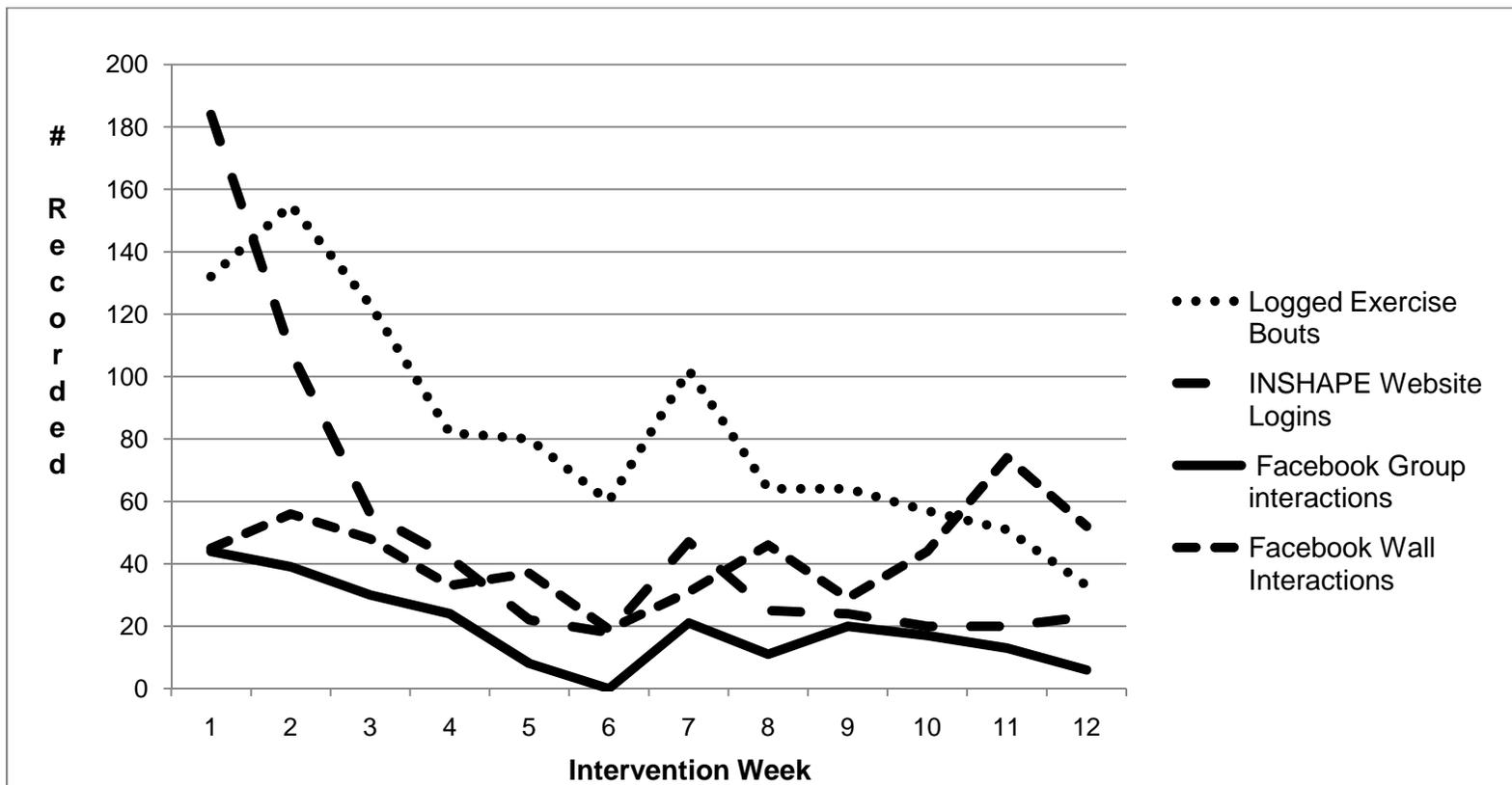
CHAPTER V

THE ROLE OF COMPANIONSHIP, ESTEEM, AND INFORMATIONAL SUPPORT
IN EXPLAINING PHYSICAL ACTIVITY AMONG YOUNG WOMEN IN AN ONLINE
SOCIAL NETWORK INTERVENTION

V.A. Introduction

Given the benefits associated with adequate physical activity and the fact that the

majority of Americans do not meet recommended national guidelines, developing

programs that increase physical activity is a public health priority (CDC, 2007; Eaton, et

al., 2008; Warburton, et al., 2006). One approach to increasing physical activity that is

commonly used in health interventions is increasing social support. A solid theoretical

understanding of the physical activity-social support relationship could benefit the design

of these interventions (Baranowski, Anderson, & Carmack, 1998). Many studies have

examined the social support – physical activity relationship within established health

behavior theories including the theory of planned behavior (TPB) (Ajzen, 1991). These

studies have elucidated some of the mechanisms that mediate this relationship, but have

largely been cross-sectional or used global measures of social support. This paper aims

to extend this work by examining the relationship between multiple types of social

support and physical activity in a modified TPB framework using longitudinal data

collected from an online social support based physical activity intervention.

The TPB (Figure 5.1) has been widely used in studies to predict physical activity

across a variety of populations. In the TPB, behavioral intention, which is an indication of

a person's readiness to perform the behavior, is assumed to be the most important and

proximal determinant of behavior. Perceived behavioral control, or one's belief in their

control over performing the behavior, is predicted to have both a direct effect on

behavior that is not completely volitional and an indirect effect through intention. For example, a person's ability to exercise might be constrained by factors that reflect actual control (e.g., a lack of access to facilities). In these cases, perceived behavioral control is theorized to have a direct effect on behavior. The other constructs in the model, attitude and subjective norm, are thought to influence behavior only through intention. Attitude consists of the affective and instrumental beliefs individuals hold about the behavior and subjective norms are beliefs individuals have about what important others think of their performing the behavior.

Results from meta-analyses and reviews have supported the TPB's overall ability to predict physical activity behavior (Blue, 1995; Downs & Hausenblas, 2005; Hagger et al., 2002). These analyses have consistently found the strongest relationships between intention and physical activity, attitude and intention, and perceived behavioral control and intention. The significance of a direct relationship between perceived behavioral control and physical activity when controlling for intention has been inconsistent in meta-analyses and the relationship has been consistently weaker than that for intention and physical activity. Because subjective norm has exhibited a weak or non-significant relationship with intention in these analyses when controlling for perceived behavioral control, some authors have suggested that this construct be dropped from the TPB in the physical activity domain (Courneya & McAuley, 1995; Courneya, et al., 2000; Rhodes & Nigg, 2011).

In part to find a psychosocial construct that could augment or replace subjective norm in the TPB in the physical activity domain, several studies have examined the relationship between social support, TPB constructs, and physical activity. These studies have found support for the prediction of intention and several types of physical activity behavior by social support as well as a greater ability to predict physical activity than subjective norm (Courneya, et al., 2000; Okun, et al., 2003; Rhodes, et al., 2002;

Saunders, et al., 2004). The relationships of specific types of social support with the TPB variables and physical activity, however, have been addressed less frequently than studies that treat social support as an overall global measure. In one study where social support types were included, differential effects on intention, perceived behavioral control, and physical activity were found, indicating that examining distinct types of social support may provide a better understanding of its role in the TPB (Okun, et al., 2003).

The current analysis used data from the Internet Support for Healthy Associations Promoting Exercise (INSHAPE) study -- a randomized controlled health promotion intervention trial designed to increase perceived social support for physical activity and physical activity among female undergraduate students using Facebook™, a popular online social networking website. To better explain how social support might mediate the effects of the intervention on physical activity, TPB variables (intention, attitude, perceived behavioral control) were measured to provide a theoretical analytic framework. Analysis of the trial outcomes found significant differences in physical activity and perceived social support for participants over time but not between groups (AJPM, under review).

Although the research literature has encouraged more studies that examine how theoretically targeted intervention components mediate intervention effects, this procedure is inappropriate for the current study and many other physical activity intervention studies because of a lack of significant changes between treatment and control groups over time on outcome variables (Baranowski, et al., 1998; Hillsdon, Foster, & Thorogood, 2005; Rhodes & Pfaeffli, 2010). In cases, however, where significant effects on outcome variables over time are observed across participants, such as in the current study, the opportunity remains to examine the direct and mediated relationships between social support and physical activity. The current study builds on

previous research by exploring multiple social support types as constructs in the TPB using these data.

V.B. Methods

Participants.

The study sample for the INSHAPE trial consisted of 134 female undergraduate students at a large Southeastern public university. Female undergraduates were selected for this study based on their widespread use of online social networks and previous research that supports the greater influence of social support on physical activity for women than men (Kelsey, et al., 1997; Lenhart, 2010; Molloy, Dixon, Hamer, & Sniehotta, 2010; Sallis, Calfas, Alcaraz, et al., 1999). Participants were recruited through flyers, university listserv emails, Facebook and Twitter™ accounts affiliated with the university, and advertisements in the college newspaper. Interested participants completed an online screener to determine their eligibility. Participants were deemed eligible if they were currently enrolled female undergraduates at the University under the age of 25 years, reported less than 30 minutes of daily physical activity, and more than 30 minutes of daily use of Facebook. Participants were excluded if they answered yes to two or more questions on the SCOFF disordered eating questionnaire (Perry, et al., 2002). To identify participants with contraindications to an unstructured exercise program, they were required to submit physician approval if they answered yes to one or more questions on the Physical Activity Readiness Questionnaire (PARQ) (Thomas, et al., 1992). None of the 19 individuals who screened positive on the PARQ submitted physician clearance, so they were ineligible to participate. A full description of participant recruitment is included in Figure 5.2. All study participants provided informed consent.

Design.

Study participants were randomized into two groups, online social network plus self-monitoring (n=67) and education control (n=67). Perceived social support for

physical activity, perceived behavioral control, attitude, and intention were assessed at baseline (time 1) and 10 weeks (time 2). Physical activity was assessed at baseline (time 1) and 12 weeks (time 2a). These measures were staggered due to the need to establish an appropriate timeframe between prospective TPB variables and retrospective social support measures at time 2 and the retrospective physical activity measure at time 2a. Participants received 30 dollars for completing all study measures. The Institutional Review Board at the participating university approved this study.

Description of the INSHAPE Trial.

The INSHAPE trial was designed to test the efficacy of using Facebook to increase perceived social support for physical activity and physical activity. The primary hypothesis of the original trial was that participants enrolled in a physical activity themed online social network combined with web-based education and self-monitoring would exhibit greater changes in perceived social support for physical activity and physical activity than those in an online education-only control group.

Intervention participants had access to the INSHAPE website, which included educational materials related to physical activity and a self-monitoring tool. (Dishman, et al., 2009) Self-monitoring was included in the intervention group as an evidence-based behavior change strategy and to provide structure and give participants a basis for exchanging social support by discussing their experiences and progress in the program (Burke, Wang, & Sevick, 2011). Participants were invited to join a Facebook group accessible only to members, where they could post comments to a common area (e.g., the group wall); respond to others' posts; create and post to discussion boards; and post web links, photographs, and videos. Participants were encouraged through incentives, emails, and messages posted to the group to exchange social support by discussing their experience in the program. The moderator's role in the group included answering technical questions about the study or responding to physical activity related questions

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from participants posted on the group wall or received through email, but did not include direct social support to individual group members. Control group participants were provided access to a limited version of the INSHAPE website, which included only the educational materials described previously. A more detailed description of the intervention and control conditions for the trial is published elsewhere (AJPM under review).

Measures.

Perceived social support for physical activity was measured using the positive subscales from Chogahara's Social Influence on Physical Activity questionnaire, adapted for a college-aged population. In the original validation study, confirmatory factor analysis of the scale supported three distinct positive social support dimensions; informational support, esteem support, and companionship support. Chogahara defined informational support as "knowledge assistance that suggests "'you should know'""; companionship support as "partnership assistance that suggests, "'we participate together'""; and esteem support as "esteem information provision that suggests "'you are good.'"" These subscales exhibited good internal reliability (α =.84 to .90) and test-retest reliability (r=.75 to .88) (Chogahara, 1999). A few of the original scale items were not included based on a study that adapted the instrument for a college-aged population, which also reported good internal reliability (α =.85 to .89) for the modified subscales (Okun, et al., 2003). The wording used to assess social support was modified to explicitly include online forms of communication. Specifically, participants were asked how often in the past six weeks they had experienced certain social interactions with friends (e.g., made plans for exercising) including "friends on Facebook or other members of groups you have joined on Facebook." Each subscale consisted of 4 items and 5 response levels ranging from "never" to "very often." Subscale scores were

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calculated by taking the mean of the individual items such that higher scores indicated greater perceived social support.

Several scale instruments developed and validated in previous studies examining the TPB in the physical activity domain were used to measure attitude, intention and perceived behavioral control (Rhodes & Courneya, 2005; Rhodes, Blanchard, & Matheson, 2006; Rhodes & Courneya, 2003).

A 6 item, 7-point bipolar adjective scale was used to measure exercise attitude. Adjective choices were prefaced with the statement, "For me, exercising regularly over the next 2 weeks would be…" followed by three items each for affective attitude (enjoyable-unenjoyable, interesting-boring, relaxing-stressful) and instrumental attitude (useful-useless, wise-foolish, beneficial-harmful). These dimensions of attitude have exhibited discriminant validity in previous studies (Rhodes, et al., 2006; Rhodes & Courneya, 2003). The current study used a single summed score, however, based on a study with undergraduate students that found no difference in predictive discriminant validity when summing all items (Rhodes & Courneya, 2003).

Intention was measured with two items. Participants were presented with the statements: " I intend to exercise regularly over the next 2 weeks" and " I plan to exercise regularly over the next 2 weeks" and asked to rate them on a 7-point scale (strongly disagree-strongly agree).

Three items were used to measure perceived behavioral control: (1) "How much personal control do you feel you have over exercising regularly in the next 2 weeks?" (very little control-complete control); (2) "How confident are you over the next 2 weeks that you could exercise regularly if you wanted to do so?" (very unconfident-very confident); and (3) "How much I exercise regularly over the next 2 weeks is completely up to me." Responses were measured on a 7-point scale (strongly disagree-strongly agree).

Physical activity was measured using a version of the Paffenbarger activity questionnaire adapted for online use (Paffenbarger, et al., 1995). This measure asks participants to report the amount of time spent walking, climbing stairs, and recreational activities engaged in over the past week. Total kilocalories are estimated based on the intensity and amount of time spent for each activity. This scale has demonstrated adequate reliability and predictive validity in previous studies (Pereira, et al., 1997).

Data Analysis.

Differences at baseline between participants who did and did not complete post intervention measures were examined using non-parametric tests and independent t-tests. The path analysis model was estimated with full information maximum likelihood procedures to account for missing data at follow up. Confirmatory factor analyses were estimated using weighted least squares with robust standard errors and means for categorical data. Mplus, version 6.11, was used for both path and confirmatory factor analyses. All other data analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 19).

Model Fit.

