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The Role of Social Support for Physical Activity among Young Survivors of Breast Cancer

By

Pamela Kim Washington

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Public Health

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Joan Bloom, Chair
Associate Adjunct Professor Susan Stewart
Professor Lonnie Snowden
Professor Judith Warren Little

Fall 2011

The Role of Social Support for Physical Activity among Young Survivors of Breast Cancer

By

Pamela Kim Washington

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Abstract

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Doctor of Public Health

University of California, Berkeley

Professor Joan Bloom, Chair

BACKGROUND: There is strong evidence that physical activity mitigates negative psychosocial effects and sequelae associated with adjuvant chemotherapy among cancer survivors. Given the many benefits of physical activity in this population, it is important to understand the factors that influence continued participation post diagnosis. One possible determinant that has received little attention to date is the influence of social support. This study is unique in that it is the first to explore the role of social support for physical activity among young survivors through the use of mixed methods.

METHODS: Survey data (n=273) were used to determine actual levels of moderate and vigorous physical activity. These data were subsequently used to identify women of interest to participate in face-to-face qualitative interviews. Semi-structured interviews (n=31) were conducted with a subset of women from the quantitative sample. Participants were Bay Area women who were age 55 or less and premenopausal at the time of diagnosis and who also received adjuvant chemotherapy. Following qualitative analyses, hypotheses were developed to test the association between social support and obtaining recommended levels of physical activity through the use of logistic regression analyses using a sample of 273 women.

FINDINGS: Qualitative analyses indicated that women who have a partner with whom they engage in physical activity are more likely to adopt and maintain physical activity behaviors over time. Regression analyses provide evidence that women who have support specifically for physical activity are more likely to meet recommended activity guidelines ($\beta=.030$, OR=1.030 per unit of scale, $p=.003$, C.I.=1.01 – 1.05).

CONCLUSION: When considering correlates of physical activity, social support specific to physical activity may be important or even pivotal in assisting survivors to adopt and/or maintain participation in a given activity at recommended levels.

KEYWORDS: Breast cancer, survivorship, physical activity, exercise, social support, adherence

For Raymond, my most precious gift.

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The only people for me are the mad ones, the ones who are mad to live, mad to talk, mad to be saved, desirous of everything at the same time, the ones who never yawn or say a commonplace thing, but burn, burn, burn, like fabulous yellow roman candles exploding like spiders across the stars and in the middle you see the blue centerlight pop and everybody goes Awww!

- Jack Kerouac

My heart sings praise to the “mad ones” who journeyed with me through this work, whether briefly or for the long haul. I am especially thankful to:

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CHAPTER 1: INTRODUCTION

1.1 Background

Breast cancer is the most common cancer among US women, accounting for nearly one third of all new diagnoses [1, 2]. In 2005, women under age 50 represented an estimated 23% (48,338) of all new cases [3]. In the San Francisco Bay Area, the most recent age-adjusted incidence rate for all women under age 50 is 43.7 per 100,000. By racial and ethnic groups, the rates are 50.1 for per 100,000 for White, non-Hispanic women, 40.3 for African Americans, 46.2 for Asian Americans and 28.1 for Hispanic/Latina women [2, 4]. While incidence rates have remained relatively constant in recent years, breast cancer mortality rates in US women under age 50 have decreased markedly from 9.5 per 100,00 in 1974 to 4.8 per 100,000 in 2009 [5]. The combination of steady incidence rates and decreasing mortality rates means that more young women are becoming long-term survivors [1, 6]. Since 1975, the 5-year relative survival rate across all racial and ethnic groups of US women under age 50 has increased from 76% to over 85% in 2009 [7]. Improvements in early detection and advances in treatment have contributed to increased survival rates and have led to an entire new field of research in survivorship.

1.2 Survivorship and Longevity

The increasing numbers and longevity of breast cancer survivors raise numerous questions about the long-term effects of breast cancer treatment on physical health, mental well-being, and perceived quality of life [6]. Several studies have shown that women diagnosed with breast cancer at age 50 or less are more likely to receive aggressive treatment including mastectomy and adjuvant chemotherapy compared to older women [8]. At present, little is known about the late effects of chemotherapy and irradiation in younger women. For many young women, more immediately obvious are physical and emotional problems including fatigue, depression, abrupt menopause or menstrual changes, infertility, sleep problems, altered body image, changes in sexuality, lymphedema, limitations in physical and recreational activity, and weight gain [9-21]. Further, survivors who experience abrupt menopause as a result of surgery or chemotherapy are at increased risk for osteoporosis – a disease characterized by decreased bone density [9, 11, 12, 14-24]. The degree to which these physical and psychosocial problems are present depends on the relationship between various factors including modes of treatment, side effects, and individual characteristics [25]. These problems also interact with social and emotional functioning and may result in persistent reductions in quality of life [26-28].

1.3 Physical Activity and Survivorship

In the past, conventional wisdom was for women to rest following breast cancer treatment. However, there is a growing body of evidence that has emerged pointing to a positive association between physical activity and breast cancer survivorship. Indeed, physical activity is an important health behavior for the prevention and management of many chronic conditions, and it may be especially advantageous for survivors. Defined as any bodily movement that is produced by the contraction of skeletal muscles and that substantially increases energy

expenditure [29], physical activity, specifically weight-bearing and aerobic activity has been shown to mitigate the negative psychosocial effects and sequelae associated with adjuvant chemotherapy [30-34]. Several studies have shown that physical activity increases cardiovascular and muscular strength [35, 36], improves health-related quality of life [37], and alleviates the debilitating side effects of cancer treatment that interfere with daily life including fatigue [38, 39], nausea [40], and sleep disturbance [41]. Associations between physical activity and increased physical functioning [36], weight control [42, 43], decreased body fat [36, 41], and bone health [44, 45] are also well documented. Other studies have shown that physical activity does not cause or exacerbate lymphedema [46-53]. Further, physical activity is generally considered safe and does not pose health-related risks post treatment [54, 55]. As such, there is consensus among healthcare clinicians to advise their patients to be active to the extent they are able to do so [55, 56].

Given the many benefits of physical activity to survivors, encouraging women to be active post breast cancer treatment is a public health priority. In general, recommended physical activity guidelines for healthy adults also apply to cancer survivors. The American College of Sports Medicine, U.S. Department of Health and Human Services and others currently recommend a minimum of 30 minutes of moderate-intensity physical activity five days per week or 20 minutes or more of vigorous-intensity activity three days per week. Combinations of moderate and vigorous intensity activity can be performed to meet this recommendation. For example, a person could meet the recommended guidelines by walking briskly for 30 minutes twice during the week and jogging for 20 minutes on two other days. Moreover, any moderate intensity activity that increases one's heart rate can be accumulated by performing an activity for 10 or more minutes at a time [57-59].

1.4 Physical Activity Guidelines and METs

A well-known physiologic effect of physical activity is energy expenditure. A metabolic equivalent (MET) is a unit used to estimate the amount of energy expenditure of a specific activity. METs are derived as a ratio of the rate of energy expended during an activity to the rate of energy expended at rest. For example, 1 MET is equal to the energy used while sitting quietly. Any activity that burns 3.0 to 5.9 METs is considered moderate-intensity physical activity (e.g., leisure walking). Any activity that burns 6.0 METs or more is considered vigorous-intensity physical activity (e.g., jogging or swimming). Using METs as an indicator of activity intensity allows one to accumulate credit for the various moderate or vigorous intensity activities she performs in a given week. According to the American College of Sports Medicine, when combining moderate and vigorous intensity activity, in order to meet the current recommended physical activity guidelines, one should achieve a range of 450 to 750 METs per week [58]. The range of METs recommended by the Centers for Disease Control and Prevention is slightly broader at 500 to 1,000 METs per week [60]. It is generally accepted and well substantiated that a range of METs is necessary because the amount of physical activity needed to produce a given health benefit cannot be determined with a high degree of precision [58]. Actual MET values can also vary from one individual to another depending on a variety of

factors including how an activity is performed as well as one's skill level and body composition [58, 60].

A few studies have uniformly measured metabolic equivalents among breast cancer survivors. Holick et al. [61], prospectively examined the relationship between post-diagnosis recreational physical activity and risk of breast cancer death among women who previously had invasive breast cancer. After controlling for age at diagnosis, stage of disease, body mass index, menopausal status, hormone therapy use, and demographic variables, findings from this study indicate that women who had greater MET -hours per week had a significantly lower risk of dying from breast cancer. Another study of average time spent per week on moderate and vigorous intensity physical activity among breast cancer survivors between the ages of 30-55 at 8-year follow-up showed similar results with increased risk of mortality among women who engaged in lower amounts of physical activity [62].