Model fit was assessed using several fit indices including the chi-square test statistic, the comparative fit index (CFI), and the root mean squared error of approximation (RMSEA). The chi-square test statistic was considered a reliable evaluation method based on the relatively small sample size used for this analysis. The CFI is an incremental fit index that compares the proposed model to a null model. The RMSEA is an absolute fit index and differs in that it assesses how well the model reproduces the sample data. Models were considered to have good fit if chi-square statistics were insignificant at the 0.05 level, if CFI values exceeded 0.95, and if RMSEA values were less than 0.06, based on standard cut off recommendations for relative fit indices (Hu & Bentler, 1999).

Model Specification.

Assessment of the overall model exploring the relationship between social support, TPB variables, and physical activity was performed in two steps. In the first step, confirmatory factor analysis was performed on modified measures used for social support subtypes. For these models, factor loadings and model fit were estimated for each social support subtype with indicators based on their respective scales items. Each factor was scaled by setting the unstandardized regression coefficient of one indicator to 1. In the second step, path analysis was performed using the means of all scale variables as observed variables to explore the relationships between social support, TPB constructs, and physical activity. A comprehensive structural equation model with latent variables was not used due to sample size and the resulting need for model parsimony. A preliminary model including group assignment found only a marginally significant relationship for one variable (PBC) and so group was not included as a predictor in the final model. Time 1 measures were included as predictors for the time 2 endogenous variables as a proxy for change, similar to methods used in multiple regression (Twisk, 2003). Time 2 measures of predictor variables were used instead of time 1 to capture values based on 10 weeks of study participation. The path model (Figure 5.3) was based on previously described studies examining the validity of the TPB in predicting physical activity and modifications to the theory to include social support. The model was designed to assess the magnitude and statistical significance of the relationships between perceived social support, attitude, and perceived behavioral control and physical activity, mediated by intention. In addition, the direct relationships between perceived behavioral control and social support and changes in physical activity were assessed.

V.C. Results

   Results include descriptive statistics for participant demographics and all study variables. The values and significance of parameter estimates and overall model fit and variance explained for path and confirmatory factor analyses are also presented.

Participants.

   Participants were predominately white (73%), non-Hispanic (92%), whose parents had attained college or higher-level education (79%). Participant attrition was 8% (n=11) at time 2 and 10% (n=14) at time 2a. There were no significant differences between the baseline demographic characteristics of participants who completed all study measures versus those who did not.

Descriptive Statistics.

   Descriptive statistics are included in Table 5.1. All scale items exhibited good internal reliability at baseline (α = .81 - .91). Variables were screened for outliers and cases with scores greater than three standard deviations from the mean were examined for validity. Two cases were excluded from the path analysis due to extreme total physical activity values in excess of 12,000 kcals per week. Skewness and kurtosis values indicated that variables were sufficiently normally distributed and a linear relationship between variables was found upon examination of partial plots from relevant regression equations. VIF values calculated using multiple regression procedures did not indicate extreme multi-collinearity among variables in the analysis. Table 5.2 presents inter-correlations for all variables included in the path model.

Confirmatory Factor Analysis.

   The three subscales for social support; information, esteem, and companionship were analyzed at baseline using confirmatory factor analysis. Models for information and companionship subscales indicated good fit with the exception of the RMSEA statistic for

companionship. [Information: χ^2 (2, N=134)=1.26, p=.53, CFI = 1.00, RMSEA = .00,

Companionship: χ^2 (2, N=134)=3.69, p=.16, CFI = .99, RMSEA = .08] The esteem

subscale only met the CFI criteria for good fit, χ^2 (2, N=134)= 16.03, p<.01, CFI = .98,

RMSEA = .23. Based on modification indices, a second model for esteem support that

correlated the errors between two indicators yielded an improved fit. [χ^2 (1, N=134)=.18,

p=.68, CFI = 1.00, RMSEA = .00] Standardized factor loadings for each subscale are

included in Table 5.3. All loadings were in excess of .80 with the exception of one

indicator for esteem social support.

Path Analysis.

Standardized parameter estimates for the model are included in Figure 5.3.

Twelve cases from the sample were excluded from the path analysis due to missing

values on predictor variables in addition to the two excluded for extreme kcal per week

values. Overall fit for the path model was good. [χ^2 (3, N=120)=.47, p=.93, CFI = 1.00,

RMSEA = .00] The model explained 39% of the variance in physical activity at time 2a

and 67% of the variance in intention at time 2. (R^2 = .39, .67 respectively) As expected

for self-report measures taken at two time points, there were significant positive

relationships between pre and post intention and physical activity measures.

Significant predictors of physical activity intention at time 2 controlling for

intention at time 1 included time 2 perceived behavioral control, attitude, and

companionship social support. The only significant predictor of time 2a physical activity

controlling for time 1 physical activity was time 2 intention. No significant relationships

between information or esteem social support and other variables were found in the

model. Significant, indirect effects on time 2a physical activity via intention were found

for perceived behavioral control (.13, p<.01), attitude (.10, p<.01), and companionship

support (.09, p=.02).

V.D. Discussion

The primary purpose of this study was to evaluate the predictive ability of a modified TPB model that replaced subjective norms with multiple social support types and that assessed changes over time. By using path analysis and CFA, we were able to assess the strength and significance of theoretically predicted pathways in the model, overall model fit, and the proportion of variation explained in intention and physical activity.

Overall, our modified model of the TPB exhibited good fit by standard indices. This model was successful in explaining a significant amount of the variance in physical activity and physical activity intention. The current model explained more of the variance in intention and less of the variance in physical activity than values reported by Rhodes et al. (2002) A direct comparison, however, is difficult given the differences between the models used, especially the inclusion of baseline values as predictors in the current study, which accounts for a significant portion of the model's explanatory power.

The results of this study support the primacy of the relationship between intention and behavior predicted by the TPB. Intention was the strongest and sole significant predictor of physical activity in our model when controlling for baseline physical activity, which is consistent with meta-analyses that have found either a weaker or non-significant relationship between perceived behavioral control and exercise when controlling for intention (Downs & Hausenblas, 2005; Hagger, et al., 2002). In the TPB model, greater actual control over performing a behavior is theorized to reduce the direct effect of perceived behavioral control on that behavior (Ajzen, 1991). For instance, access to a gym would increase the actual control an individual has over participating in a group aerobics class. In this case, perceived behavioral control over participating in the class does not have as direct an effect on participation because the perceived behavioral control – physical activity relationship is more fully mediated by intention. It is

possible that for the cohort enrolled in the INSHAPE study, their actual control was high, given that they have free and full access to on campus physical activity resources such as gyms and may have few environmental barriers to physical activity. Both perceived behavioral control and attitude were strong significant predictors of intention in our model. This pattern is consistent with previous meta-analyses of the TPB examining the prediction of physical activity intention and several studies examining social support in a modified TPB framework (Courneya, et al., 2000; Downs & Hausenblas, 2005; Hagger, et al., 2002; Okun, et al., 2003; Rhodes, et al., 2002; Saunders, et al., 2004). In the current model, the perceived behavioral control-intention relationship was stronger than attitude-intention. The relative strength of these constructs in predicting intention has been debated and previous studies, including those examining social support within the TPB framework, have found mixed results (Courneya, et al., 2000; Downs & Hausenblas, 2005; Okun, et al., 2003; Rhodes, et al., 2002; Saunders, et al., 2004).

Contrary to other studies examining the relationship between social support and physical activity in a modified TPB framework, none of the social support constructs in our model were a significant direct predictor of physical activity (Rhodes, et al., 2002; Saunders, et al., 2004). The only study that has previously looked at this direct relationship with the subtypes of social support used in the current study (informational, esteem, and companionship support) found a significant relationship between esteem social support and total and strenuous exercise and surprisingly a negative relationship between companionship support and strenuous exercise (Okun, et al., 2003). Our examination of the social support intention relationship revealed a significant relationship between intention and companionship support, but not information or esteem support. This contrasts with Okun et al. (2003), who reported no significant relationships between any social support variables and intention in regression analysis. The social support intention relationship does have prior support, however, in several other studies with

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varying measures of the social support construct, reinforcing the idea that social support influences physical activity behavior through greater intention (Courneya, et al., 2000; Rhodes, et al., 2002; Saunders, et al., 2004).

A possible explanation for a mediated but not a direct effect of companionship support on physical activity in the current study is that it might be a reflection of the level of volitional control over participating in physical activity among this study's participants. Because social support implies assistance, if it is largely perceived but not received in a tangible sense, and the support does not address actual barriers to physical activity outside the control of the individual, this perception might influence physical activity but only through increased intention. Because this study, unlike previous studies, explicitly included measurement of online forms of support, the support may have been less acted upon. In other words, participants may have discussed getting together with each other on Facebook but not followed through. This may have increased physical activity behavior by increasing the participants' intentions overall for physical activity but not had a direct effect, such as actually working out with a person.

The effects of informational support on physical activity were non-significant and had the smallest magnitude of all the social support types. This is consistent with previous findings examining informational support (Chogahara, 1999; Okun, et al., 2003).

The stronger influence of companionship support in comparison with esteem support in the current study conflicts with the results of several studies (Chogahara, 1999; Duncan & McAuley, 1993; Okun, et al., 2003). Two of the prior studies were conducted in an older population, and it is possible that college undergraduate students are more dependent on companionship with friends at this stage in their lives. Another possible explanation is the difference between studies in the participants' stage of change for physical activity. Stage of change theories hypothesize that individuals can

be at distinctly different stages in their progression to performing a health behavior

(Prochaska & Velicer, 1997). For instance, a person in the pre-contemplation phase is

not performing the behavior and does not intend to. In later stages, the person is more

prepared for taking action or is attempting to maintain the behavior. Differences in the

ability of TPB and social support constructs to predict different stage changes have been

found, indicating that some constructs might be more important in moving individuals

between earlier stages than later stages (Courneya, Plotnikoff, Hotz, & Birkett, 2001). It

is possible that because the INSHAPE cohort joined a physical activity study they may

be at a later stage of behavior change than survey participants in a cross sectional

study. Companionship may be a more important influence for individuals in a later stage

who are ready to join others for physical activity.

The study has several strengths including the use of multiple types of social

support and longitudinal data. In addition, the measure of perceived social support in this

study explicitly included support experienced online through the use of online social

networks, such as Facebook. Limitations of the current study include the use of a self-

report measure of physical activity, which is subject to bias and considered less

desirable than more objective measures. In addition, the sample size available for this

analysis limited the complexity of the model, reduced the power to detect significant

relationships, and did not allow for the testing of multiple models on subsamples.

Despite this, the model agreed largely with predictions derived from the TPB. The

generalizability of this study is also limited demographically and because participants

were motivated to join a study designed to increase their physical activity. It may be that

a sample of less motivated individuals would not be influenced in the same ways.

Conclusion.

This study suggests that companionship support is important among college-

aged women who are motivated to be physically active. Therefore, strategies that link

individuals with others to exercise together should be emphasized in physical activity interventions among this population.

Informational support had little influence in the current study on physical activity, similar to previous research. Because much of this research has been conducted in young, educated populations, future interventions conducted with similar populations expected to already have physical activity knowledge should not emphasize this type of social support.

Esteem support did not have a significant direct or indirect relationship with physical activity in this study. Despite this, results from previous studies and the magnitude of the direct relationship in this study suggest that future research should include esteem support to clarify its contribution.

Table 5.1. Descriptive statistics for physical activity, social support, and TPB variables.

	n	Mean	Std. Deviation	Skewness	Kurtosis
CFA					
Informational Support Time 1	134	1.76	.83	1.14	.56
Esteem Support Time 1	134	1.84	.79	1.12	1.39
Companionship Support Time 1	134	2.18	.94	.50	-.42
Path Analysis					
Physical Activity – Time 1	120	1676.48	1151.72	1.11	2.54
Physical Activity – Time 2a	118	2318.16	1493.10	.84	.48
Attitude Time 2	120	5.79	.98	-.81	.14
Intention Time 1	120	5.18	1.42	-.62	-.28
Intention Time 2	120	5.09	1.55	-.82	-.13
Perceived Behavioral Control Time 2	120	5.18	1.34	-.79	-.06
Informational Support Time 2	120	1.90	.79	.70	-.39
Esteem Support Time 2	120	2.23	.90	.27	-.77
Companionship Support Time 2	120	2.51	1.05	.07	-1.10

Table 5.2. Estimated correlations among path model variables.

	1	2	3	4	5	6	7	8	9
1. PA T1	1.00								
2. PA T2a	.39**	1.00							
3. Attitude T2	.09	.22*	1.00						
4. Intent T1	.23*	.22*	.26**	1.00					
5. Intent T2	.17	.47**	.58**	.35**	1.00				
6. PBC T2	.15	.22*	.38**	.20*	.63**	1.00			
7. Info T2	-.20*	.09	.21*	.11	.32**	.29**	1.00		
8. Esteem T2	.02	.39**	.27**	.15	.55**	.38**	.57**	1.00	
9. Comp T2	.01	.41**	.25**	.11	.51**	.22*	.47**	.72**	1.00

** $p < 0.01$

* $p < 0.05$

PA = physical activity, Intent = intention to exercise, PBC = perceived behavioral control,

Info = informational support, Esteem = esteem support, Comp = companionship support

Table 5.3. Factor loadings for perceived companionship, esteem, and informational social support scales

Question Item	Factor Loading
The questions asked were, "During the past 6 weeks, how often have your friends ..."	
Informational Support	
Informed you about the expected positive effects of exercise on your health?	.84
Explained to you why exercise is important to improve your health?	.98
Clarified for you how you may achieve your health goals through exercise?	.92
Explained to you about the amount or intensity of exercise necessary for improving your health?	.85
Esteem Support	
Affirmed that you have done well in your physical activity?	.82
Told you that you should be proud of your physical activity skills?	.90
Praised you for starting or sticking with your exercise program?	.53
Complimented your mastery of a physical activity skill?	.90
Companionship Support	
Made plans with you for exercising together?	.90
Teamed up with you to exercise together?	.99
Given you helpful reminders to exercise together with them?	.88
Changed their schedules so you could exercise together?	.85

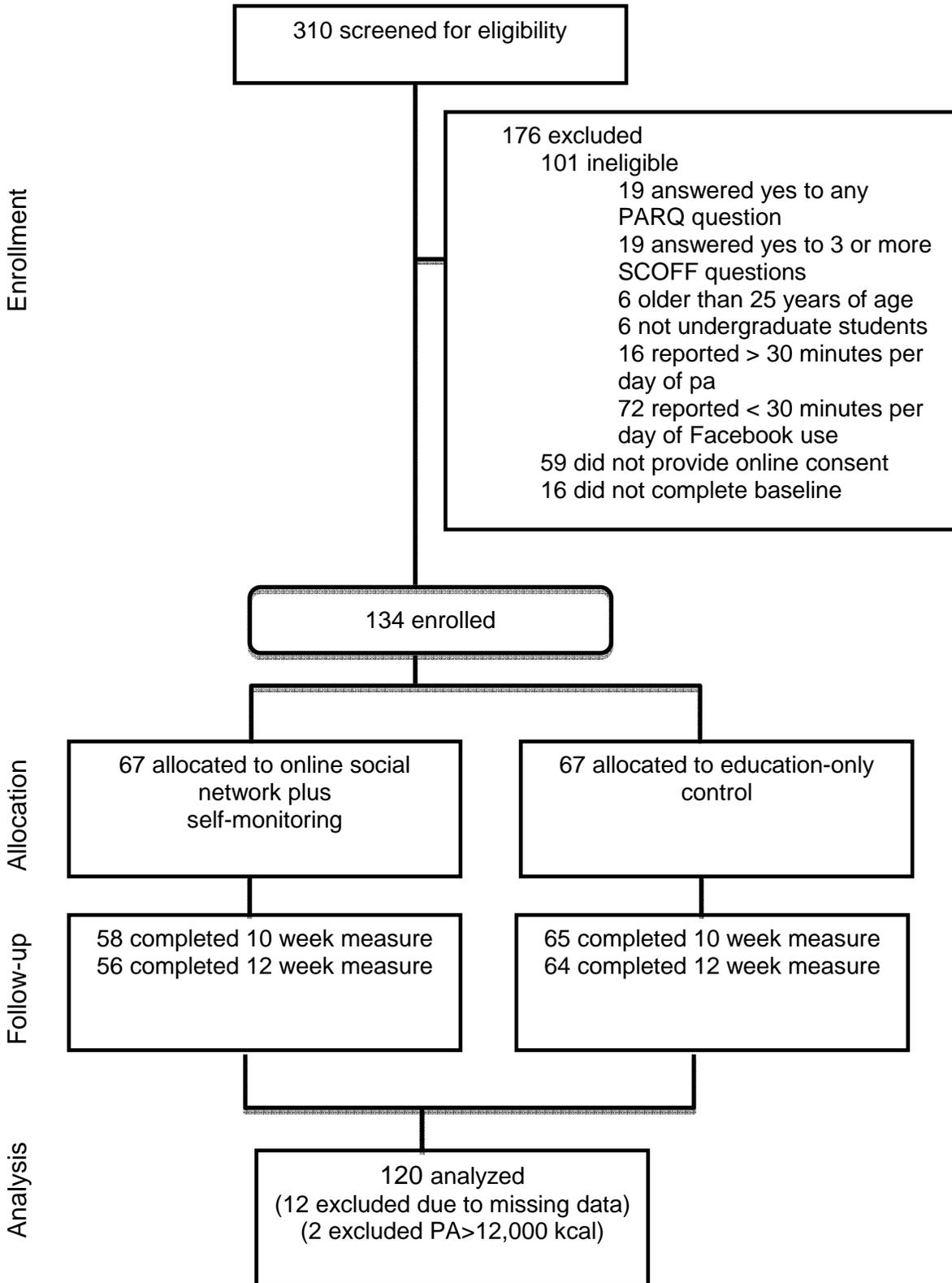Figure 5.1. CONSORT diagram showing flow of participants through trial

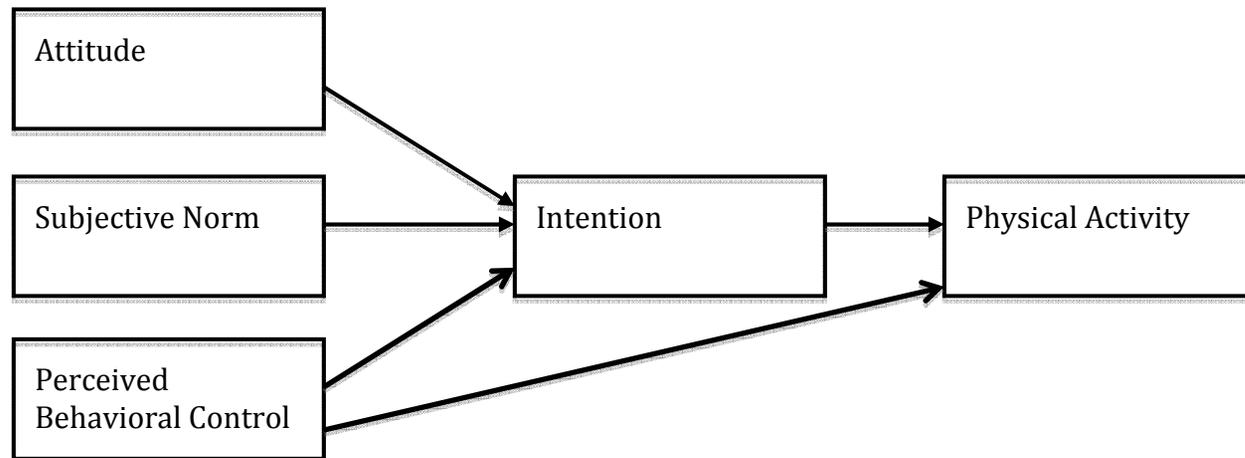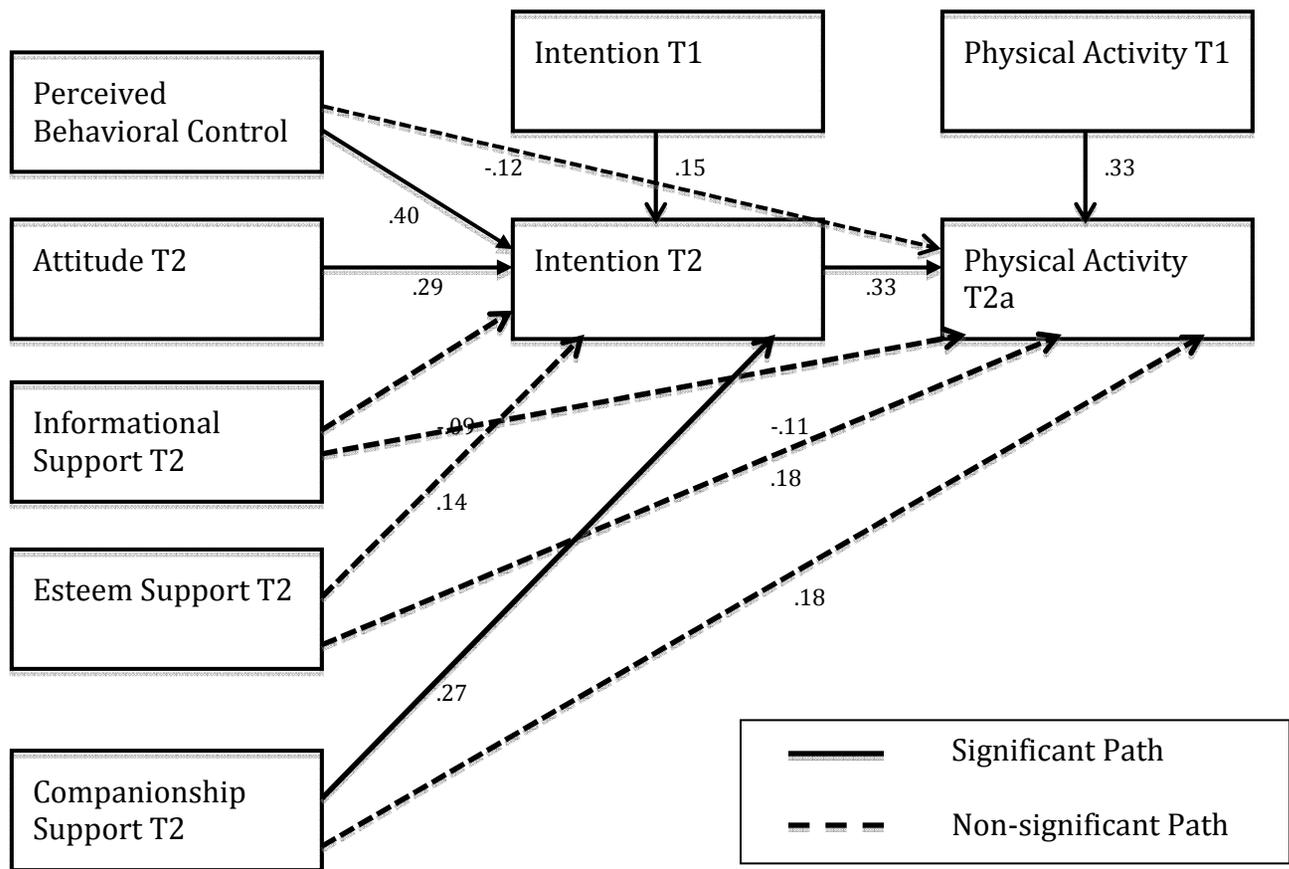Figure 5.2. The Theory of Planned Behavior (Ajzen, 1991)

Figure 5.3. Model of the relationship between social support and theory of planned behavior constructs

CHAPTER VI

A MIXED METHODS ANALYSIS OF SOCIAL SUPPORT FOR PHYSICAL ACTIVITY
EXCHANGED IN AN ONLINE SOCIAL NETWORK

VI.A. Introduction

Social support is a well-established correlate with greater physical activity
(Sherwood & Jeffery, 2000; Trost, et al., 2002; Van Der Horst, et al., 2007). Increasing
social support is also recommended for promoting physical activity in community settings
(Kahn, et al., 2002). Interventions targeting social support for physical activity have used
several strategies including group meetings and activities, encouraging participants to
elicit support from their existing social network, and recruiting small groups of friends
(Avila & Hovell, 1994; Perry, et al., 2007; Rovniak, et al., 2005; Simmons, et al., 1998;
Wing & Jeffery, 1999). A growing number of web-based health intervention studies have
applied these strategies using online bulletin board services, group chats, and facilitating
email communication between participants (Glasgow, et al., 2003; Gold, et al., 2007;
Harvey-Berino, Pintauro, Buzzell, et al., 2002; Harvey-Berino, et al., 2004; Harvey-
Berino, Pintauro, & Gold, 2002; Harvey-Berino, et al., 2010; Kim, et al., 2011; Kosma, et
al., 2005; McKay, et al., 2002; McKay, et al., 2001; Micco, et al., 2007; Richardson, et
al., 2010; Tate, et al., 2003; Tate, et al., 2006; Tate, et al., 2001). Online social networks,
such as Facebook, that incorporate social relationships, have extensive reach, and
include more advanced web 2.0 data generation and aggregation features, could
potentially enhance the social support components of web-based interventions targeting
physical activity behavior (Bennett & Glasgow, 2009; Buis, 2011).

An understanding of the types of social support that are exchanged in online social networks could help inform the design of online social network interventions. To our knowledge, only one intervention study in the published literature has examined the use of an online social network to change physical activity behavior and that was in the context of weight loss (Napolitano, et al., 2012). That study did not report on the specific types of social support interactions among participants. Health promotion studies targeting physical activity that have included more basic online social support components, such as bulletin boards, have rarely reported details about the types of social support interactions exchanged by participants other than the number of interactions (Kim, et al., 2011; Kosma, et al., 2005; McKay, et al., 2001). Two studies have reported more detailed descriptions of interactions among online communities focused on weight loss and walking and have found social support to be an important component (Hwang, et al., 2010; Resnick, et al., 2010). A detailed examination of what physical activity social support looks like in an online social network and how it is perceived, however, would make a useful contribution to this limited literature and aid in the design of interventions using online social networks.

Using data collected as part of the Internet Support for Healthy Associations Promoting Exercise (INSHAPE) randomized controlled trial, this paper uses a mixed methods approach to describe the frequency and types of physical activity social support exchanged through Facebook among female undergraduate students. (AJPM under review) It also examines perceptions of the receipt and provision of physical activity social support in online social networks.

VI.B. Methods

Data Sources.

This paper examines four sources of data collected as part of the INSHAPE trial: (1) structured interviews conducted prior to the intervention to inform its design; (2) post-

intervention structured interviews assessing participants' experiences in the intervention; (3) a survey administered to intervention participants to assess their participation and perceptions of the intervention; and (4) Facebook interactions collected during the intervention. Facebook interactions include those recorded in the Facebook group established for the intervention (group) and those recorded from participants' regular use of Facebook on their personal Facebook wall (non-group). A brief description of the trial as well as the recruitment, data collection, and data analysis methods for each data source are included in this section. All participants provided informed consent and the study was approved by the institutional review board at the participating university.

Description of the INSHAPE Trial.

INSHAPE was a randomized controlled trial designed to test the efficacy of using Facebook to increase perceived social support for physical activity. The primary hypothesis was that intervention group participants enrolled in a physical activity themed online social network combined with web based education and self-monitoring would exhibit greater changes in perceived social support for physical activity than those in an online education-only control group. INSHAPE materials and measures primarily used the term "exercise" and the intervention was designed to increase structured exercise. The broader phrase "physical activity" is used in the current manuscript to describe the intervention, however, because this broader phrase is more inclusive of potential interactions between participants, which were the primary mechanism of intervention delivery. Analysis of the trial outcomes found significant differences in physical activity and perceived social support for participants over time but not between groups (AJPM, under review).

As part of the intervention, participants were invited to join a Facebook group, whose purpose was to provide participants with a mechanism to exchange social support. Facebook is a widely used social networking website service that includes the

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ability to: maintain a public profile that includes personal information; post comments, web links, photos and video; communicate with other members via email and chat; indicate approval of content by hitting a "like" button; and create and manage groups based on topics of interest. (www.facebook.com) The Facebook group allowed participants to post comments to a common area (e.g., the group wall); respond to others' posts; create and post to discussion boards; and post web links, photographs, and videos. To encourage participation, participants received a maximum of one entry per week into a biweekly drawing for a $40 gift card for any number of posts made to the Facebook group in a given week. Participants were also asked upon joining the group to answer icebreaker questions on a discussion board including the types of exercise they were interested in and when and where they preferred to exercise. Participants were encouraged to post information related to their exercise efforts to their own Facebook wall or set up a group of friends in Facebook with whom they could share their experience in the program. The moderator's role in the group included answering technical questions about the study or responding to exercise related questions from participants posted on the group wall or received through email, but did not include direct social support to individual group members. Control group participants were provided access to a limited version of the INSHAPE website, which included only the educational materials described previously, such as exercise safety and recommendations, with no instructions regarding Facebook. Further description of the trial is available elsewhere (AJPM, under review).

Participant Recruitment.

Formative interview participants (n=15) were recruited using convenience sampling through flyers, email messages posted to the university listserv, snowball sampling wherein participants were asked to refer other participants, and direct referral of participants through study staff contacts. Interested participants completed an online

screener to determine their eligibility. Participant were considered eligible if they were currently enrolled female undergraduates between the ages of 18 and 25, reported less than 30 minutes of daily physical activity, and more than 30 minutes of daily use of Facebook.

Trial participants (n=134) were recruited through flyers, university listserv emails, Facebook and Twitter™ accounts affiliated with the university, and advertisements in the college newspaper. Interested participants completed an online screener to determine their eligibility. Participants were deemed eligible if they were currently enrolled female undergraduates at the University under the age of 25 years, reported less than 30 minutes of daily physical activity, and more than 30 minutes of daily use of Facebook. Participants were excluded if they answered yes to two or more questions on the SCOFF disordered eating questionnaire (Perry, et al., 2002). To identify participants with contraindications to an unstructured exercise program, participants were required to submit physician approval if they answered yes to one or more questions on the Physical Activity Readiness Questionnaire (Thomas, et al., 1992). None of the 19 individuals who screened positive on the PARQ submitted physician clearance, so they were ineligible to participate. A full description of participant recruitment for the trial is included in Figure 6.1.