1.5 Problem

Despite compelling evidence on the benefits of physical activity, young survivors are largely sedentary [63-65]. Failure to meet recommended physical activity guidelines may in part be attributed to persistent side effects of cancer treatment, lack of awareness that physical activity is safe, or lack of motivation. Only 15% to 44% of women engage in some form of activity during or following treatment for breast cancer. A few studies have shown that activity levels prior to diagnosis decrease significantly during adjuvant chemotherapy. Greater declines have been documented in vigorous activity compared with moderate intensity activity among women whose treatment involved surgery and chemotherapy versus surgery alone or surgery in combination with radiation [63, 65-67]. Not surprisingly, overall levels of physical activity among survivors are consistent with those in the general population and are significantly below the recommended guidelines. One study reported that only 20% to 30% of survivors meet the recommended physical activity guidelines [66]. The low levels of activity among survivors and salutatory benefits of being active underscore the need for interventions aimed at the adoption and maintenance of physical activity behaviors.

More research is needed to better understand the correlates of physical activity, particularly for young survivors [68]. One possible determinant that has received little attention to date is the influence of social support. Social support refers to assistance one receives from others when experiencing life challenges and includes both perceived availability and actual support received [69]. While research has consistently demonstrated that social support is an important variable that moderates the impact of stressful life events on physical and mental health, its role in physical activity behaviors among breast cancer survivors is less well understood [12, 70, 71]. In fact, many studies have been conducted on the role of social support in long-term survivorship in terms of health-related quality of life (HRQOL) during diagnosis and treatment for breast cancer. However, there do not appear to be any studies that have examined social support exclusively in the context of the adoption and maintenance of physical activity at any stage of diagnosis [10, 72, 73]. The purpose of the current research was

to explore the influence of social support on physical activity participation among young survivors of breast cancer.

1.6 Dissertation Outline

This dissertation proceeds in seven parts. This chapter has provided an overview of the issue and states the specific aims and research questions addressed in this research. A brief overview with respect to the concepts and terminology related to social support, review of the literature research questions, and hypotheses is summarized in chapter two. Chapter three outlines the qualitative methods, chapter four describes the quantitative methods used and how both types of data were analyzed. Chapter five summarizes key findings as they relate to qualitative research questions. Chapter six summarizes quantitative results with respect to the hypotheses tested. Lastly, chapter seven provides conclusions, addresses study limitations, and identifies opportunities for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Concepts and Terminology

This chapter begins with a brief primer to orient the reader to the basic concepts and terminology associated with social support, followed by empirical evidence on social support as it relates to health outcomes in general and physical activity explicitly. Social support has been studied extensively as an important variable that moderates the impact of stressful life events such as breast cancer diagnosis and treatment on one's health and perceived HRQOL [12, 70, 71]. While there is a lack of consensus on a definition, in this study social support is defined as the density of social network ties an individual has coupled with the amount and type of support she receives through those ties [74]. Social ties refer to the extent to which one is integrated into broader society as well as her social and family life. Social networks are social structures made up of individuals (or organizations) called "nodes", which are tied (connected) by one or more specific types of interdependency including friendship, kinship, common interest, financial exchange, or relationships of beliefs (e.g. religious, political) [75]. Increasing the size of one's social network influences the amount of social support and aid received [76].

Being part of a network of supportive relationships can foster a sense of community necessary for successful coping with illness and present opportunities for reciprocity and mutuality in a familiar setting [77, 78]. These networks can range from formal ones such as support groups to informal ones consisting of family, friends, or fellow-cancer patients or survivors. Further, social networks are typically measured by specific network properties that emphasize both structure and function. Structural measures are properties of relationships that are easily quantifiable such as the size or number of social ties and the frequency of contact with others. Functional measures emphasize the qualitative nature or type of relationship and perceptions of supportiveness [76, 79, 80].

While social networks emphasize the number of ties one has, social support refers to the function and quality of social relationships including perceived availability of support and support actually received. Indeed, social support is a complex and multi-dimensional concept that has been the subject of much inquiry in the fields of social epidemiology, anthropology, sociology, and psychology [69, 81]. It is important to note that social networks and social support do not connote theories per se but rather are constructs that describe the structure, processes, and functions of social relationships. Both can enhance an individual's ability to access new contacts and information and to identify and solve problems [78]. The section below explores the empirical evidence for social support.

2.2 Social Support and Health

The study of social support owes much to psychologist Emile Durkheim and contemporary social epidemiologists [81]. Durkheim's seminal work on suicide documented the importance of family, friends, and work roles as regulative influences that integrate one into society. His work

showed that those who lacked social ties were likely to be isolated, lonely or in extreme cases in a state of anomie [82, 83]. Drawing from numerous animal and human studies, Cassel posited that social support serves as a key psychosocial protective factor that reduces the deleterious effects of stress on both physical and mental health [84, 85]. He also specified that such support was likely to play a nonspecific role in the etiology of disease and thus may influence the incidence and prevalence of a wide array of health outcomes [81].

Cobb was the first to define social support as information leading individuals to believe they are cared for and loved, esteemed and valued, and belong to a network of communication and obligation [86]. Later work by Cassel, Cobb, Cohen and Wills further demonstrated that social support has a “buffering” effect on stressful situations or events [84]. In fact, social support has been shown to decrease the negative effects associated with a wide variety of stressful events including unemployment, bereavement, divorce, and/or diagnosis with a chronic illness [87, 88]. A breast cancer diagnosis in particular may cause women to experience emotional distress, disruption in marital relationships, feelings of helplessness or fear about treatment and/or disease progression. The social support received from one’s social network may serve as an invaluable resource for dealing with these reactions by enhancing self-esteem and confidence in making informed treatment-related decisions [85].

In response to Cassel and Cobb’s early findings and questions regarding the rigor of the studies they reviewed, additional research on the nature and impact of social relationships on health status burgeoned and has continued to be key area of inquiry to social epidemiologists and others interested in population health [28, 71, 89]. Three major studies conducted since Cassel and Cobbs initial findings further demonstrate the link between social support and health outcomes and mortality. The first by Berkman and Syme assessed the relationship between social and community ties and all causes of mortality in a random sample of adults in Alameda County, California [90]. Findings from their subsequent 9-year and 17-year follow-up showed that people who were not married or lacked social and community ties were more likely to die in the follow-up period than those with more extensive contacts. Further, the association between social ties and mortality was found to be independent of self-reported health status at baseline, year of death, socioeconomic status, health practices (i.e., smoking, alcohol consumption, physical activity), and utilization of preventive health services [90]. This correlation was later confirmed by House et al. in the Tecumseh Community Health Study in Michigan. Findings in that study showed an inverse relationship between mortality risk at 12-year follow-up and number of social relationships. Through the use of a modified version of measures created by Berkman and Syme, Schoenbach et al. found that lack of social ties was related to increased risk of mortality among older white men and women, even when individual level confounders were controlled for [91]. More recently, correlations between mortality risk and social ties have been further confirmed in other studies, including those conducted by Eng et al. and Rutledge et al. [92, 93].

With regard to cancer specifically, Chou and colleagues identified that an increase in the amount of social contact, representing greater social network, may increase the likelihood of survival from breast cancer by enhancing survivors’ coping skills, providing emotional support,

and expanding opportunities for information sharing [85]. Other notable studies as well as meta-analysis that examined factors such as the amount of social support defined by network size, frequency of contact with family and friends, and adequacy of emotional support received by cancer patients [94-96] report that each has a significant impact on survival.

2.2.1 Structural vs. Functional Support

A synthesis of literature shows a consensus that there are two conceptually distinct aspects of one’s social support system that consist of structural and functional support [97]. Structural support assesses the existence or interconnection among ties in one’s social network, whereas functional support assesses the specific functions that relationships in a given network may serve [77]. At its core, structural support consists of networks of relationships that exist between people including friends, relatives, neighbors, co-workers etc. that connect an individual to her community. These networks are in essence linkages between people who may (or may not) provide social support and/or serve functions other than providing support [78].

Cohen and Wills purport that functional measures of support are more likely to be associated with stress buffering effects because they can more directly meet the needs elicited by stressful events [69, 84]. Functional support assesses the actual functions served by members of a social network and can be categorized into the following four broad types of supportive behaviors or acts: 1) informational, 2) instrumental or tangible, 3) appraisal, and 4) emotional support [97-100]. Informational support refers to the provision of advice, suggestions, and information. Specific to cancer patients, helpful information may include obtaining a reference for an oncologist, low-cost treatment, or access to a tumor board [85]. Instrumental or tangible support refers to help, aid, or assistance with tangible needs such as transportation to physician’s appointments, child care, cooking or cleaning, a personal loan, or a temporary place to stay. Appraisal support refers to the provision of encouragement or positive reinforcement for learning a new activity or skill, decision-making, giving appropriate feedback, or help with deciding with a course of action to take [69, 101]. Emotional support consists of one’s perception of being cared for, loved, and valued regardless of achievement. Table 1 summarizes the various types of functional support.