A sample of intervention group participants (n=9) was recruited via email to participate in post-intervention structured interviews. A purposive sampling approach was taken in order to include participants with varying levels of participation in the Facebook group during the intervention.

Formative Interviews.

To inform the design of the INSHAPE trial, formative structured interviews were conducted. Participants completed a brief survey prior to the interview that included demographic questions and questions pertaining to their Facebook use. Interviews were

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conducted on campus using a structured interview guide. All interviews were recorded

and transcribed verbatim. The guide included questions pertaining to participants'

existing use of Facebook to exchange general social support as well as physical activity

social support and their perceptions about using Facebook as part of a program to

increase social support for physical activity. Participants received a $20 gift card upon

completion of the interview.

Facebook Interactions.

At enrollment, all trial participants were asked to "friend" a dedicated study

administrator Facebook account, which was established specifically for the study. This

allowed the administrator to record Facebook interactions related to physical activity

found on the individual Facebook walls (non-group) of both intervention and control

participants including responses to participant interactions from non-study participants.

The study administrator recorded these interactions manually on a daily basis during the

intervention including all comments and web links, discussion board posts, and

instances where participants hit the "like" button in response to content. In addition to

message content; source, receiver, originating message, and message type (e.g., wall

post, picture) were recorded for each interaction. Prior to data collection, a codebook

was developed with definitions and examples of physical activity related

communications. This codebook was tested on a sample of Facebook posts by two

coders and demonstrated adequate inter-rater agreement (κ = .94). Non-group

Facebook data was collected for the 130 participants who accepted the Facebook friend

invitation from the study moderator. In addition to physical activity related non-group

interactions, all interactions within the Facebook group were collected using the methods

described above for the 64 participants who joined the group.

Survey.

An online survey was administered to INSHAPE trial participants at the end of the twelve-week intervention using the Qualtrics survey program version 2009. Among trial participants, 120 (90%) completed the survey. This survey included questions about participants' experiences with Facebook interactions related to physical activity during the course of the intervention. Both intervention and control group participants received questions related to their non-group Facebook interactions. Additional questions related to Facebook group interactions were included for intervention participants. Survey questions focused on the frequency of Facebook interactions and participant attitudes about the interactions. For instance, participants were asked "During the past three months, how many times do you remember... receiving a post or comment about exercise on your Facebook wall," with answer choices ranging from "Never" to "Daily." Attitudes were assessed using Likert-type bipolar scale items. Participants were presented with statements such as "Over the past three months, I found Facebook comments about exercise from my friends to be..." and asked to rate them on multiple items (e.g., Not motivating at all – Very motivating). Questions assessing attitudes about the use of different types of interactions were only administered to participants who indicated they had used that interaction during the study. (n = 23-74)

Process Interviews.

Process interviews were conducted on campus using a structured interview guide. All interviews were recorded and transcribed verbatim. The guide included questions pertaining to participants' use of and perceptions of exchanging physical activity social support through Facebook. Participants received a $20 gift card upon completion of the interview.

Data Analysis.

Formative and Process Interviews.

An initial codebook was developed using deductive codes based on questions asked in the interview guides and inductive codes developed from a review of interview transcripts. A trained second coder then reviewed the interview guides, transcripts, and draft codebook. The two coders then met to discuss and modify the codebook by collapsing similar codes, clarifying definitions, and adding new codes not included in the initial codebook. This codebook was then used to code a small sample of transcripts by both coders, who subsequently met to discuss and make appropriate changes to the codebook based on this sample. The remaining interviews were double coded iteratively with periodic meetings between coders to reconcile coding. Disagreements in coding were resolved by discussion and mutual agreement. All coding and analysis was performed using Atlas Ti version 6.2.

Survey.

Survey data were analyzed using SPSS version 19. Due to sample size, we focus on key trends and themes from the data instead of statistical comparisons. For questions pertaining to attitudes, means are presented and percentages are reported for questions pertaining to frequency of use.

Facebook Interactions.

Facebook interactions were analyzed qualitatively and quantitatively. Qualitative analysis was performed as described previously for interviews using a separate codebook specific to Facebook interactions. Deductive codes were developed based on three social support dimensions used in previous studies; companionship support, informational support, and esteem support (Chogahara, 1999; Okun, et al., 2003). Companionship support has been defined as "partnership assistance that suggests, "'we participate together'"; informational support as "knowledge assistance that suggests,

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"'you should know'"; and esteem support as "esteem information provision that suggests,

"'you are good.'" Additional inductive codes were developed from a review of Facebook

interactions. Based on qualitative analysis, Facebook interactions were coded with

specific social support types and combined with other codes (e.g., sender, receiver,

communication type) to create a data table for quantitative analysis. Using these data,

we examined the frequency and types of physical activity social support Facebook

interactions.

VI.C. Results

Participants.

Detailed characteristics of interview and survey participants are included in Table

6.1. Participants were predominately white, non-Hispanic, whose parents had a greater

than high school education.

Formative and Process Interviews.

Results for formative and process interviews have been synthesized and are

presented together. A description of more general social support exchanged in online

social networks is included to provide some context to the findings related to physical

activity social support.

Characteristics of General Social Support Exchange in Facebook.

Interview participants described a number of instances where social support is

exchanged using Facebook. The majority of these instances were related to the sharing

of experiences and attitudes, both positive and negative, and reactions to those

communications.

> *"I'll see people all the time like encouraging people like 'oh you did really well.'*
> *Like people will complain,'oh I'm so stressed about this,' and people will be like,*
> *'oh you'll be fine. Like you'll be okay.'"*

In some cases receiving support related to more serious situations such as dealing with the death of a friend or family member was described. Whether or not Facebook was used to exchange support and the type of communication used was a function of several factors. The first factor is the seriousness of the situation that precipitated the need for social support. In general, private forms of communication, such as chat or messaging, are used for more serious issues (e.g., problems in relationships). Communications posted in more public forums, such as on the Facebook wall, are more likely to be positive and in cases where a negative item or attitude was posted, it is most likely something general and not serious (e.g., "I am having a stressful week."). Sometimes support would move from one type of communication to another.

> *"Yeah, I like to respond [to a Facebook post] especially when someone's feeling down because I like to respond and be like 'everything will be ok' and that 'if you need to talk you can call or text me…'"*

A second factor determining social support exchange is the nature of a participant's Facebook friends. Many participants described having a large number of Facebook friends, many whom they are not close to. That many of their Facebook network were not considered close friends was repeatedly cited as a reason that more personal or sensitive issues are not disclosed in more public forums. In addition, responding with social support is more likely if the person is a close friend. Participants liked receiving support but generally negative feelings were expressed about individuals who disclosed information that was too personal.

> *"But if it's somebody that like friend requested me that I haven't seen since fourth grade, which does happen all the time, I mean that's like the majority of my Facebook friends are people that I haven't talked to in years, like I really don't feel like I have a place to like communicate with them. (Laughs) You know…which is one of the reasons that I feel like it's so strange that they're gonna tell me how they are feeling about their day, cause I, I wouldn't feel like*

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that's my business knowing how they're doing."

Exchange of Physical Activity Social Support in Facebook.

Reports of physical activity social support were rare compared to other types of

support but several participants described receiving informational, esteem, and

companionship social support for physical activity through non-group Facebook

interactions. For instance, participants described using Facebook as a tool to

communicate about exercising together.

> *"… with my climbing partner, we used a lot of text messages and I think
> Facebook as well, like Facebook messages to just try to like keep in touch and
> touch base on like when we would be going to the gym together and if there was
> anything that came up for the week…"*

They also reported receiving compliments about exercising and physical activity

information.

> *"Well I love using my Facebook status, so sometimes I'll write that I'm either
> going to walk or possibly going to the gym…. So, I'll have people comment you
> know 'good job,', or, 'you know, this is something you can try…', different things
> like that. My friends definitely offer a lot of advice and encouragement and even
> like some people just send like news articles, like they'll post it in a note or
> something or send it out to people."*

Privacy and personal familiarity also emerged as moderators of engaging in the

exchange of support in Facebook about physical activity. Although several individuals

felt comfortable sharing physical activity related information with their entire Facebook

friend list, many said they would be more likely to do so with close friends or in a private

group.

> *"I feel like if it was like the small support group that I would be completely fine
> with doing it [posting physical activity goal and tracking information], I think it*

would take me a little bit more time to warm up to doing it with people that I don't necessarily know."

"To me a workout program is something I'm like not sure that I would stick with or maybe I would stick with it but it's about like weight loss and like body image so like maybe I wouldn't post a status about it. If it were me personally trying to go about like getting support for a Facebook, I mean for an exercise program I was starting I might like send a message and be like 'here's, hey guys here's what I'm doing like here's what you guys could do for me.'

In addition, many participants indicated that having some prior social contact

offline would facilitate meeting up with other group members to exercise.

"I think that's where like it's important like your role, or like this end of it. I think if you want that to happen [participants exercising together] as part of this whole thing then maybe do, I don't know if it's feasible, but maybe meet in person at some point just to get that, some kind of ice breaker thing, just to get it out there, like 'hey these are some of the people lets kind of get rid of some of the awkwardness'. And then they could probably get to that next level of exercising with each other."

Facebook Interactions.

Excluding the moderator's contributions, 775 physical activity related Facebook

interactions were recorded over a 12-week period (259 group, 516 non-group). Of the

group posts, 48% were in response to a post from the moderator. The most popular

communication types for Facebook group interactions were responses to discussion

board posts (31%), posting to the group wall (28%), responding to group posts (23%),

and hitting the like button (16%). The majority of discussion board posts were responses

to an icebreaker question posted by the study moderator at the beginning of the

intervention. The most popular non-group interactions included hitting the like button

(34%), posts to another user's wall (20%), status posts (14%), and responses to status

posts (14%). Responses to originating posts made up 64% of the total interactions with a

mean of 1.46 (range 0-52) responses per post. No discernible pattern emerged with regard to what types of originating communications generated the greatest response.

Approximately one fifth (22%) of the interactions were coded as one or more of three types of social support (companionship, esteem, informational). The most common type of social support was companionship (107 interactions) followed by information (51) and esteem (23). Companionship support usually took the form of friends connecting up to participate in exercise together:

> *"lol i was JUST about to text yu becuz i was rethinking that double zumbaa....we can hit that hip hop hustle tomm if u want :-)"*

> *"… defying spring daylight savings time and getting up earlier than usual! Gym at 9 anyone? :-)"*

Informational support consisted primarily of the exchange of information related to how, when and where to exercise. Many group posts also addressed how participants were overcoming barriers.

> *"if any of you like to dance, i really recommend the cardio funk class at the src on thursdays at 3:30! i was sweating so hard but i felt amazing afterwards :)"*

> *"You should try something less intense, as [Name] suggested. Try taking a yoga class, or pick up a yoga dvd to use in your room. I found one at Target for less than $10!"*

> *"I've found it to be easier to stick with my goals if I participate in a class on a regular basis."*

Esteem support was expressed between individuals and in some cases directed toward the Facebook group at large:

"SO proud of you! You should probs just go ahead and run the half marathon with us in a few weeks…"

"So everytime I see an updated status you are working out. Yayy!"

"I definitely haven't been meeting the exercise goals or improvements, but I do think it's great and truly motivating to see that the group averages have increased!"

Although companionship support was the most common type among all interactions, there were significant differences between the composition of group and non-group interactions. Participants posted more companionship support than informational support to their own Facebook network (16.1% vs. 9.3%, χ^2 = 6.74, *p* < .01). In contrast, participants offered less companionship support than information support within the Facebook group (3.9% vs. 12.0%, χ^2 = 18.37, *p* < .001).

Survey Results.

Participants' use of Facebook to communicate about exercise is described in Figure 6.2. In general, for most Facebook communications modalities, the majority of participants reported communicating about exercise at least once during the past three months but the frequency was no more than once a month. Some respondents reported interacting about exercise using Facebook more frequently with the most prevalent communication type being receipt of a Facebook message related to exercise. Participants' rankings about how motivating, supportive, and informative different exercise communications were over the past three months are included in Table 6.2. Participants reported Facebook comments posted by their friends to be the most motivating category of exercise interaction. The most informative Facebook interactions reported were those that participants experienced in the intervention, which scored higher than those experienced by individuals through their own Facebook use. Facebook

comments, both those on the group wall and on participants' walls scored highest on supportiveness. In all three categories, the means for all interaction types were similar and close to average.

VI.D. Discussion

The primary purpose of this study was to describe the characteristics of social support for physical activity that are exchanged through Facebook. This study demonstrates that important types of physical activity social support are exchanged in the regular use of online social networks and can also be facilitated using an online social network group dedicated to social support exchange.

Although many interview participants could not provide examples of physical activity social support, objective data from Facebook interactions revealed that even in a small sample of young women in a short period, there were a substantial number of social support interactions. In cases where interview participants described physical activity social support, they reported finding it helpful. The INSHAPE Facebook group was also successful in facilitating important types of social support. This is consistent with previous studies examining interactions in online support communities with online social network features, where participants reported being motivated and encouraged by other members' contributions (Hwang, et al., 2010; Resnick, et al., 2010).

Companionship support interactions through Facebook were the most prevalent type recorded in the study. Other studies examining the influence of offline social support on physical activity, however, have found esteem support to be more strongly associated with or predictive of physical activity than companionship support (Chogahara, 1999; Duncan & McAuley, 1993; Okun, et al., 2003). One of these studies was in an older population, however, and it may be that young women in a college setting have greater opportunities for joining each other for physical activity or see the

social aspects of physical activity as more important. It may also be the case that esteem support is not exchanged through online social networks as readily.

Participants found Facebook comments related to physical activity through group and non-group interactions to be the most motivating and supportive types of communications. Given that many participants reported being more likely to exchange support through more private communication types, this is surprising as higher ratings for messaging would be expected. It may be that more casual and less emotional types of physical activity support, such as planning to exercise, are not subject to participants' concerns about privacy as much as sharing difficulties or other issue about trying to participate in physical activity.

Differences between the type of group and non-group interactions most likely resulted from the intervention design. Posts from the moderator specifically encouraged participants to exchange information about physical activity. Although a discussion board was also set up to provide a place for participants to join each other for physical activity, it was not very successful. Because most intervention group members did not know each other prior to the start of the study, the relatively low level of companionship support in the group may be explained by participants' preference for being with existing friends for physical activity. This preference is also consistent with higher ratings reported for motivation and supportiveness for friend comments versus group comments.

To our knowledge, this is the first study to examine the content of social support exchanges related to physical activity in an online social network. By using a mixed methods approach, we were able to explore the research question using multiple sources of data including surveys, interviews, and interaction content collected directly from Facebook. This study has several limitations. Incentives provided for posting in the Facebook group were reported as a significant motivation for many participants to

contribute and this should be taken into consideration when evaluating the content and frequency of group interactions. The sample used was limited in terms of range in age, race, parent education, ethnicity, and gender. Participants also self-selected into a health promotion intervention to increase their physical activity. As a result, their levels of motivation to exchange social support for physical activity may be greater than the general population they represent. Certain types of Facebook communications, such as messaging and chat, are private and could only be assessed by self-report.

This study has implications for the design of physical activity interventions using online social networks. Although our findings reveal that valuable types of social support are exchanged in online social networks, results from the INSHAPE trial did not find that enrollment in the Facebook group increased social support or physical activity compared to education controls. This indicates that future interventions may need to increase the dose and fidelity of social support interactions. Findings related to the exchange of social support and the level of familiarity between participants in the current study suggest that this may be partially accomplished by enrolling participants who are already friends. Online social networks are particularly appropriate in this regard because their function is primarily to allow participants to articulate and share information with their existing social network (boyd & Ellison, 2007). Further research in this area should focus on more diverse populations and attempt to collect objective data on private communication types such as messaging and chat.

Table 6.1. Participant Characteristics

	Survey (n=120)		Formative Interviews (n=15)	Process Interviews (n=9)
Grade, No. (%)				
Freshman	10	(8.3)	4	2
Sophomore	24	(20.0)	3	2
Junior	28	(23.3)	7	2
Senior	57	(47.5)	1	3
Other	1	(0.8)	0	
White, No. (%)	87	(72.5)	7	5
Not Hispanic or Latino, No. (%)	111	(92.5)	15	8
Parent Education College or More, No. (%)	95	(79.2)	11	8

Table 6.2. Participants' attitudes toward physical activity Facebook interactions

Measure	n	Mean	SD
Not at all motivating = 1, Very motivating = 7			
Over the past three months, I found Facebook comments about exercise from my friends to be...	63	4.67	1.40
During this study, I found viewing comments posted to the INSHAPE group wall to be…	56	4.41	1.73
Over the past three months, I found Facebook messages I received about exercise from my friends to be…	74	4.34	1.53
During this study, I found participating in exercise with other INSHAPE group members to be…	23	4.30	1.94
During this study, I found links posted by other INSHAPE group members to be…	56	4.18	1.71
Not at all informative = 1, Very informative = 7			
During this study, I found viewing comments posted to the INSHAPE group wall to be…	56	4.68	1.75
During this study, I found links posted by other INSHAPE group members to be…	56	4.46	1.64
Over the past three months, I found Facebook comments about exercise from my friends to be…	63	3.98	1.54
Over the past three months, I found Facebook messages I received about exercise from my friends to be…	74	3.81	1.50
Over the past three months, I found Facebook chat I participated in about exercise to be…	59	3.73	1.60

Not supportive at all = 1, Very supportive = 7

Over the past three months, I found Facebook comments about exercise from my friends to be...	63	4.75	1.43
During this study, I found viewing comments posted to the INSHAPE group wall to be…	56	4.68	1.82
Over the past three months, I found Facebook chat I participated in about exercise to be...	60	4.55	1.51
Over the past three months, I found Facebook messages I received about exercise from my friends to be…	74	4.50	1.55
During this study, I found participating in exercise with other INSHAPE group members to be…	23	4.43	1.97
During this study, I found links posted by other INSHAPE group members to be…	56	4.30	1.67

Figure 6.1. CONSORT diagram showing flow of participants through trial


```
                    ┌─────────────────────────────────────┐
                    │     310 screened for eligibility     │
                    └─────────────────────────────────────┘
```

Enrollment	**176 excluded**
	    101 ineligible
	        19 answered yes to any PARQ question (0 provided Dr. clearance)
	        19 answered yes to 3 or more SCOFF questions
	        6 older than 25 years of age
	        6 not undergraduate students
	        16 reported > 30 minutes per day of physical activity
	        72 reported < 30 minutes per day of Facebook use
	    59 did not provide online consent
	    16 did not complete baseline

134 enrolled

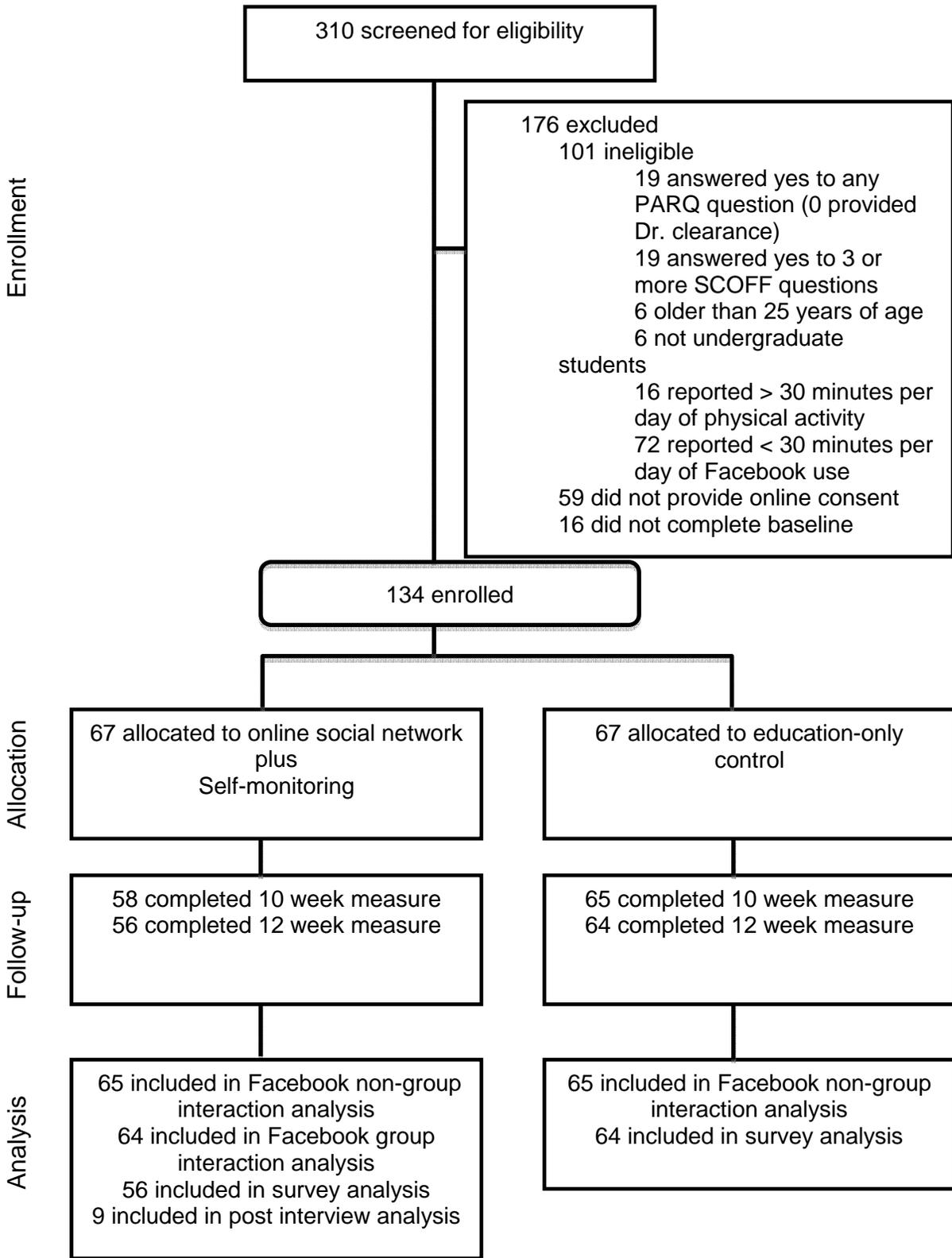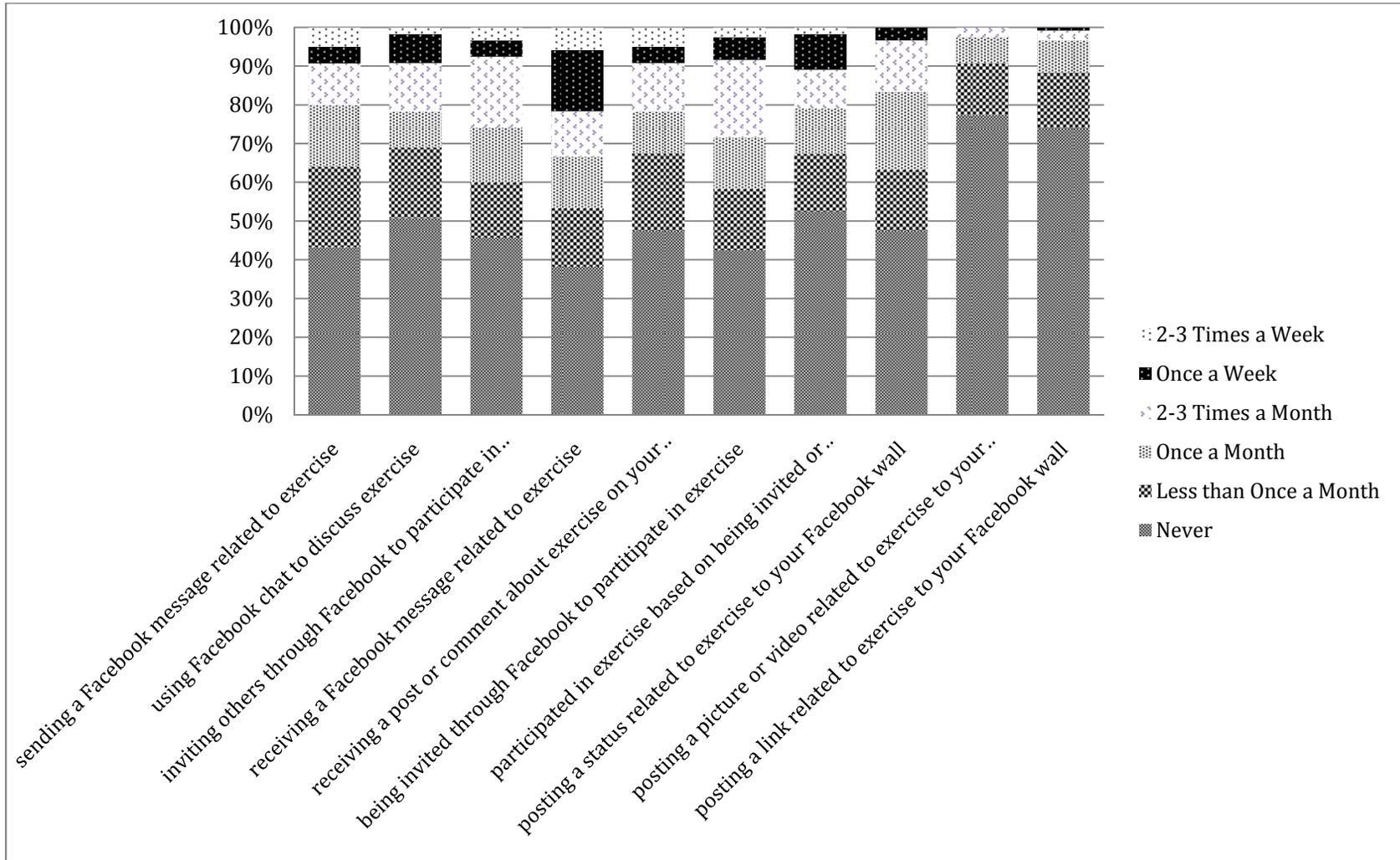|	
Allocation	67 allocated to online social network plus Self-monitoring
	67 allocated to education-only control
Follow-up	58 completed 10 week measure 56 completed 12 week measure
	65 completed 10 week measure 64 completed 12 week measure
Analysis	65 included in Facebook non-group interaction analysis 64 included in Facebook group interaction analysis 56 included in survey analysis 9 included in post interview analysis
	65 included in Facebook non-group interaction analysis 64 included in survey analysis

Figure 6.2. Frequency of Facebook interactions related to physical activity

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

VII.A. Summary of findings

The results of this study fail to establish the efficacy of an intervention primarily administered through an online social network to increase physical activity social support or physical activity. Participant use of and attitudes toward the intervention, however, suggest that online social networks may be a feasible means of delivering physical activity social support interventions. Additionally, this study elucidates the content of physical activity social support interactions in online social networks and adds to the understanding of how social support affects physical activity in an established theoretical framework. Taken together, this information can be used in the design of future health promotion efforts using online social networks.

In chapter 4, we reported the results of a randomized controlled trial testing the efficacy of an intervention combining a physical activity themed Facebook group and self-monitoring to increase physical activity social support versus education-only controls. The primary hypothesis was that physical activity social support would increase more in the Facebook plus self-monitoring group than education controls. However, there were no statistically significant differences between groups on social support or physical activity outcomes over the course of the intervention nor were moderation effects found for Facebook intensity, baseline social support, or participation. Process measures from this trial did find that participants were willing to join a physical activity themed online social network group and exchange social support. Participants also reported favorable attitudes toward the intervention. These findings are promising given

the reach of online social networks and the dissemination potential of using them in health interventions.

In chapter 5, we examined the theoretical relationship between social support and physical activity within a modified Theory of Planned Behavior framework. Three perceived social support scales (information, esteem, and companionship), that explicitly included online forms of support, were examined using confirmatory factor analysis and found to have good model fit. Analysis of these forms of social support and their relationship with physical activity intention and physical activity behavior found a significant, indirect effect of companionship social support on physical activity via intention. The remaining social support types did not have an indirect or direct effect on physical activity.

In chapter 6, we explored the content of and user perceptions of physical activity social support interactions exchanged in online social networks. Analysis of incentivized interactions within the physical activity themed Facebook group and non-incentivized interactions through individual's everyday use of Facebook revealed a substantial amount of physical activity social support. Consistent with the results presented in chapter five, companionship support was the most prevalent type exchanged among all interactions recorded. In the Facebook group dedicated to physical activity social support, however, there were more informational support messages. Interview participants described physical activity social support through Facebook as helpful and motivating.

VII.B. Recommendations

Although we did not find significant differences between groups over time on the primary outcomes of social support and physical activity as a result of this intervention, this research represents a meaningful step toward understanding how to use online social networks for physical activity promotion by elucidating participant behavior and

attitudes. Participant contributions to the Facebook group in this study were higher than those reported in the literature for other online support mechanisms and it is encouraging that important social support types were exchanged during the intervention and occur naturally within online social networks. Future research should, however, examine the effects of including incentives for contributing. In the event that incentives are an important influence on contributions, non-monetary alternatives that would be more practical for large-scale interventions should be developed.

The significant increases over time in physical activity and social support across participants in this trial could be the result of behavior that occurred as a result of enrollment in the study. It is possible that participants increased their physical activity in both groups as a result of their motivation to join the study and that increases in physical activity social support were a natural result. The relative increase from this phenomenon versus intervention effects may have also been large enough to reduce the power of the study to detect interaction effects. Other possible explanations for the main effects of this study are measurement reactivity, demand characteristics, or seasonal effects. Using more objective measures, such as accelerometers, and increasing sample size could improve future iterations of this research. It may also be helpful to include a measure that assesses online social support between groups instead of a social support measure that includes the combination of online and offline support.

Unlike the current study, some previous offline studies have been successful in increasing physical activity social support between intervention and control groups. In addition, comparisons of social support effect size changes between intervention groups in these studies and INSHAPE show that these interventions were comparatively more effective. This suggests that including strategies from these studies, such as incorporating existing networks and encouraging more structured interaction, may benefit future online social network based interventions.