Table 1. Functional Support: Types & Definitions

Support Type	Definition
Emotional	Expressions of empathy, love, trust, and caring
Instrumental	Tangible/material aid and services that directly assist a person in need (e.g., childcare or a personal loan)
Informational	Advice, suggestions, or information
Appraisal	Provision of encouragement or positive reinforcement

Adapted from Health Behavior and Health Education: Theory, Research, & Practice, p. 187 [102].

Of the four types of support that can be exchanged among social network members, emotional support has been shown to be the most strongly and consistently related to good health and

well-being [102, 103]. This type of support is thought to be beneficial because it provides the recipient with a sense of acceptance and may bolster one's self esteem during life challenges [28, 69, 77]. In a study of young survivors of breast cancer, Bloom et al. found that emotional support is a significant predictor of mental wellbeing soon after diagnosis and again five years later [26, 104, 105]. Other studies by Sorensen, Kroenke and colleagues as well as Mols and colleagues of long-term survivors also documented an association between social support and perceived HRQOL [73, 106, 107].

While the types of functional support are conceptually distinct, studying them empirically is a challenge as relationships typically provide more than one type of support [77, 78]. For example, useful guidance or advice from one's spouse or friends may be construed as both instrumental and emotional support. Moreover, research suggests that one's social network members are likely to provide differing amounts and types of support and that the perceived effectiveness of the support provided may depend on the source of support (e.g., spouse, family member, or friends vs. a co-worker) [77, 78].

2.2.2 Personal Characteristics Perceived Support

Kahn theorized that a person's requirement for support at any given time is determined jointly by her personal characteristics (e.g., personality traits and demographic characteristics) and by the properties of the situation (i.e. expectations and demands of work, family, or other roles) [108]. For example, an extremely independent person may require very little (if any) support and potentially has a smaller social network compared with someone who has a more dependent personality. One's ability to cope with stressful events may in turn influence her ability to ask for, accept and/or provide support to others [109]. If an individual perceives that she is coping well in a given situation, support may not be requested or if offered may be refused. Conversely, one who is unable to cope in a given situation may not be able to request support or drive away potential support providers. In general, one's history of coping with a particular situation, supportive behaviors or interactions, and the assessment of alternative available resources are thought to determine whether support is requested, accepted, or deemed effective.

Thoits posits that effective provision of support is likely to stem from people who are socially similar to the support recipients and who have experienced similar stressors or life experiences (e.g., a fellow survivor) [110]. In her view, these characteristics enhance the "empathetic understanding" of the support provider, making it more likely that the support proffered matches the needs and values of the recipient. Empathetic understanding is particularly relevant to the exchange of emotional support, but also applies to instrumental, and informational support [78, 110]. Regardless of the type, support is always intended to be helpful by the provider. Whether or not the intended support is perceived or experienced as helpful by the receiver is a question that is not well understood [69, 77]. Recipients may perceive support as negative if there is an interpersonal conflict or they are not ready to accept the support provided [78]. Support that is non-reciprocal may also be construed as negative [111, 112].

In many instances, the perception of available emotional or instrumental support is more important than their actual utility [110, 113]. In terms of age, social support may play a larger role for younger breast cancer survivors as the burden of disease may be greater for younger women than for their older counterparts. The treatment is often aggressive which heightens their need for emotional and instrumental support. Moreover, younger breast cancer patients are in the midst of their productive years. The demands from family and work are already great in addition to their disease diagnosis, thus making the need for social support even more critical [105].

2.3 Social Support for Physical Activity

Given the increased need for emotional and instrumental support, it is highly probable that social support may be a factor in the adoption and maintenance of physical activity behaviors in this population and thus merits in-depth exploration. In general, much of the research on physical activity among breast cancer survivors has focused on patients closer to diagnosis and treatment [114]. Studies in this realm have relied primarily on quantitative methods and have been subject to methodological limitations including small, non-representative samples, and/or inadequate adjustment for factors such as disease severity [73]. Further, these studies have been inadequate in providing an explanation for how breast cancer survivors adopt, maintain, or cease participation in physical activity [115].

Very little is known about survivors' exercise behavior post-treatment. Presumably, survivors may experience similar challenges and barriers in adopting and maintaining physical activity as asymptomatic adults [116]. Although a number of studies have addressed independent participation in physical activity as a strategy for the self-management of or recovery from chronic disease in general [117, 118], a comprehensive search of PubMed, PsychInfo, Eric and Google Scholar using the terms social support, social network or social embeddedness in combination with physical activity or exercise, reveals that very few studies have examined the role of social support for physical activity specifically. A study of male and female teachers showed that social support for exercise was positively correlated with physical activity and that the association varies by gender, specific types of support (i.e., family, friend), and dimensions of physical activity (i.e., work, sports, and leisure) [119]. Two studies demonstrated that spousal support is positively associated with maintenance of exercise programs [120, 121]. Another identified relationships between specific family support behaviors and physical activity [122].

While these studies (albeit only a few) have added to the literature on social support, most have focused on social support for physical activity among healthy adolescents or adults. To date it appears that no studies have examined the role of structural and functional support in adopting and maintaining exercise behaviors. An exception is a recent longitudinal study by Emery and colleagues [123] of determinants of physical activity among breast cancer survivors which showed a curvilinear pattern in physical activity among 5-year breast cancer survivors. Participants' level of physical activity increased in the first 18 months after diagnosis and then

declined steadily over the next few years. Poor physical health, symptoms of depression, and lower emotional quality of life were associated with lower rates of activity, whereas higher perceived family support was associated a slower decline in physical activity overtime. While this study was not specific to young survivors (average age was 50.9 years), results point to the potentially positive impact that social support may have on the adoption and maintenance of physical activity in this population.

In summary, the current literature demonstrates that social support is a key factor in bolstering health and perceived quality of life. The dearth of evidence on social support for physical activity among young survivors in particular underscores the need for inquiry in this area. This study seeks to understand the ways in which social support may or may not play a role in helping women meet recommended minimums of physical activity post treatment for breast cancer.

2.4 Research Questions & Hypotheses

The qualitative research questions raised in this study are:

1. Does social support influence physical activity among young survivors of breast cancer?
2. How do women find support for being physically active?

Further, hypotheses tested include:

1. Women who self-report having social support for physical activity are more likely to have higher MET minutes per week of moderate and vigorous activity than women who do not, holding all other variables constant.
2. Women with large social networks are more likely to report higher MET minutes per week of moderate or vigorous activity than those who do not, holding all other variables constant.

CHAPTER 3: QUALITATIVE METHODS

This chapter begins with an overview of the data sources and study design followed by a detailed description of the qualitative methods. Chapter four outlines the quantitative methods used and how both qualitative and quantitative data were integrated

3.1 Data Sources

Data from the *Exercise for Bone Health Study: Young Women Survivors* (Bone Health, Joan Bloom, Principal Investigator) were the basis for exploring the research questions and hypotheses. The Bone Health study is a randomized intervention trial in which 273 women who were age 55 or less and premenopausal at diagnosis and completed chemotherapy were randomly assigned to an exercise program at the YMCA or the control group. Eligible women were identified via the California Cancer Registry. Beyond the age and treatment requirements, participants' eligibility was also contingent upon their physician of record's specification of no contraindications. Bone mineral density was assessed for all women via Dual Energy X-ray Absorptiometry (DXA) at baseline and one year later. Women in the exercise group received a one-year YMCA membership and were assigned a Y Coach (personal trainer) who assessed her physical fitness, developed a tailored exercise program, and monitored adherence. Women in the control group received a monthly wellness newsletter. Findings from this study will enhance knowledge of the effects of abrupt menopause due to adjuvant treatment on bone loss in young breast cancer survivors and the extent to which an individualized exercise program that emphasizes resistance training may help to reduce bone loss in this population.

Beyond understanding the effects structured, gym-based interventions on aspects of health and wellbeing, understanding predictors associated with the adoption and maintenance of physical activity behaviors at recommended levels is equally important. In an effort to understand what influence (if any) social support has on physical activity behaviors, this study focuses on physical activity more generally as an outcome rather than changes in bone density as a result of the Bone Health intervention specifically.

3.2 Research Design

A mixed methods (qualitative and quantitative) design was used. The core premise of this design is that quantitative and qualitative data collection and analyses in combination provide a better understanding of a research problem than sole use of either approach alone [124-126]. In this study, quantitative data were used first to determine self-reported levels of moderate and vigorous physical activity. These data were subsequently used to identify women of interest to participate in face-to-face qualitative interviews. Next, semi-structured interviews were conducted with women of interest to assess potential types and sources of support that may influence their physical activity behaviors. Qualitative findings were then used to inform hypotheses testing the association between social support and obtaining recommended levels of physical activity. The use of qualitative and quantitative data in tandem helped to refine,

explain, and elaborate on the statistical results [125-128]. Together, these data provided a more in-depth understanding of the role of social support for physical activity among young survivors of breast cancer.