Evidence from this study also supports the use of existing social networks to increase support. This is based on our findings related to the moderation of support exchange by personal familiarity and the primacy of companionship support. This could be accomplished by recruiting groups of friends into interventions or creating support groups for individual participants consisting of their existing friends.

An alternative approach may also be warranted based on evidence that health behaviors spread through networks. Participants with friends who do not participate in physical activity may find it difficult to solicit support from their existing network. In this case, matching participants without a prior relationship on their exercise preferences so that participants with similar schedules, exercise interests, and geographic location could join each other for physical activity could also be used to facilitate companionship support. Through the use of software applications within online social networks, both of these types of study designs could be easily automated. A comparison of these approaches is recommended in future research.

The results form this study did not support a predictive relationship between esteem support and physical activity. This is in contrast to previous studies that have found significant mediated relationships between esteem support and physical activity. Based on these conflicting results and the possibility that this relationship is moderated by an individual's stage of change, future studies should include esteem support strategies, especially in case where participants my be in an earlier stage of change. Within online social networks, applications could be developed that would provide participants easy ways of providing esteem support such as digital awards or gifts.

The effect of online social support components in increasing physical activity is difficult to ascertain. Most studies use multi-component intervention strategies, which do not isolate the effects of social support components. Although there is evidence that social support is associated with physical activity, the causal direction of this relationship

is difficult to assess. It may be the case that physical activity leads to greater physical activity social support or that social support and physical activity have a reciprocal relationship. The analysis in this study is not capable of addressing this issue of causality. More precise mediation analysis and isolation of social support components could help to clarify these issues in future studies.

This intervention employed an existing online social network and a stand-alone website for intervention delivery. Several participants reported in process interviews that delivering the intervention through a technology that is part of their customary online behavior encouraged them to participate and that they would have preferred the INSHAPE website be integrated into Facebook. Although using an existing, commercial online social network has disadvantages, such as lack of control over design change and data collection, we recommend that e-health researchers begin to adopt a model that tests existing technology versus developing expensive and quickly outdated platforms. This will require innovative study designs, such as engineering models based on testing rapid iterations of technology.

Several aspects of this study could have benefitted from having objective data collection directly from the online social network service. It is well known that much of the behavior in online groups consists of individuals who view group activities but do not contribute. In addition, several types of popular communication, such as chat and messaging, cannot be assessed through viewing more public exchanges such as group posts and individual wall posts. Having access to server data would assist in the assessment of these behaviors. Based on the volume of data collected by commercial online social networks services, both demographic and behavioral, these data could allow for increased power for statistical analyses and more innovative network level analyses. Future online social network research should include partnerships with

commercial online social network firms to examine data that can only be collected at the administrative level.

The use of online social networks has moved beyond young, computer-savvy individuals to incorporate a wide range of age and socioeconomic groups. Interventions using online social networks are also not constrained by temporal and geographic considerations. Future research should move beyond the relatively homogenous sample in the current study to incorporate other groups, particularly those that experience the greatest health disparities or may not be eligible for face-to-face programs.

VII.C. Future research

Results from this dissertation suggest several potential areas of future research:

1. A more comprehensive version of this study should be conducted in the future that better uses the technological capabilities of online social networks. Specifically, efforts should be made to incorporate participants' existing friend networks and compare those designs to those that try to create networks.

2. Future research should build on the methods and results of this study to examine the efficacy of online social network interventions to increase other health behaviors such as fruit and vegetable intake or reduce risk behaviors such as tobacco or drug use.

3. In addition to online social networks, other popular social media technologies, such as Twitter, should be tested as intervention strategies individually and in combination with online social networks.

4. Based on the amount of social support exchanged in the everyday use of Facebook by this small group of study participants over a limited period of time, future research using existing online social network data obtained from commercial sources would allow for powerful cross sectional analyses of the

prevalence of supportive behaviors in these networks and their relationship to user characteristics and activities.

5. Through the use of participant characteristic data and data related to participant social relationships that are available through online social networks, future research should examine higher-level network effects of interventions.

6. The design of this study was based on formative work conducted with participants, which is limited by self-report and recall bias. In order to gain a better understanding of the effect of individual design elements of online social network interventions on participation and behavior, future research should employ methods that can rapidly test small iterative changes in intervention to inform large-scale interventions.

7. The homogeneity of the population in the current study limits its generalizability. Future studies should examine the efficacy of online social network physical activity social support interventions in more diverse populations.

In Summary, this study is an informative first step in understanding how to use online social networks to promote physical activity and other health promoting behaviors. Future research should build on these findings by using technology that integrates existing social connections and analyzing existing data collected directly from commercial online social network sites. Consideration should also be given to studies that enroll diverse participants and employ more objective outcomes measures.

FORMATIVE INTERVIEW GUIDE

The INSHAPE Trial, Participant Aim 1 Interview Guide

1. **Participant prescreened?**

   a. Yes   SKIP TO STEP 6

   b. No (intercept recruitment)   CONTINUE TO STEP 2

2. **Procedure for intercept recruits:**

   a. Look for students who may be interested and meet the qualifications for the study.

   b. Approach student, introduce yourself, and hand out recruitment flyer

3. **Woman interested?**

   a. Yes   CONTINUE TO STEP 4

   b. No   THANK FOR TIME, STOP, MOVE ON

4. **Go over pre-screening form**

5. **Meets eligibility criteria?**

   a. Yes   CONTINUE TO STEP 6 OR COLLECT
      EMAIL ADDRESS

                                        FOR INTERVIEW SCHEDULING

   b. No   THANK FOR TIME, EXPLAIN
      INELIGIBILITY, STOP

6. **Obtain consent in a private location.** Allow participant to read the consent form silently and then ask if she has any questions. Be sure to read aloud these major points:

   Purpose and procedures:

   "We want to learn about the types of social support female students receive from their friends and family when they are trying to exercise. We also are interested in knowing how female students use online social networks like Facebook and their experience and ideas about how these online social networks might support more exercise."

   Risks:

"You should not have any discomfort from being in this study. We think you will be at ease answering the questions we will ask you. Although we will be careful to protect your privacy, loss of privacy is a risk of being in this study. Also, there is always a chance of unknown risks. You should report any problems to the research staff."

Benefits:

"Research studies are designed to obtain new facts. These new facts may help people in the future. You may not receive any direct benefit from being in the research study."

Alternatives:

"Before you learn about the study, you should know that:
Your choice to be in the study is voluntary.
You may decide not to join the study.
If you choose to be in the study, you may stop at any time."

Confidentiality:

"We will make every effort to protect your privacy in this study. Your name will not appear on the notes from the tape or survey. The study data we collect from you will be stored in a locked file cabinet and/or password protected computer. All study data will be destroyed when the study is complete."

Person to contact:

"You have the right to ask and have answered any questions you may have about this research. If you have questions, or concerns, you should contact David Cavallo, MPH (917-572-5944, davidcavallo@unc.edu). He is the leader of this project and will be happy to answer your questions."

7. **Answer any additional questions about the study, research or what will happen today.**

8. **Confirm that participant is comfortable with the level of privacy of the interview location.**

9. **After obtaining verbal consent, obtain participant signature on your copy of consent form, and give participant her copy.**

10. **After consent form is signed, give the participant her copy of the consent form and you keep the one with signatures. If participant agrees, start recorder and begin interview.**

11. **Interviewer will introduce herself and provide an explanation of the purpose of the interview, as follows:**

"As I said earlier, my name is_____and I want to thank you for chatting with me today. As reviewed in the consent form, the purpose of this interview is to hear your thoughts about social support from friends and family for your participation in exercise and how you think support through Facebook could help improve it. You should feel free to make any sort of comments – positive or negative – about what we are talking about today. There are no right or wrong answers. I am only interested in your thoughts. You may skip any question in this interview for any reason. This should take about 60 minutes and after we are finished with our interview, you will receive a $20.00 gift certificate for your time.

"First I'd like to ask you some general questions about yourself and your use of Facebook."
[INTERVIEWER NOTE: READ QUESTIONS AND RESPONSE OPTIONS ON DEMOGRAPHIC AND ONLINE SOCIAL NETWORK USE FORM OUT LOUD. MARK PARTICIPANTS' RESPONSES ON THE FORMS. THEN PROCEED TO ASK THE QUESTIONS BELOW.]

<u>Icebreaker Questions</u>

1. Are you from this area?

2. What are you studying?

3. What do you like to do on the weekends?

<u>Section 1 – current exercise behavior</u>
"Let's talk a little bit about Exercise"
1. How much time do you spend exercising? Would you describe your level of activity now as: Very active, Active, Inactive, Very Inactive?

2. Why did you choose XXX (e.g., 'very active') to describe your exercise level?

3. Would you like to keep your exercise level the same, or change it?

4. Why do you want to change/not change your exercise level?

5. What types of exercise do you currently participate in?

6. If you were to increase or change your exercise level, what type of exercise activities would you choose?

7. What type of exercise activities do your female friends participate in?

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<u>Section 2 – Existing offline social support for health behaviors</u>

"Now I am interested to learn more from you about social support you may or may not receive from friends and family members, especially support for exercise. This can be support you are currently receiving or have received in the past."

1. Describe some times, if any, where you felt your friends or family members were supporting your efforts to exercise. **[PROBE: EMOTIONAL, INFORMATIONAL, APPRAISAL, INSTRUMENTAL]**

    a. How did you receive the support? **[GIVE EXAMPLES: phone, conversation, email]**

    b. How did you feel about the support?

    c. What are some ways that the support could have been more helpful?

2. What about changing other health behaviors? **[GIVE EXAMPLES: EATING, SMOKING].** Describe some times, if any, where friends and family members supported you. **[PROBE: EMOTIONAL, INFORMATIONAL, APPRAISAL, INSTRUMENTAL]**

    a. How did you receive the support? **[GIVE EXAMPLES: phone, conversation, email]**

    b. How did you feel about the support?

    c. What are some ways that the support could have been more helpful?

3. Describe some times, if any, that your friends or family members invited you to exercise with them.

    a. If they asked you, did you exercise with them?

    b. If you didn't exercise with them, what do you think might have changed your mind?

    c. If you did exercise with them, what about the invite made it appealing to you?

4. How much do your friends and family exercise?

    a. How did you arrive at that answer (observation, talking about it)?

    b. How do you feel about your own level of exercise when you see or hear about your friends and family exercising?

    c. How do you feel about your own level of exercise when you see other people who are not friends and family exercising?

<u>Section 3 – Existing social support within Facebook</u>

"Now I'm going to ask you questions to learn more about different kinds of social support and interaction you may receive from or provide to your friends through Facebook. This does not have to be related to health behaviors or exercise. For example, this could be about school, or relationships, or other things you need help with. This can be any support you are currently receiving or have received in the past."

1. Describe some times, if any, that you have asked for any kind of support from friends through Facebook?

    a. How did you ask for the support? **[GIVE EXAMPLES: WALL POSTS, MESSAGE, CHAT]**

    b. Please give me an example of how the message was written? **[RECORD TEXT]**

    c. If you haven't ever asked for support on Facebook, what led to that decision?

2. Describe some times, if any, that you have received any kind of support from friends through Facebook?

    a. How did you receive the support? **[GIVE EXAMPLES: WALL POSTS, MESSAGE, CHAT]**

    b. How did you feel about the support?

    c. What are some ways that the support could have been more helpful?

    d. Please give me an example of how the support messages you received was written? **[RECORD TEXT]**

3. Describe some times, if any, that you have offered support to friends through Facebook?

    a. How did you offer the support? **[GIVE EXAMPLES: WALL POSTS, MESSAGE, CHAT]**

    b. How do you think they felt about the support? How do you know? What was their response?

    c. Please give me an example of how you wrote, or would write a support message to a Facebook friend? **[RECORD TEXT]**

4. How do you feel when friends ask for support on Facebook?

5. How do you feel when friends offer support to each other on Facebook?

6. What motivates you to post pictures on Facebook?

7. What motivates you to look at pictures on Facebook?

8. What do you think about being invited to events through Facebook? Have you ever attended an event you were invited to through Facebook?

    a. What did, or would, make you want to attend?

    b. What did, or would, make you not want to attend?

Section 4 - Design of Online Social Network for Physical Activity

"As you know, the purpose of this interview is to help design a program using online social networks to promote social support for exercise. I'm now going to ask you some questions about how you think it should be designed based on your own and your friend's Facebook use."

1. What are some ways that you think Facebook could help people exercise more?

2. What are your favorite features of Facebook? **[PROBE: DESIGN, LAYOUT, APPLICATIONS]**

3. Thinking about the groups you interact with most on Facebook, what do you like about them? What do you dislike about the groups?

    a. Please describe how you use the groups.

        i. What do the groups have to offer?

        ii. What features of the groups do you find most helpful?

    b. Please describe your level of awareness about what is happening in the group?

    c. Please tell me about who is in the groups you belong to? Are they Facebook friends, not Facebook friends, or some combination?

    d. How interested would you be in joining a group dedicated to exercise?

    e. If you were designing a Facebook group **[SHOW EXAMPLE OF GROUP PAGE]** what types of things do you think should be included to help members increase exercise?

4. If you had a friend who made their status that they were starting an exercise program, how would you respond? How do you think your friends would respond?

5. How comfortable would you be asking in your status or sending a message for your Facebook friends to support your efforts to increase exercise?

6. How comfortable would you be posting your exercise goals on your Facebook wall or an exercise group wall?

7. How comfortable would you be posting whether or not you have achieved a goal on your Facebook wall or an exercise group wall?

8. How comfortable would you be posting pictures or videos of yourself exercising on Facebook?

    a. Please describe any instances when friends have posted videos or pictures related to physical activity?

    b. What did you think when you viewed those videos or pictures?

9. How comfortable would you be in meeting up with members of a Facebook group to exercise together?

    a. What types of things would make you more or less likely to meet up with members of a Facebook group to exercise?

    b. How far would you travel to exercise with other group members?

    c. Can you describe any instances when friends have invited you to participate in exercise?

    d. If you didn't do it, what do you think might have changed your mind?

    e. If you did do it, what about the invite/event made it appealing to you?

10. Can you describe some ways that you think information can be shared on Facebook?

11. How do you and your friends show approval and disapproval on Facebook?

Section 5 – Acceptability of Intervention Protocol

"Now I would like to ask you some questions about participating in a research study based on the physical activity Facebook group we have been discussing."
1. How comfortable would you be "friending" a study administrator who would collect data on your communications and pictures on Facebook related to exercise?

2. How comfortable would you be joining a Facebook group with strangers who have a similar interest to yours? What about a group dedicated to exercise?

3. Have you ever changed your privacy settings on Facebook? What led to that decision?

4. What do you think about receiving email reminders from a study administrator through Facebook to perform study activities? What is the most appropriate frequency?

5. How would you feel about filling out a journal of your physical activity on a daily basis?

6. What are some ways that you think we could recruit participants like you for a 12 week study? **[PROBE: EMAIL, FACEBOOK MESSAGE, FLYER, INTERCEPT]**

7. What types of incentives would be most appealing to you for participation in a 12 week study? **[PROBE: GIFT CERTIFICATES (TYPE?), CHECK, RAFFLE]**

<u>Closing</u>

"Is there anything else you feel we did not talk about that would be important for me to know?"

"Thank you!"

[INTERVIEWER NOTE: GIVE PARTICIPANT INCENTIVE AND GET SIGNATURE ON REIMBURSEMENT FORM]

PROCESS INTERVIEW GUIDE

The INSHAPE Trial, Participant Aim 3 Interview Guide
1. **Obtain consent in a private location.** Allow participant to read the consent form silently and then ask if she has any questions. Be sure to read aloud these major points:

Purpose and procedures:

"We want to learn about your experience as a participant in the INSHAPE study. In particular, we are interested in what elements of the program you found helpful and those that you did not find helpful. Also, we want to understand what determined your level of participation and your thoughts on how to improve the program."

Risks:

"You should not have any discomfort from being in this study. We think you will be at ease answering the questions we will ask you. Although we will be careful to protect your privacy, loss of privacy is a risk of being in this study. Also, there is always a chance of unknown risks. You should report any problems to the research staff."

Benefits:

"Research studies are designed to obtain new facts. These new facts may help people in the future. You may not receive any direct benefit from being in this part of the research study."

Alternatives:

"Before you learn about the study, you should know that:
Your choice to be in the study is voluntary.
You may decide not to join the study.
If you choose to be in the study, you may stop at any time."

Confidentiality:

"We will make every effort to protect your privacy in this study. Your name will not appear on the notes from the tape or survey. The study data we collect from you will be stored in a locked file cabinet and/or password protected computer. All study data will be destroyed when the study is complete."

Person to contact:

"You have the right to ask and have answered any questions you may have about this research. If you have questions, or concerns, you should contact

David Cavallo, MPH (917-572-5944, davidcavallo@unc.edu). He is the leader of this project and will be happy to answer your questions."

2. **Answer any additional questions about the study, research or what will happen today.**

3. **Confirm that participant is comfortable with the level of privacy of the interview location.**

4. **After obtaining verbal consent, obtain participant signature on your copy of consent form, and give participant her copy.**

5. **After consent form is signed, give the participant her copy of the consent form and you keep the one with signatures. If participant agrees, start recorder and begin interview.**

6. **Interviewer will introduce herself and provide an explanation of the purpose of the interview, as follows:**

"As I said earlier, my name is_____and I want to thank you for chatting with me today. As reviewed in the consent form, the purpose of this interview is to learn about your experience as a participant in the INSHAPE program. You should feel free to make any sort of comments – positive or negative – about what we are talking about today. There are no right or wrong answers. I am only interested in your thoughts. You may skip any question in this interview for any reason. This should take about 45 minutes and after we are finished with our interview, you will receive a $20.00 gift certificate for your time.

Icebreaker Questions

1. Are you from this area?

2. What are you studying?

3. What is your favorite thing to do on the weekends?

Section 1 – INSHAPE Website

"Let's start by discussing the INSHAPE Website" **[Interviewer uses hard copy of the website when necessary to provide examples to the participant about specific sections]**

8. How difficult was it for you to login to the website and set your password?

9. How frequently did you use the INSHAPE website?

10. What did you think of the INSHAPE website?

11. What parts of the website did you find most helpful? **[If necessary, review the parts of the website: content, text links, video links, worksheets, goal setting/tracking]**

12. What parts of the website were least helpful?

13. What things would have gotten you to visit the site more often?

14. Can you describe any technical problems you had with the website?

15. What did you think of the website's appearance?

16. How would you describe the level of privacy you felt using the website?

17. How would you improve the website overall?

Section 2 – INSHAPE Facebook Activities

"Now I am interested to learn from you about your experience using Facebook as a part of the INSHAPE program." **[Interviewer uses hard copy of the website when necessary to provide examples to the participant about specific sections]**

5. How frequently did you visit the INSHAPE Facebook group?

6. What did you think about the INSHAPE Facebook group?

7. What parts of the Facebook group did you find most helpful/motivating? **[give examples: discussion boards, wall posts, links, other participants' experience]**

8. What parts of the Facebook group were least helpful/motivating?

9. What determined whether or not you posted to the Facebook group?

10. What determined whether or not you participated in exercise with other group members?

11. Can you describe how aware you were of information posted to the Facebook group?

12. What would you suggest we do to increase participation in the Facebook group amongst participants?

13. How could we improve the Facebook group overall?

14. What determined whether or not you posted information about your exercise activities on your own Facebook wall?

Section 3 – Study Communications

"Now I'm going to ask you questions about communications you received from the study"

9. Which communications related to the program were you most aware of? **[Give examples, FB email, direct email, posts on the Facebook wall]**

10. What did you think of the frequency of communications during the study?

11. How clear to you were the goals of the study?

12. How clear to you was the timeline of the study?

13. How clear to you were the activities you were supposed to be participating in?

14. What did you typically do with communications you received from the study?

15. How would you suggest we improve the communications between the study and participants?

<u>Closing Questions</u>
1. What motivated you to join this study?

2. What, if anything do you feel you got out of participating in this study?

3. Is there anything else you feel we did not talk about that would be important for me to know?

"Thank you!"
[INTERVIEWER NOTE: GIVE PARTICIPANT INCENTIVE AND GET SIGNATURE ON REIMBURSEMENT FORM]

APPENDIX C

INTERVIEW QUALITATIVE CODEBOOK

Interview Codes		
Code Name	Sub-Topical Code Name	Description and Application Rules
Exercise		Apply this code to information about exercise of participants or their friends that does not fit under any of the sub-topical codes below.
	Activities	Apply this code to information about the type of participant, friend, and family current exercise activities or activities they would like to participate in the future.
	Motivation	Apply this code to information about participants' motivation for changing their exercise level.
	Barriers	Apply this code to information about barriers to participating in exercise
	Facilitators	Apply this code to information about facilitators to participating in exercise
	Group	Apply this code to information about participants' exercise with other participants in the Facebook group
Non-Facebook Social Support		Apply this code to information about non-Facebook social support that does not fit under any of the sub-topical codes below.
	Request for support	Apply this code to information about participants' experiences with requesting social support.
	Receipt of support	Apply this code to information about participants' experiences with receiving social support.
	Provision of support	Apply this code to information about participants' experiences with providing social support.
	Support attitudes	Apply this code to information about participants' attitudes toward social support.
Facebook Social Support		Apply this code to information about Facebook social support that does not fit under any of the sub-topical codes below.
	Request for support	Apply this code to information about participants' experiences with requesting social support through Facebook.
	Receipt of support	Apply this code to information about participants' experiences with receiving social support through Facebook.
	Provision of support	Apply this code to information about participants' experiences with providing social support through Facebook.
	Support attitudes	Apply this code to information about participants' attitudes toward social support through Facebook.
Exercise awareness		Apply this code to information about how participants ascertain their friends and families

			exercise frequency and type
Friend influence			Apply this code to information about the influence friends and family have on participants' exercise behavior
Stranger influence			Apply this code to information about the influence strangers have on participants' exercise behavior
Facebook Pictures			Apply this code to information about the use of photographs and videos on Facebook that does not fit under any of the sub-topical codes below.
	Posting		Apply this code to information about the frequency, type and motivation for posting photographs or videos on Facebook.
	Viewing		Apply this code to information about the frequency, type and motivation for viewing photographs or videos on Facebook.
	Comments		Apply this code to information about the frequency, type and motivation for commenting on photographs or videos on Facebook.
Facebook Groups			Apply this code to information about Facebook groups that does not fit under any of the sub-topical codes below.
	Group type		Apply this code to information about the types of Facebook groups that participants are members of.
	Group design		Apply this code to information about positive and negative group aspects.
Intervention Design			Apply this code to information about intervention design and acceptability that does not fit under any of the sub-topical codes below.
	Sending/Receiving invites		Apply this code to information about the frequency and type of event invites received or sent on Facebook.
	Positive/Negative Attributes Invites		Apply this code to information about positive and negative characteristics of event invites.
	Joining a group		Apply this code to information about participants' willingness to join a Facebook group for exercise.
	Posting to status		Apply this code to information about factors that determine whether or not a person would or did post to their own Facebook wall
	Posting to group wall		Apply this code to information about factors that determine whether or not a person would or did post to the group wall
	Communications		Apply this code to information about designing effective intervention communications
	Tracking PA		Apply this code to information about participants' willingness to track their exercise.
	Recruitment		Apply this code to information about strategies to recruit and incentivize participants for a Facebook exercise intervention.
	Multiple Platforms		Apply this code to information about participant's preference for a single platform (not separate web

			site and Facebook)
Inshape Website			Apply this code to information about the INSHAPE Website that does not fit under any of the sub-topical codes below.
		Technical Difficulties	Apply this code to information about technical difficulties that participants experienced with the web site
		Useful	Apply this code to information about the usefulness of different components of the website
		Pros	Apply this code to positive comments participants made about the web site
		Cons	Apply this code to negative comments that participants made about the web site
Study Motivation			Apply this code to information about participants' motivation to join the study.
Value			Apply this code to information about what value participants received from participating in the intervention.
Privacy			Apply this code to information about participant's Facebook privacy settings.
Icebreaking Activities			Apply this code to information about icebreaking activities
Communications Preferences			Apply this code to information about participant's preferences when communicating with others.
Facebook Approval/Disapproval			Apply this code to information about how participants express approval and/or disapproval on Facebook including norms around negative communications.
Facebook Friends			Apply this code to information about participant's description of their Facebook friends.
Feature Awareness			Apply this code to information pertaining to features offered in the intervention that were not apparent to participants

APPENDIX D

INSHAPE WEBSITE SCREEN SHOTS

About the Study

>About the Study

Why Should I Participate?

What Will I Be Doing in the Study?

Am I Eligible?

User Login

Username [   ]
Password [   ]
[Login] [Clear]

Forgot Password

About the Study

The INSHAPE study is being conducted by the UNC Center for Health Promotion and Disease Prevention, a CDC funded Prevention Research Center.

This study involves a program for female undergraduate students at the University of North Carolina designed to increase the social support that they receive for their efforts to exercise.

This program provides participants information about how to increase their own exercise and encourages them to support each other through the social networking website Facebook.

Please go learn more about the benefits of joining this study.

Contact INSHAPE@unc.edu

Why Should I Participate?

About the Study

**>Why Should I
Participate?**

What Will I Be Doing in the
Study?

Am I Eligible?

User Login

Username [ ]
Password [ ]
[Login] [Clear]

Forgot Password

The INSHAPE program is designed to help female undergraduates at the University of North Carolina increase their exercise.

Regular exercise has numerous benefits including:

- Reducing stress and improving mood
- Improving weight management
- Reducing the risk of heart disease and cancer

Upon completion of the study, you will receive a $30 monetary incentive.

This program promotes exercise through education, social support, and goal setting and tracking. Go learn more about what you will be doing as a participant.

Am I Eligible?

You may be eligible if you:

- Are female
- Use Facebook
- Are an undergraduate student at UNC-CH
- Exercise less than 30 minutes per day

If you are interested in signing up, go to our online screener to check for full eligibility.

About the Study

Why Should I Participate?

What Will I Be Doing in the Study?

>Am I Eligible?

User Login

Username
Password

Login   Clear

Forgot Password

Contact INSHAPE@unc.edu

My Weekly Exercise Goal

Goal Tips

You must set your goal for this week before going to the Exercise Dashboard

Previous Week's Goal	18
Increase for the week (in ten-minutes blocks):	1

Increase

Exercise Dashboard

>Goal-Setting

Exercise Tracker

Exercise Information

Participant Instructions

Change Password

Logout

Contact INSHAPE@unc.edu

INSHAPE

InterNet Support for Healthy Associations Promoting Exercise

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Exercise entry

04/17/2011

Activity   Aerobics/ Fitness Classes

# of 10 min. blocks

Intensity Level   light

Submit

Weekly Exercise Log

Date	Activity	Minutes	Intensity
04/17/2011	Aerobics/ Fitness Classes	20 mins.	light
04/17/2011	Running	30 mins.	moderate
04/17/2011	Swimming	20 mins.	vigorous

You can enter exercise tracking for up to 7 days prior to the current day, and this will be added to your weekly progress. However, the exercise log will only display activities entered for the current week, which starts each Sunday.

My Weekly Progress

Minutes

200
150
100
50

Last Week's Goal | This Week's Goal | This Week's Activity

My Overall Progress

Minutes

200
150
100
50

1 2 3 4 5 6 7 8 9 10 11 12
Weeks

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Goal-Setting

Exercise Tracker

Exercise Information

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Logout
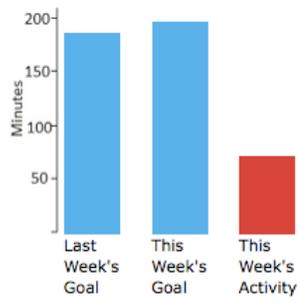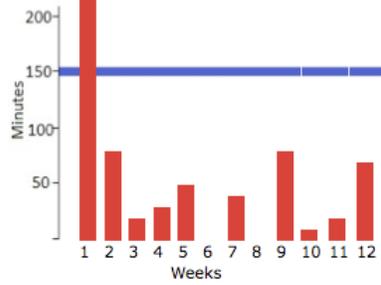
My Weekly Tracking at a Glance

| Sun. | Mon. | Tues. | Wed. | Thurs. | Fri. | Sat. |

Contact INSHAPE@unc.edu

Tips Setting Goals

Setting your goals using this tool is easy. Just review your previous goal and enter how much you would like to increase it for the coming week to see your new goal. For example, if your goal last week was 10-minute blocks and you want your new goal to be 12 ten-minutes blocks, you would enter 2 in the "Increase for this Week" box. The program will then calculate your new weekly goal.

When setting your goal, please keep these tips in mind.

1. Goals should be clear, concise, and to the point

Vague, general goals, such as "striving to do one's best" are useless because they don't produce change. Specific goals, like "I am going to walk five times a week for 30 minutes each time" are useful because they give a benchmark for change.

2. Goals should be easy to evaluate or assess

It is a good idea to keep track of your exercise activity, so that you can your goal completion and success. In this program, you will use an online daily activity log to keep track of the number of ten-minute blocks of exercise that you do each week. Keeping track of this information will only take a few moments each time and is so important to helping you see how successful you are.

3. Goals should be challenging, but achievable and practical

Often people set goals that are not realistic and so they become discouraged when they don't meet them and stop exercising. For example, if you are averaging 5 ten-minute blocks of exercise, per

INSHAPE

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Safety

Exercise is generally safe for most people. There are however some situations in which you should talk to your doctor before you start an exercise program. Prior to joining this study, you answered a questionaire to determine your ability to start an unsupervised exercise program. These questions are again listed below for your review. If anything has changed and you answer YES to any of these questions, you should notify the study principal investigator inshape@unc.edu and consult your doctor before starting this or any other exercise program.

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended be a doctor?
2. Do you feel pain in your chest when you are not doing physical activity?
3. In the past month, have you had chest pain when you are 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, neck, 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 know any other reason why you should not do physical activity?