3.3 Qualitative Methods

Results from Bone Health surveys were used to guide the qualitative component of this study. In particular, data specific to changes in moderate and vigorous metabolic equivalents (METs) per week were used to identify women of interest. Women with the greatest increase or decrease in METs as well as those whose MET levels remained constant at post-test were eligible to participate. These criteria permitted the researcher to explore what role (if any) social support may have attributed to changes in participants' behaviors with respect to physical activity. Semi-structured interviews were used to explore perceptions, sources, and types of social support and how they may or may not contribute to the adoption and maintenance of participation in physical activity in greater depth. The use of open-ended questions that correspond to the specific aims of the study allowed participants to provide a wider range of responses. Probes or follow-up questions were used to both clarify responses and increase the richness of participants' responses in order to provide a deeper understanding of aspects of social support.

3.3.1 Sample

The sample consisted of women who completed participation in the Exercise for Bone Health Study. Consistent with that study, survivors were defined as women who completed treatment for breast cancer. Similarly, women were age 55 or less and premenopausal at time of diagnosis and also had adjuvant chemotherapy. Women in both the intervention and control arms of the Bone Health study were eligible for participation in this study. The sample is reflective of the Exercise for Bone Health study with respect to participants' diversity of age, relationship status, level of educational attainment, employment status, and racial and ethnic background.

3.3.2 Semi-Structured Interviews

Women were contacted by telephone and/or email. Those who expressed interest were given detailed information about the study and invited to participate in a face-to-face interview. The purposive sample size was chosen for its sufficiency in achieving data saturation (i.e., no new information emerged from the data), permitted demographic variation, and provided rich, detailed insight into social support as it relates to physical activity. Informed consent was obtained from all participants and each was given \$30 in appreciation of their time. Study protocols were reviewed and approved by the Committee on the Protection of Human Subjects at the University of California, Berkeley.

Interviews ranged between one to three hours and took place at a location of participants' choosing including their homes, churches, community centers, and place of employment. The variation in length is attributed to the open-ended nature of the interview questions. All

interviews were digitally recorded and the full content of each was transcribed to facilitate data analysis. Field notes were taken immediately after each interview in order to facilitate memory of and provide a detailed description of each interview. These notes supplemented transcript data and were reviewed as appropriate throughout the study to facilitate data analysis. Selected interview questions include:

- Tell me about the kinds of activities you do in a typical day (work, household, leisure, physical activity).
- Tell me about your physical activity habits before diagnosis.
- In what ways have your habits changed since you were diagnosed?
- Tell me about your current physical activity habits.
- What kinds of activities do you enjoy the most? How often are you able to do them?
- Do you prefer to be active on your own or with others? Please give some examples.
- In what ways do people in your life encourage or discourage you from being active?
- What are some of the reasons you may or may not be active?
- What are some of the things that make it hard for you to be active?

It is important to note that the qualitative component of this study was designed to broadly explore social support and was neither designed to characterize nor to compare women by ethnicity. As such, there is no attempt to identify differences by ethnic group in the analysis. Further, the names of women quoted in the analysis are pseudonyms and not their real names.

3.4 Qualitative Data Analysis

Standard qualitative analysis techniques were used in this study [129-131]. Interview data were analyzed in tandem with pre & post-test questionnaire data to illuminate key areas of interest. As is standard in qualitative research, an iterative process of analysis in which facts and meanings contained in collected data were examined and re-examined to develop successively more refined ideas about domains of interest. This process of analysis specifically involved: 1) parsing of descriptive data; 2) the development of a coding manual and subsequent classification (coding) of themes; and 3) the identification of associations between themes. The researcher read text data and formulated categories that represented emergent themes and domains of interest. These categories (codes) were entered into a qualitative software package that facilitated the retrieval of text segments associated with each code. Through this process the researcher was able to identify central themes and further investigate relationships and links between these themes. Interview transcripts were reviewed line-by-line and coded for relevant concepts, themes, and categories. *Atlas.ti* qualitative software was used in order to organize textual data and facilitate analysis. The coding scheme was revised as new codes emerged. Qualitative findings were linked with quantitative findings from the sample of 273 women and together these data provided a broader understanding of the role of social support for physical activity. The sample, consisting of 31 women, yielded sufficient data to provide answers to the study questions.

CHAPTER 4: QUANTITATIVE METHODS

Results from qualitative interviews provided a nuanced, subjective understanding of the sources and types of support that influence participation in physical activity. Given the importance of social support expressed in qualitative interviews, it was appropriate to test the associations of social support and social network size with achieving recommended guidelines for physical activity. This chapter describes the methods and analytical plan used for quantitative analyses.

4.1 Dataset

De-identified pre-test data from the Bone Health study were used to test the hypotheses (N=273). These data are self-reported and were collected via in-person interviews. As noted previously, all participants in the Bone Health study completed chemotherapy and were age 55 or less at the time of their breast cancer diagnosis.

4.2 Data Measurement

The measures used in this study are largely validated and commonly employed in the literature. Each of the dependent, independent, and control variables used in the analysis are described below.

4.3 Dependent Variables

The main outcome measures for this analysis were continuous and binary indicators of women's self-reported levels of moderate and vigorous physical activity combined (i.e., METs). Continuous measures were used in bivariate analyses to assess the relationship between total METs per week and measures of social support. In regression analyses METS were measured as a binary variable; specifically 0 to 499 METS or 500 or more METs (coded as 0 and 1 respectively). Based on CDC guidelines, women in the 500 or more category achieved the recommended amount of physical activity per week. Women in the 0 to 499 category did not meet recommended levels of activity. As described below, the calculation of METs was based on a modified version of the Ainsworth CAPS scale.

4.3.1 Physical Activity Measures

Metabolic Equivalent (METS): Levels of weight bearing and aerobic physical activity were measured through a modified version of the Ainsworth Cross Cultural Activity Participation Study (CAPS) survey. The Ainsworth CAPS has been used in numerous studies that assess levels of physical activity among women of all ages and ethnicities [132, 133]. This study focused on a subset of items specific to moderate and vigorous intensity activities (i.e., light activities were excluded). Moderate effort activities were defined as those resulting in some increase in

breathing or heart rate. Vigorous activities were defined as an all-out effort that produced large increases in breathing or heart rate.

The original questionnaire was modified to include separate items for weight-bearing and non-weight-bearing moderate and vigorous conditioning activities. Examples of weight-bearing activities included aerobics and running/jogging. Examples of non-weight-bearing activities included swimming and bicycling. Women were asked about the types of activities they did in a typical week in the past month at baseline. For each activity performed, women were then asked to report the number of days they did the activity Monday to Friday and Saturday to Sunday as well as the average time spent in hours and minutes.

Consistent with CAPS, moderate intensity activities were assigned a value of 4.0 METs. Accordingly, MET scores for moderate intensity activities were derived by summing the total amount of minutes spent on all moderate intensity activities per week and multiplying by 4.0. Likewise, vigorous activities were assigned a value of 7.0 METs. Scores for vigorous activities were derived by summing total minutes spent on all vigorous activities per week and subsequently multiplying by 7.0. Total MET minutes per week for moderate and vigorous activities were derived by adding the respective MET scores for each intensity type. Subsequent to this, a bivariate measure was created where 500 or less METs per week represented not meeting recommended physical activity guidelines and 500 or greater METs per week represented meeting or exceeding recommended guidelines.

4.4 Independent Variables

Independent (predictor) variables included: 1) socio-demographic; 2) treatment; 3) perceived health-status and 4) measures of social support and self-efficacy. Each of these variables is based on self-reported data derived from the Bone Health pre-test survey.

4.4.1 Socio-Demographic Variables

Race/ethnicity: women were asked to self-report their racial/ethnic background. All responses that indicated non-Hispanic white were grouped together. All other responses were coded as “non-white”. The resulting variable is white or non-white.

Relationship Status: women were asked to report their relationship status. Responses that indicated married or in a committed relationship were grouped together and coded as “yes”. All other responses were coded as “no”. The resulting variable is whether or not women are married or in a committed relationship (yes or no).

Children at home: This variable represents whether or not women have children age 18 or less living at home (yes or no).

Employment status: women were asked to report if they were employed full-time, part-time or unemployed. Responses that were full-time or part-time were grouped together and coded as

“yes”. All other responses were coded as “no”. The final variable is whether or not women are employed (yes or no)

Education: reported level of educational attainment in years

Age: this variable represents participants’ age in years at baseline. This variable was calculated by subtracting participants’ date of birth from their pre-test interview date.

4.4.2 Treatment-Related Variables

Surgery Type: women were asked to report whether or not they had a mastectomy. Those who responded “yes” were then asked to specify whether or not they had reconstruction. Responses to these questions were merged resulting in a variable that represents mastectomy with reconstruction, mastectomy without reconstruction, or no mastectomy.

Radiation: women were asked whether or not they had radiation. All “yes” responses were grouped together. All other responses were coded as “no”. The resulting variable represents whether or not participants’ had radiation as part of their treatment (yes or no)

Drug Therapy: current or prior use of Tamoxifen and/or anti-estrogen drugs following chemotherapy (yes or no)

Time Since Chemotherapy: number of months since completion of chemotherapy at baseline. This variable was calculated by subtracting participants’ reported chemotherapy end date from their baseline interview date.

4.4.3 Perceived Health-Related Quality of Life Variables

Physical and Mental Health were assessed through the use of the Medical Outcomes Study (MOS) SF-36 - a 36 item self-report measure of health related quality of life based on eight multi-item scales that measure specific health dimensions including 1) physical function, 2) social function, 3) bodily pain, 4) general health, 5) vitality, 6) role limitations due to physical health, 7) role limitations caused by emotional problems, and 8) mental health. Internal consistency reliability for the eight subscales is high ranging from .78 to .93. These subscales can be used independently or combined using factor weights for each of the eight subscales to yield summary physical health and mental health component measures. This study employs physical and mental health component scores only. Similar to other studies, summary component scores were computed following Ware et al.’s methodology of transforming the raw scale to a 0 to 100 scale where 0 indicates worst possible score and 100 indicates best possible score [134].

4.4.4 Social Support and Other Psycho-social Measures

Consistent with the Exercise for Bone Health study, two components of social support were measured: 1) Social support in general through the use of a modified version of Berkman & Syme's Social Network Index (SNI) and 2) emotional support through the use of Flamer's Emotional Support Scale (ESS). By including both the SNI and ESS measures, this study balances the meaning of social support in general between the objective number of ties and the subjective meaning of those ties. Self-efficacy and social support specific to physical activity was also included in the analyses.

Berkman & Syme Social Network Index (SNI): SNI is a validated index that assesses the number of social contacts and the amount of social involvement with one's friends and relatives [90]. This index has been widely used to explore the social networks of both patient and community samples and has been found to be successful in predicting the utilization of screening services, and morbidity and mortality in community samples [135]. The index was incorporated in the Bone Health Study due to its brevity and consistency in cultural meaning [26, 74, 90, 135]. The SNI is constructed from four different types of social connections: 1) marital status, 2) sociability (number and frequency of contacts with friends and family); 3) religious group affiliation (yes vs. no), and 4) membership in other community or social groups (yes vs. no). The SNI considers both the number and relative importance of social ties across the four categories and combines this information into a summary measure ranging from 1-4 (1=low, 2=medium, 3=medium-high, and 4=high).

Emotional Support: The Flamer Emotional Support Scale (ESS) consists of a list of 11 basic emotional supports that respondents identify as available or unavailable to them (i.e., perceived support) [136, 137]. More specifically, respondents are asked "how sure are you that there is someone who does or will do a series of 11 behaviors such as "kisses or hugs me, understands my feelings, listens to me, and helps me with my problems". Response categories range from strongly agree (4) to strongly disagree (1). Responses across the eleven items are combined to provide a continuous summary score, is coded such that high scores indicate high levels of social support. In previous use of this measure in the Psychological Aspects of Breast Cancer Study Group, the inter-item correlations ranged from 0.15 to 0.69 and Cronbach's alpha was .92 [136]. In this study, emotional support is measured on a scale of 0 to 100, where 0 is the worst possible score and 100 is the best possible score.

Social Support for Physical Activity: perceived support for physical activity was measured through the use of a modified version of the Social Support for Diet & Exercise Behaviors survey developed by Sallis et. al [138]. Questions include how often during the past three months family or friends: 1) exercised with me; 2) offered to exercise with me; 3) gave me helpful reminders to exercise; 4) gave me encouragement to stick to an exercise program; and 5) changed their schedule to exercise with me? Each question is measured on a Likert scale ranging from 1 (none) to 5 (very often). In general, factor test-retest reliabilities for this scale range from .55 to .86 and Chronbach's alpha ranges from 0.61 to 0.91. In this study, the

Chronbach's alpha is strong at .86. Further, summary scores were transposed into a scale from 0 and 100, where 0 is the worst possible score and 100 is the best possible score.

Physical Activity Self-Efficacy: Self-efficacy - a construct of Social Cognitive Theory, has been widely applied to many programs and interventions aimed at behavior change including the adoption and maintenance of physical activity behaviors [33, 139-143]. In this study, self-efficacy is specific to physical activity behaviors; accordingly, the variable is labeled physical activity self-efficacy. This variable represents a continuous score that assesses the degree to which a woman believes that she can engage in physical activity independently or with others. Questions include how confident are you that you could exercise in each of the following conditions: 1) when I am tired; 2) when I am in a bad mood; 3) when I feel I do not have time; 4) when I am on vacation; 5) when it is raining or snowing? Each question is measured on a Likert scale where 1 represents not at all confident and 5 represents extremely confident. Summary scores were transposed into a scale from 0 to 100, where 0 is the worst possible score and 100 is the best possible score. The Chronbach's Alpha in this study is strong at .82.

4.5 Data Cleaning

A preliminary review of the data suggested that some data cleaning was necessary. In order to facilitate ease of interpretation, all Likert scales were coded such that "1" represented the lowest possible value and "5" represented the highest possible value. This was done to ensure consistency in across all variables. Binary variables were created and coded as 0 ("No") or 1 ("Yes"). All categorical variables were recoded such that each value category had at least 10% of the total sample. For example, the variable to assess self-reported number of times per week of physical activity originally had three options including "one time per week", "less than once per week", and "I do not exercise" that only represented 7.4% of the total sample. In the recoded variable, these response options were combined into a more general "1 time or less" option. Other response options for this question (e.g. "4-6 times per week" and "almost daily") were not changed. Lastly, the dataset was reviewed for missing data on variables of interest.

The unexpectedly high proportion of the sample meeting physical activity recommendations suggested problems with over reporting of time spent on moderate and vigorous activities. While it is possible that survivors may be more motivated to be physically active compared to healthy adults, in some instances reported time spent on activities was not plausible. To address over reporting, the survey was reviewed to identify items that may have overlapped and thus increased the potential for double counting of self-reported amount of spent on a given activity. A total of five items were ultimately removed from the analysis resulting in a more realistic assessment of leisure walking, dancing, sports, and conditioning activities such as swimming, aerobics, cycling, or running. Consistent with International Physical Activity Questionnaire (IPAQ), both minutes per day and hours per week spent on a given activity were truncated [144]. Specifically, items in which women reported engaging in an activity for less than 10 minutes per day were recoded to zero (n=11 changes). The rationale for this was that women are unlikely to receive any material benefit from performing any activity for such a

short duration. Further, the number of hours per day was capped to three hours maximum (n=4 changes). While average METs remained high after implementing these changes, the percentage of women meeting physical activity guidelines decreased and overall numbers are more credible.

4.6 Analytical Plan

The analytical plan for descriptive and regression data analysis is outlined below.

4.6.1 Descriptive Analysis

Quantitative data analysis was performed using SPSS statistical software (version 19.0). The first step of analysis included descriptive statistics (e.g., frequencies, means, and standard deviations) for each of the dependent and independent variables. Given the skewedness of the distribution of METs, non-parametric correlation matrices were calculated in order to discern the association between the ranked (continuous) METs outcome variable and perceived health status, social support measures, and self-efficacy. Nonparametric, or distribution free tests are so-called because the assumptions underlying their use are “fewer and weaker than those associated with parametric tests” [145]. Simply stated, nonparametric tests require few if any assumptions about the shapes of the underlying population distributions. For this reason, they are often used in place of parametric tests if/when one feels that the assumptions of the parametric test have been too grossly violated (e.g., if the distributions are too severely skewed).

4.6.2 Regression Analysis

Following the calculation of correlation matrices, bivariate associations between METs (above or below 500 per week) and independent variables were performed using: 1) Pearson’s Chi-Square for categorical variables; and 2) two-sided independent t-tests for continuous variables. Next, both hypotheses were tested through the use of logistic regression using a binary outcome variable controlling for demographics, treatment, health status, social support, and social network size.