Even for healthy individuals there are some general tips that can help reduce your risk of injury. Please read these carefully and follow them as you start your exercise program.

- If you haven't been active in a while, start slowly and build up. In general, you should not

Participant Activities

One of the most important determinants of how much people exercise is social support. Think about your own experiences with exercising or doing other things; it's easier and more fun when you have people to join and support you. That's what the INSHAPE program is all about: helping you get more fit while having some fun and meeting new friends. We use Facebook because it is a great way to connect people and you're already using it so you can fit the study activities into your daily use. The only catch is that everyone needs to participate. That's how social support works. If everyone contributes to the group, it will be successful!

This page has guidance on activities that we would like for you to participate in during the 12 weeks of the study. These activities include things you will do in the Facebook group and/or with your existing Facebook friends as well.

Set Up a "Circle of Friends" with Your Existing Facebook Friends: reach out to your existing friends on Facebook for support. You can pick all your friends or just a smaller group. You can share with them that you are starting an exercise program, keep them up to date on how you are doing with your goals, and share your experiences with them about the program. If you only want to share with a smaller group, there are two ways to do that in Facebook. You can make a list of those people and only post a status to that list (see instructions) or you can create a group of those people and post to that group (see instructions). Please include the study admin in the list or group so we can observe.

Break the Ice: Since you probably don't know any other members of the Facebook group, we are going to have a quick icebreaking activity that we would like everyone to participate in. Next time you're logged into Facebook, go to the group. We have a discussion board thread set up called "Icebreaker". We'd like for you to go there and answer a few simple questions so that other group members can get to know you (and vice versa). Once everyone posts their answers, you can check out

Facebook Privacy & Safety

Your privacy and well being are very important to us. For that reason, we wanted to remind you about your responsibilities to other group members during this study. It is very important that you do not to reveal anything you learn from group discussions or other activities to anyone outside of the group. In addition, you agree not to use the study Facebook group to:

1. upload, post, email, transmit or otherwise make available any content that is unlawful, harmful, threatening, abusive, harassing, tortious, defamatory, vulgar, obscene, libelous, invasive of another's privacy, hateful, or racially, ethnically or otherwise objectionable;
2. impersonate any person or entity, including, but not limited to, a UNC official, study administrator leader, guide or host, or falsely state or otherwise misrepresent your affiliation with a person or entity;
3. collect, store, or use for research, personal data or information about other users.
4. post content or take any action in the Facebook group that infringes or violates someone else's rights or otherwise violates the law.

Please report any offensive content you find in the group to the principal investigator at inshape@unc.edu. If you feel like you have been harmed by any comments posted on the group wall or your own wall, please notify the principal investigator of this study. If you feel like you need counseling, you can contact campus wellness counseling services at (919) 966-3658 or you can walk in between 9:00 am and 3:30 pm, Monday through Friday. If you are having a psychological crisis, you are encouraged to call or visit campus wellness right away and speak to a CWS therapist for same day crisis intervention. If it is after hours, on a weekend, or university holiday, call (919) 966-2281.

As a Facebook user, you should also be aware of your own privacy settings and set them in such a way

Exercise Dashboard

Goal-Setting

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>Participant Instructions

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Logout

FACEBOOK INSHAPE GROUP SCREEN SHOT

APPENDIX F

FACEBOOK INTERACTION QUALITATIVE CODEBOOK

Facebook Codes		
Code Name	Sub-Topical Code Name	Description and Application Rules
Exercise Social Support Types	Information	Apply this code to posts related to informational support (knowledge assistance that suggests "you should know")
	Companionship	Apply this code to posts related to companionship support (partnership assistance that suggests "we participate together")
	Esteem	Apply this code to posts related to esteem support (esteem information provision that suggests "you are good")
	Encouragement	Apply this code to posts related to encouragement support (encouragement information that suggests "you should start or continue exercise activities")
	Sympathy	Apply this code to posts related to sympathy support (information that suggests "I share your feelings about the obstacles or difficulties that you have")
Exercise Support Request		Apply this code to posts that request support from others
Exercise Modeling		Apply this code to posts that describe performed exercise
Exercise Endorsement		Apply this code to posts that endorse specific exercise types
Exercise Failure		Apply this code to posts related to exercise failure
Exercise Success		Apply this code to posts related to exercise success
Exercise Consequences	Positive	Apply this code to posts related to the positive consequences of exercise
	Negative	Apply this code to posts related to the negative consequences of exercise
Like Button Text		Apply this code to text associated with the "like button" for individual posts
Exercise Competitiveness		Apply this code to posts related to exercise motivation associated with competitiveness
Sedentary Relapse		Apply this code to posts related to starting exercise after a period of inactivity
Exercise Barriers		Apply this code to information about barriers to participating in exercise
Exercise Facilitators		Apply this code to information about facilitators to participating in exercise

Event Attendance Text	Apply this code to text associated with event attendance for individual posts
Backing Out	Apply this code to text associated with individuals backing out of previously planned exercise activities

POST INTERVENTION SURVEY

Now, we're going to ask you some questions about the INSHAPE website (www.inshape-unc.org).

I find the INSHAPE website easy to use.

	1	2	3	4	5	6	7
Strongly Disagree:Strongly Agree	○	○	○	○	○	○	○

I know where to find the information I need on the INSHAPE website.

	1	2	3	4	5	6	7
Strongly Disagree:Strongly Agree	○	○	○	○	○	○	○

I find the design of the INSHAPE website appealing.

	1	2	3	4	5	6	7
Strongly Disagree:Strongly Agree	○	○	○	○	○	○	○

Please rate how often you viewed the following sections of the INSHAPE website.

	Never	Once	A Few Times	Many Times
Exercise Safety	○	○	○	○
Exercise Recommendations	○	○	○	○
Exercise Benefits	○	○	○	○
Exercise Types	○	○	○	○
Overcoming Barriers	○	○	○	○
UNC Resources	○	○	○	○
Participant Instructions	○	○	○	○

Please rate how often you viewed the following videos linked to the INSHAPE website.

	Never	Once	A Few Times	Many Times
Aerobic Exercise Types	○	○	○	○
Aerobic Exercise Intensity	○	○	○	○
Aerobic Exercise Duration and Frequency	○	○	○	○
Strength Training in the Gym	○	○	○	○
Strength Training at Home	○	○	○	○
Flexibility	○	○	○	○

Please rate how often you viewed the following educational web pages linked to the INSHAPE website.

	Never	Once	A Few Times	Many Times
How Women Build Muscle	○	○	○	○
Control Your Weight	○	○	○	○
Reduce Your Risk of Cardiovascular Disease	○	○	○	○
Reduce Your Risk of Type II Diabetes and Metabolic Syndrome	○	○	○	○
Reduce Your Risk of Some Cancers	○	○	○	○
Strengthen Your Bones and Muscles	○	○	○	○
Improve Your Mental Health and Mood	○	○	○	○
Increase Your Chances of Living Longer	○	○	○	○

During this study, which of the following worksheets linked to the INSHAPE website did you complete. (check all that apply)
- ❑ Exercise Time Finder
- ❑ Power of Positive Rituals
- ❑ None of the Above

During this study, which of the following links to articles/videos that your received by email did you read/view? (check all that apply)
- ❑ Vigorous Exercise Linked with Better Grades
- ❑ Concentrate on the Workout, No Thanks
- ❑ More Bone (and Less Fat) Through Exercise
- ❑ Gym Bag Essentials Checklist
- ❑ Which is better — 30 minutes of aerobic exercise every day, or one hour of aerobic exercise three times a week?
- ❑ How to Choose Proper Workout Clothes
- ❑ What is Zumba?
- ❑ What Really Causes Runner's High?
- ❑ Put Those Shoes On: Running Won't Kill Your Knees
- ❑ Do Toning Shoes Really Work?
- ❑ Forget theTreadmill, Get A Dog
- ❑ None of the above

Please rate the usefulness of the following INSHAPE educational content.

	Very Useless	Useless	Neutral	Useful	Very Useful
INSHAPE Website Pages	○	○	○	○	○
Educational Videos Linked to the INSHAPE Website	○	○	○	○	○
Educational Web pages Linked to the INSHAPE Website	○	○	○	○	○
Worksheets Linked to the INSHAPE Website	○	○	○	○	○
Videos/Articles Posted emailed to you	○	○	○	○	○

Now we're going to ask you some questions about things you did on Facebook over the past three months.

During the past three months, how many times do you remember...

	Never	Less than Once a Month	Once a Month	2-3 Times a Month	Once a Week	2-3 Times a Week	Daily
sending a Facebook message related to exercise.	❍	❍	❍	❍	❍	❍	❍
using Facebook chat to discuss exercise.	❍	❍	❍	❍	❍	❍	❍
inviting others through Facebook (chat, message, wall to wall, event invite) to participate in exercise.	❍	❍	❍	❍	❍	❍	❍

During the past three months, how many times do you remember...

	Never	Less than Once a Month	Once a Month	2-3 Times a Month	Once a Week	2-3 Times a Week	Daily
receiving a Facebook message related to exercise.	❍	❍	❍	❍	❍	❍	❍
receiving a post or comment about exercise on your Facebook wall	❍	❍	❍	❍	❍	❍	❍
being invited through Facebook (chat, message, wall to wall, event invite) to participate in exercise.	❍	❍	❍	❍	❍	❍	❍
participating in exercise based on being invited or inviting others through Facebook.	❍	❍	❍	❍	❍	❍	❍

During the past three months, how many times do you remember...

	Never	Less than Once a Month	Once a Month	2-3 Times a Month	Once a Week	2-3 Times a Week	Daily
posting a status related to exercise to your Facebook wall.	❍	❍	❍	❍	❍	❍	❍
posting a picture or video related to exercise to your Facebook wall.	❍	❍	❍	❍	❍	❍	❍
posting a link related to exercise to your Facebook wall.	❍	❍	❍	❍	❍	❍	❍

Over the past three months, I found Facebook comments about exercise from my friends to be...

	1	2	3	4	5	6	7
Not motivating at all:Very motivating	❍	❍	❍	❍	❍	❍	❍
Not informative at all:Very informative	❍	❍	❍	❍	❍	❍	❍
Not supportive at all:Very supportive	❍	❍	❍	❍	❍	❍	❍

Over the past three months, I found Facebook messages I received about exercise from my friends to be...

	1	2	3	4	5	6	7
Not motivating at all:Very motivating	○	○	○	○	○	○	○
Not informative at all:Very informative	○	○	○	○	○	○	○
Not supportive at all:Very supportive	○	○	○	○	○	○	○

Over the past three months, I found Facebook chat I participated in about exercise to be...

	1	2	3	4	5	6	7
Not encouraging at all:Very encouraging	○	○	○	○	○	○	○
Not informative at all:Very informative	○	○	○	○	○	○	○
Not supportive at all:Very supportive	○	○	○	○	○	○	○

Over the past three months, how important to you were the following activities you did on Facebook?

	Not at All Important	Slightly Important	Somewhat Important	Very Important	Extremely Important
Posting a status, comment, link or event about exercise to your Facebook wall	○	○	○	○	○
Posting a picture or video related to exercise to your Facebook wall	○	○	○	○	○
Sending a Facebook Message about Exercise	○	○	○	○	○

Were you friends on Facebook with any of the participants assigned to the Facebook (not control) group of this study?
○ Yes
○ No
○ Don't know

During this study, did you hear from friends about activities they did in the Facebook (not control) group for this study?
○ Yes
○ No

Which activities did you hear about? (please check all that apply)
❑ Posting information about your efforts to exercise on your Facebook wall.
❑ Setting up a small group on Facebook to support your efforts to exercise.
❑ Other _____

How did you hear about the INSHAPE study? (please check all that apply)
- ❑ Flyer
- ❑ Daily Tar Heel Advertisement
- ❑ Email
- ❑ Twitter
- ❑ Facebook
- ❑ Friend

Please add any other comments that you think could help us improve the INSHAPE program.

Intervention only

Next we're going to ask you some questions about your participation in the INSHAPE Facebook group.

During this study, how many times do you remember...

	Never	Less than Once a Month	Once a Month	2-3 Times a Month	Once a Week	2-3 Times a Week	Daily
visiting the INSHAPE group on Facebook.	○	○	○	○	○	○	○
receiving a Facebook message from the INSHAPE group.	○	○	○	○	○	○	○
seeing a post to the INSHAPE group in your newsfeed.	○	○	○	○	○	○	○
Participating in exercise with other INSHAPE group members.	○	○	○	○	○	○	○

During this study, how important to you were the following activities you did in the INSHAPE Facebook group?

	Not at All Important	Slightly Important	Somewhat Important	Very Important	Extremely Important	I Never Did This
Posting a status, comment, link, or event to the INSHAPE group wall or discussion board.	○	○	○	○	○	○
Posting a video or picture to the INSHAPE group wall.	○	○	○	○	○	○
Receiving a comment on the INSHAPE group wall or discussion board.	○	○	○	○	○	○
Visiting the INSHAPE Group Wall	○	○	○	○	○	○

During this study, I found viewing comments posted to the INSHAPE group wall to be:

	1	2	3	4	5	6	7
Not at all motivating:Very motivating	○	○	○	○	○	○	○
Not at all informative:Very informative	○	○	○	○	○	○	○
Not at all supportive:Very supportive	○	○	○	○	○	○	○

During this study, I found links posted by other INSHAPE group members to be:

	1	2	3	4	5	6	7
Not at all motivating:Very motivating	○	○	○	○	○	○	○
Not at all informative:Very informative	○	○	○	○	○	○	○
Not at all supportive:Very supportive	○	○	○	○	○	○	○

During this study, I found participating in exercise with other INSHAPE group members to be:

	1	2	3	4	5	6	7
Not at all motivating:Very motivating	○	○	○	○	○	○	○
Not at all supportive:Very supportive	○	○	○	○	○	○	○

Please choose the reasons that prevented or reduced your participation in the INSHAPE group. (check all that apply)
- ❑ I forgot
- ❑ Not enough time
- ❑ Did not want to share personal information
- ❑ Did not want to meet up with strangers
- ❑ Did not feel that the group was valuable
- ❑ None
- ❑ Other _____

Please choose the reasons that prevented or reduced your exercise goal setting and tracking on the INSHAPE website. (check all that apply)
- ❑ I did not exercise.
- ❑ I forgot
- ❑ Not enough time
- ❑ It was not important to me
- ❑ Technical difficulties with the website
- ❑ None
- ❑ Other _____

I found the amount of communication from the study administrator during this study to be...
- ❍ too little.
- ❍ appropriate.
- ❍ too much.

During this study, did you set up a "circle of friends" in Facebook to share your exercise information with?
- ❍ Yes
- ❍ No

During this study, how many INSHAPE group members did you add as a Facebook friend?
○ None
○ Less than 10
○ 10-20
○ 20-30
○ 30-40
○ 40-50
○ 50-60
○ 60-70

I would recommend the INSHAPE exercise program to my friends.
○ Yes
○ No

How did you hear about the INSHAPE study? (check all that apply)
❑ Flyer
❑ Daily Tar Heel Advertisement
❑ Email
❑ Twitter
❑ Facebook
❑ Friend

Please add any other comments that you think could help us improve the INSHAPE program.

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