Logistic regression is often used in social behavioral research [146, 147]. This approach to statistical analysis was appropriate in this study given the binary outcome variable (i.e. below 500 METs per week and 500 METs or more per week). The model was created in blocks, beginning with demographic variables, then adding treatment and health-related variables, and finally included measures of social support, self-efficacy, and social network size. Odds ratios for categorical variables represent the increase or decrease in odds compared to the referent category (e.g. not-white was the referent category for race/ethnicity). Odds ratios for continuous variables reflect the increase (or decrease if the ratio is less than one) in odds of meeting or exceeding the recommended 500 to 1,000 METs of moderate and vigorous physical activity combined per week when the value of the predictor increases by one unit for categorical variables and 1 percent for continuous variables. Quantitative results are summarized in chapter five.

4.7 Integration of Qualitative and Quantitative Data

Consistent with mixed methods research, the overall synthesis of qualitative and quantitative findings in this study was an iterative process [124-126]. As noted above, quantitative data were summarized in a series of tables describing sample characteristics, correlations, and regression analyses. Qualitative data were organized thematically. Matrices were then developed to summarize quantitative and qualitative findings in key topic areas. Topics were loosely defined and fluid as findings did not match identically. These data were integrated with a goal of adding depth and richness to findings, rather than a directed effort at triangulation [125]. For the sake of simplicity, findings are presented in two separate chapters. Chapter five describes qualitative themes identified in interviews and chapter six outlines results of quantitative analyses.

CHAPTER 5: QUALITATIVE FINDINGS

5.1 Overview

The qualitative sample consists of a subset of women who completed participation in the Exercise for Bone Health Study. Results from Bone Health pre and post-test surveys were used to guide study participant selection. In particular, data specific to changes in metabolic equivalents (METs) per week were used to identify women of interest. Women who had the greatest increase or decrease in METs as well as those whose MET levels remained constant at post-test irrespective of study arm were invited to participate. Based on the selection criteria, 48 women were contacted, 31 of whom agreed to participate (intervention = 15, control = 16), representing a 64.6% response rate and 11.4% of all women who participated in the parent study. The sample is reflective of the Bone Health study with respect to participants' diversity of age, marital status, level of educational attainment, employment status, and racial and ethnic background.

The majority of women in this study were white, married, worked full time, and college educated. 48.4% had children living at home. Participants' actual age range was between 32 and 51 and average age was 44.3. Sample characteristics are summarized in detail in Table 1 below.

Table 2. Qualitative Sample Characteristics

Characteristic	Intervention Group (n=15)		Control Group (n=16)		Total	
	#	%	#	%	#	%
Race						
White	10	66.7	12	75.0	22	70.9
Non-white	5	33.3	4	25.0	9	29.1
Relationship Status						
Married/Partnered	11	73.3	13	81.3	24	77.4
Single	4	26.7	3	18.7	7	22.6
Children at home						
No	8	53.3	8	50.0	16	51.6
Yes	7	46.7	8	50.0	15	48.4
Employment Status						
Employed	11	73.3	12	75.0	23	74.2
Not Employed	4	26.7	4	25.0	8	25.8
Education						
High School or less	2	13.3	2	12.5	4	12.9
Some College	3	20.0	3	18.8	6	19.4
College Graduate	10	66.7	11	68.7	21	67.7

During interviews, participants were asked to describe their physical activity habits post treatment and reported engaging in a broad array of activities including walking, dancing, yoga, chi gong, and group fitness classes at a gym. Probing questions about perceived types of social support and the extent to which women found them helpful were also asked. Overall, 16 (control group=9, intervention group=7) perceived having some consistent form of social support for physical activity in their lives. Working mothers and newly divorced women (n=4) were interested in being active but did not perceive having any support. Five women described themselves as intrinsically motivated with respect to physical activity and thus felt that support was not necessary in order for them to be active. Eight were not active primarily due to the effects of treatment including neuropathy, lymphedema, or fatigue. These women also had aggressive treatment and in some instances reported a recurrence of cancer. There were no discernible differences in terms of the types of perceived support among women who initially participated in the intervention or control group of the Bone Health Study. Accordingly, findings for this study are synthesized in aggregate and are presented by key themes identified including: 1) buddy, 2) functional support, 3) counterproductive-support, 4) no support; and 5) intrinsic motivation. The way in which women defined physical activity and exercise is another key finding presented in the analysis.

5.2 Buddy

Women who perceived having some form of structural or functional support often had someone with whom they engaged in regular physical activity. In fact, women often described their physical activity partners as their “buddy” and thus the term buddy is used in this analysis. Among the 16 women who self-reported having a buddy, eight participated in intervention group and eight in the control group of the parent study. In terms of relationship status, 8 women were in a committed relationship and 8 women were either single or divorced. Some women met their buddy post treatment while others had one prior to diagnosis and resumed being active with that person during recovery. In general, physical activity with a buddy followed a pattern whereby participants met their buddy on the same day, time, and location at least once per week. After engaging in the activity, they went their separate ways. Occasionally women would go for lunch or coffee afterward; however, this was not the norm primarily due to time constraints attributed to family and/or work obligations. Women often referred to this routine as “sacred”, “therapeutic”, or “necessary for my sanity” and for some, being physically active with a buddy was less about the activity itself per se, but rather the camaraderie, reciprocity and mutuality during conversation while engaging in an activity, and sense of obligation to the other person to show up as planned. For others, the motivation to be active stemmed in part from the belief that physical activity was vital to the prevention of a recurrence of cancer and that having a buddy was fundamental to adopting and maintaining physical activity behaviors. The following is a summary of quotes in support of the themes identified in the analysis. As noted previously, names contained herein are pseudonyms and not participants’ actual names.

Lisa, a 39-year old single woman who works in the technology industry talked about her evolving relationship with a buddy whom she met post treatment and has walked with on weekends, “rain or shine” for the past two years.

I met a gal and she was like, “Let’s go walking.” ... She was just a walking maniac and that’s exactly what I needed to shock my body. So we walked for a good six months, her and I, first thing Saturday and Sunday mornings, ... So then she said, “Oh, my other friend is gonna come along.” I’m like, “Yeah, the more the merrier.” So it was kind of the three musketeers for a while. Those two had a little fight. So now I’ve been walking with the other gal for about two years now because the [first] one didn’t want to walk anymore. So silly. But I’m like, “Whatever, girls. I just want to walk.” Because now this became a habit and I actually enjoy the company and I think that’s the thing that helps me.... We’ve become friends.... We talk about everything under the sun that women talk about. Husbands. Recipes. Everything. I think for me personally that’s what I enjoy is the friendship component because we’re walking and talking the whole time. It’s fun. It goes so fast. I mean an hour and a half by myself would be torture, even with an iPod. I don’t like exercising alone, I don’t know if it’s a loneliness thing... I just hate exercising alone. It’s like the buddy system for me always works.

Lisa also talked about the twice-weekly spinning classes that she recently started to take with a co-worker and how she felt empowered by being able to engage in such a vigorous activity. In this example, the impetus to become physically active was engendered by Lisa’s belief that it may prevent a recurrence of cancer. Through the help of two buddies, she has been able to adopt and maintain new behaviors and in the process developed new and enduring friendships.

Marissa, a 45 year-old mother of two boys and stay-at-home mom has more than one buddy.

I have a couple friends I walk with. One is another mom, we met basically through her seeing me at a book store when I was going through chemo and asking if I was going through chemo because I was wearing a bandana and she was about to begin. Our cancers were not the same but we were diagnosed pretty close to each other and had chemo and radiation and all of that. So, we try to meet once a week and that’s been a good support.... And then the other group I walk with is anywhere from 1 to 3 women. We’re all breast cancer survivors...I love walking with them because we’re getting exercise [and] share what’s going on, you know. I mean in both cases what makes those good forms of exercise is they’re enjoyable because you’re talking and it makes it go by quicker and they’re people I like and have similarities with.

Marissa’s walking buddies are primarily in their 40’s or 50’s and like her have experienced abrupt menopause as a result of their breast cancer treatment. In her words these women “get it” because there is no explanation required in terms of the challenges and physiological

changes to her body as a result of treatment. Marissa has also enlisted the assistance of a health coach (a friend and fellow breast cancer survivor) in order to help her stay focused and achieve her personal fitness goals. Her rationale for having a coach was to have someone to be held accountable to in her efforts to stay active. During the interview, she affectionately referred to her coach as a “cheerleader” who praises her accomplishments and encourages her “to stay on target” whenever she deviates from her goals.

Lily, a 49 year old lawyer has two young sons and plays soccer on local recreational women’s team. Her buddy arose through her love of the sport and affiliation with her son’s soccer team.

I’ve developed a friendship with the woman who I coach the younger boys [soccer team] with. She’s very athletic and doesn’t like going to the gym by herself. It took some getting used to for me because that was my time - my alone time. But now I find that I really enjoy going with her. I’ll go to the gym by myself once a week and then go with her 3 times a week. We just chat and talk, we get ellipticals next to each other and we’re on there for 40 to 45 minutes. Once we do the weight training we kind of separate a little bit, but we always seem to be in the same area and it’s like, “oh yeah I forgot to tell you da da da da da”.

Lily’s husband cares for the children while she is at practice or the gym. Although she went to the gym alone prior to meeting her friend, as she stated during the interview “I think I’m more likely to go [to the gym] now... not a huge difference, but it is a difference”. This example, like others presented in this section indicates that having a partner may have a positive impact on one’s long-term adherence to physical activity behaviors.

Some women had unconventional partners with whom they engaged in physical activity. For example, one participant adopted a dog post treatment because she needed the motivation and commitment to walk on a regular basis. As stated in her interview, she discovered a new social network of dog owners who participated in group dog walks. Other women preferred to engage in physical activity in a group setting rather than one-on-one with a buddy. A few developed friendships with their teachers and/or fellow classmates outside of the classroom as a result of their common interest in a given activity. Others preferred to participate in a group class either at a gym or other setting but did not make acquaintance with other people whom they saw frequently for a variety of reasons.

Stephanie, a part-time hair stylist and mother of two middle school age children was an avid swimmer before her diagnosis. Following treatment she decided to “try something entirely different” and began to take ballroom dancing lessons. Through her classes at a local college she discovered a love of dancing and a new network of friends.

I took swimming and dance lessons from [a local] College... it challenges you and you see the same people every day so you become friends. It’s like a community and then we [students] have dance parties at each other’s houses every week. It’s a very supportive social network but yet you’re exercising and I enjoy that. I

couldn't go to [a] gym and exercise because it's one of those places that you don't connect with the people. Sometimes you see somebody, sometimes you don't... you're on your own.

Stephanie intentionally takes classes during the daytime so that she can spend time with her husband and children in the evening. On rare occasions when there is an evening class, her husband watches the children while she is away.

Michelle, a single professional who works in sales for a local newspaper described what aspects she likes about working out in a group setting at the gym where she has a membership.

It's unbearable for me to spend 30 minutes on a treadmill because I'm just there in my own head, doing my own thing and I'm bored, I'm tired, I've been doing this long enough, is it over yet? But in a class, a group environment, first of all there's a trainer that's calling out what to do and there's more accountability in a group environment. I'm not just gonna get up and leave after 20 minutes. Now if I could hire a personal trainer who would just train me one-on-one every day, I would do that, but it's not affordable. I found that it's really important to me to be in a structured environment, I get better results. For me it's not a social thing although it is for other people. I don't know anybody at the club. I don't have any friends that go there so I work out by myself which is probably one of the reasons why I like the group classes because there's some camaraderie.

5.3 Functional Support

Functional support was the most common form of social support reported, specifically emotional and informational support. Some women found appraisal support to be helpful in their efforts to become active post treatment; however this type of support was not the norm. Compliments on weight loss or increased endurance and/or ability to participate in vigorous physical activities were cited as the most encouraging. With regard to tangible support, one participant's yoga teacher gave her six months of unlimited classes (free) to facilitate her recovery from treatment, while another participant's husband bought her a bike and cycling gear to encourage her to start riding. Given the number of married women and mothers in the sample, there were surprisingly few examples of instrumental support. In general working mothers of school age children (n=4) lacked childcare and thus struggled to find time to be active. Only one mother reported having childcare on the rare occasions when she needed to attend an evening dance class. Other examples of instrumental support include a participant's husband driving her to Golden Gate Park to practice Chi Gong with her most days of the week.

5.3.1 Emotional Support

Although not explicitly stated, women often gave examples of ways in which emotional support was instrumental to their continued participation in physical activity. A common theme among

these women was the fact that they had the same buddy for at least two years. This suggests that women are more comfortable sharing their feelings with other women whom they know well and have developed a close relationship with over time. As the examples below show, support was typically given from other survivors or empathetic friends or family members.

In addition to regular gym workouts and morning walks with her dogs, Claire, a 51 year old mother of two adult children, has taken belly dancing classes for many years. During the interview she talked about an experience in class that made her feel less confident about her ability to dance and the emotional support that her friends gave her.

The chemo really messed up my balance. It was like being perma drunk; I couldn't even walk down the hall without running into the wall. I went to [belly dancing] class one night and we had to do some spinning and I fell. I came home and I was crying, "I can't do this anymore". A few days later, my teacher [and friend] called to see how I was doing. I started crying, "I don't think I can come to class anymore. Didn't you see me fall?" She said, you couldn't spin before the chemo, get your butt back to class! I was like, Okay. I was never very graceful was I? These are the type of friends that I need. I wouldn't have done well with, "oh you poor thing" - these are the types of friends I need... good women.

Claire's fellow classmates also bought her a pink bra (symbolic of breast cancer) following this incident, embellished and signed it, and gave it to her as a way to show support for her love of belly dancing. As she explained in the interview, both of these small acts of caring and support were instrumental in boosting her confidence at a time when she felt vulnerable.

One participant was recently diagnosed with a recurrence of cancer. During her interview she talked about the camaraderie and intimacy of walking with a friend with whom she has walked with for many years.

Well, we yak about everything... I actually think it's rather intimate because it's a one-on-one situation. I'm a rather shy person, so it's easy to walk because you can be silent for a moment, you can point to the nature or at the bird or whatever and then more naturally things come up. I did talk to my friends for example about my feelings and [new] diagnosis during [the] last nine weeks... which then opens the door for other people to tell.... My one walking friend lost her mother recently and we talk a lot about the grief and relationship issues and whatever, not about walking so much. Once in a while [we] will stop and say it's beautiful, did you see the light, isn't that beautiful?... look at the clouds...the nature... I really think there is this healing effect. Just being around beauty...it increases your appreciation for life - beauty of nature... Birds are there and having cancer or not, they will still be there. It's reassuring...

Clearly, walking in a natural setting and the reciprocity and mutuality it engenders has a positive effect on this participants' mental wellbeing. Not only did she find her friend's words of

encouragement, hope, and optimism to be emotionally supportive, but she was also appreciative of the fact that she was able to count on the same friend during her second cancer diagnosis. To some degree, the potential health benefits of regular walks are secondary to the emotional support that she receives.

A few women enrolled in programs or interventions that focused specifically on physical activity for breast cancer survivors. These programs were said to be invaluable because women did not feel intimidated by their baldness immediately following treatment nor have to explain their physical limitations. One woman simply stated:

After chemo I was as weak as a kitten. The whole cancer experience leaves you caved in and so it's nice to have the peer support and emotional support... When you're in the middle of cancer recovery and you try to get your body back and your sense of yourself back, having a personal trainer who's not only trained but who is also able to hang with cancer survivors where they are is key. To walk into a class and have the automatic understanding that you or somebody else is going or gone through treatment, whose been there, you can look at 'em and say, "Yep" and don't have to say a word because they get it. So there was this whole built in support thing. That kind of peer support, group support was very important.

In addition to tailored protocols, women felt a sense of kinship with their classmates. Simply being in an environment with women who had a shared experience was perceived to be supportive, contributed to women's sense of wellbeing, and deepened their commitment to continue participating in classes.

5.3.2 Informational Support

For some women, technology was a form of informational support that contributed to their ability to achieve personal fitness goals. FitLinxx, a computerized system at the YMCA that tracks members' workout sessions, was described as "an invaluable tool" and "a virtual coach with benefits". The system works by "learning" a person's exercise routine, and then using this information to coach her throughout a workout with the aim of encouraging better form in lifting weights and assistance with achieving their goals. Members can access their workout information online, receive monthly updates on their progress, and earn points that are redeemable for prizes for their efforts. One participant talked about the system in this way:

The FitLinxx thing has this thing about elephants. I love it, it's so fun and you get feedback on how you're doing. An elephant is around 4,000 pounds ...and you get an email message at the end of every month telling you how many elephants you lifted that month. My husband teases me when I come home [from the gym], "well how many elephants did you lift today?" It's cute.

Another participant liked the positive reinforcement and rewards that the system provides:

...you get t-shirts; I've gotten 3 or something like that... I'm on my way to a platinum t-shirt....It's a dumb thing, but the t-shirts, they motivate me.... I'm about to hit 100,000 [points] but it's only half way to my next t-shirt.

These examples suggest that technology may play a supportive role in the adoption and maintenance of physical activity behaviors. An added benefit is that one may not need to hire a personal trainer in order to receive feedback on her progress. This combined with the potential cost savings and positive reinforcement that technology offers may be sufficient to keep some women motivated to achieve their fitness goals.

5.4 Counterproductive Support

It is important to note that there may be instances where support can be more of a hindrance than help. In fact, there were two striking examples in this study:

Janice was somewhat ambivalent about her family and friends' well-meaning advice about physical activity:

I just get so tired of people always preaching to me... you need to drink more water, you need to exercise and blah blah blah. My life sucks already because I have cancer and you want me to fucking exercise? I don't know if this is a death sentence or not so don't tell me it's good for me because this could turn into stage IV and I could die. What good is that really? I really don't need any more stress. To me in so many ways exercise is just one more stress that people have. It's like what am I supposed to eat?; What am I not supposed to be eating?; and da da da. I don't want exercise to be a stress. And so I think I shy away from it sometimes.

This example underscores the need for sensitivity when encouraging survivors to be more active. As Janice indicated, she would be more responsive to support from health care practitioners, friends, or family that emphasized the more immediate benefits of physical activity including reduced fatigue, improved mental health, and reduced nausea rather than long-term survival. She referred to these benefits as “practical tools” – tools that people can include in their repertoire of skills in order to mitigate the effects of chemotherapy.

Rachel is stay-at-home mom of a 10 year-old child with a cognitive disability. Her yoga teacher of many years gave her six months of unlimited yoga as a gift during her treatment and recovery. Following treatment she joined a gym because she felt that yoga alone lacked sufficient weight bearing benefits. She hired a personal trainer because she felt strongly that the obligation of a regularly scheduled appointment would help keep her motivated.

I gained 20 pounds after treatment. That was the big emphasis for getting me to the gym, was to lose weight. I really wanted to start working out and I needed an appointment to keep and a reason to go because I did not have the internal willpower. I'm paying her a lot of money too - \$65 every time I see her just because I know that I'm not gonna go otherwise and because I think it's super important that I do. But, this trainer is always pushing me. That's all I could do in the last year. I quit volunteering at the school and didn't do anything else extra-curricularly or do stuff around the house because she was always pushing me with strength training and cardio, and I didn't have any more energy left. And then after each session, she'd expect me to work out on my own at least one other day a week for strength training and hopefully an additional day for cardio. I feel physically stronger but I don't have extra energy.

While Rachel receives the support that she feels is necessary to maintain her physical activity behaviors, an unintended consequence of her personal trainer's expectations and fitness regimen is chronic fatigue that affects her ability to perform daily tasks. Despite her trainer's good intentions, it appears that her workout plan may be compromising her quality of life.

5.5 No Support

Four women were struggling to be physically active. Two of these women were full-time working mothers whose leisure time was primarily spent helping their children with homework, driving them to sports activities, or caring for an aging parent. It was apparent during interviews that their husbands worked long hours thereby making it difficult for them to designate time for physical activity weekday evenings or weekends. Other trusted sources of support (i.e. family or friends) did not live in close proximity or had families of their own to care for and thus were not able to provide any kind of instrumental support either. In both situations, women prioritized the needs of their children above their fitness goals. One woman talked about the 4th grade being the biggest obstacle for her being active:

He's studying physics-type science and he's only in 4th grade! ...By the time we're done with his homework, it's 9:00 at night and there's no time for exercise. Once we get past the fourth grade, hopefully it will be a bit easier. I really really enjoy being able to work out, it's like my own private time – even if it's only for an hour. It's a goal. But for now it's a season, you know? Right now my season is with my kids.

Another mother of two school-age children simply stated:

One of the challenges of having children, working full-time, and caring for a parent is that your spare time slips away. Your role as a mother, daughter, and employee consumes most of those precious 24 hours in a day. The remaining few

hours are pretty much spent preparing and eating meals, cleaning, and sleep[ing]. There's not a whole lot of time left over to take a walk or go to the gym.

The examples presented above are in stark contrast to stay-at-home mothers' experience. Stay-at-home mothers and mothers who worked part-time (n=3) typically engaged in physical activity during weekdays while their children were in school. This was done to maximize the amount of time spent with their children and take advantage of free time afforded by them being away from home. To some degree this practice could be construed as a form of instrumental support in that children are being cared for while in school thereby permitting time for mothers to engage in physical activity.

Two newly divorced women also perceived a lack of support for physical activity. One had adult children and lived alone, the other had a roommate but no children. Each indicated a desire to have someone with whom they could walk or ride a bike with on a regular basis but felt that family or friends were not available or not interested in being active. Feelings of intimidation in terms of being able to keep up with others' fitness levels were also expressed. While the idea of participating in group classes at a gym was appealing to these women, due to work and time constraints, conflicting schedules, and limited finances, it was not possible.

Marcy, age 52, reflected on a time when she did regular walks with a friend.

When my ex-husband and I separated, I was living in a shared rental with my friend and landlord ... we both had dogs and she was trying to lose weight. She would get up every morning and do this 45 minute fitness walk. We started doing it together and then this thing happened emotionally during the separation that was really hard for me and I just didn't get out of bed to do it. When I stopped doing it, she stopped doing it too and we didn't realize that the only reason we're getting up was because the other person was gonna be standing there in front of the door with the leash and the dog waiting. I kind of wish that I had that nearby now because that could work.

She also stated:

I really want to do more. A lot of my friends are older and not so interested in doing stuff so I need to cultivate friendships with younger people who are at the same fitness level that I am... I'd also like to get a bicycle, but it's intimidating when you see all these hard core bikers in packs doing these tremendous hills and all that. So, I'm thinking geez it would be nice to do something that other people would do with me. Trying to be motivated on my own all the time is just hard - it's so much easier when there's somebody waiting for you.

These examples illuminate the potential positive impact that a buddy may have on women who might not otherwise be active. As Marcy explained in her interview, “having someone to exercise with would help me crossover making it a ‘to do’ item on my list and make it a habit”.

5.6 Intrinsic Motivation

Five women described themselves as being intrinsically motivated and thus did not need support from external sources in order to be active. Probing questions asked with regard to preferred leisure activities and nature of their employment further indicated that these women are very independent. Among the three women who dedicated time to being active, on the few occasions when support was sought, it was in the context of acquiring information or guidance on proper techniques associated with weight training or yoga poses. Two women did not have a car and walked to work or do errands. Both considered walking to be a form of transportation rather than physical activity and that being active was integrated into their lifestyle such that they did not need to dedicate time toward it.

Vicky likes to lift weights and explained her motivation for going to the gym in this way:

I've always had natural athletic abilities and I have a basic understanding of what I need to do to maintain a certain level of functioning for my body. That is so much clearer after cancer. It's like OK you can fuck around, you can moan, you can cry or procrastinate, but the point is that if you don't do it, it's not gonna happen. So it's easy to keep up with the intrinsic motivation because I know that I have to. I'm not perfect by any means. There are days [when] I'd prefer to stay in bed and some days are like fuck this, I'm gonna have a piece of cake and then another after that. There's a lot I can't do about my DNA, but the one thing I can do is modify my diet along cancer prevention guidelines and stay fit. And so I gotta keep going. Once having mastered what I need to do to help myself, I don't need that group environment. Some people are extrinsically motivated and need a lot of support and feedback and are like “I need lots of help but I can't motivate myself” vs. people [who are] intrinsically motivated. I definitely see myself as somebody who is self-reliant by nature. Once you give me the information that I need, I'll go off and do it.

Cycling was the main mode of transportation for one participant. During treatment she rode to each radiation appointment because she felt that it lessened her fatigue and helped her “maintain a sense of identity separate from cancer”. As the 39 year-old health professional describes below, riding by herself is therapeutic.

Ride to live and live to ride. I'll do whatever it takes to ride because it makes me feel better [and] clears my head... If I don't ride my bike for a week I start to get depressed, I get fatigued, I'm in a bad mood. You don't want to be around me if I don't have that physical outlet. I do my best thinking when I ride by myself too. I've figured that out. If I've got something that I've got to wrestle with I just go

out and ride and it clears everything up. I'm like "Oh, there's the answer"...The bike is my therapy...I feel better...invigorated and alive when I ride to my destination.

Although intrinsically motivated women were a minority in this study, results indicate that these women may not benefit from peer-based interventions aimed at increasing structural support for physical activity. They may however benefit from the provision of functional support, specifically informational support directed at the technical aspects of performing a given activity. Such support may not only help reduce the risk for injury but may also be a source of motivation for continued participation in a favorite activity.

5.7 Physical Activity vs. Exercise

It was apparent from the initial interviews that women think and feel very differently about the terms physical activity and exercise. Accordingly, the question, "how do you define physical activity and exercise?" was added to the interview questionnaire. In general, exercise had a very negative connotation and was often described as "boring", "drudgery", "goal oriented", something that takes place in a gym and requires time and money to perform. Further, gyms were described as "intimidating", "pick-up joints", and/or "a waste of money". Some thought they "smell bad" or that the environment was "unfriendly". In contrast, physical activity was described as "fun", "enjoyable", "therapeutic", and something that is integrated into one's daily life and can be done anywhere either alone or with friends. Participants defined the terms in this way:

When I hear the word exercise I think gag reflex and I think of something you should do, something you're supposed to do, something you feel guilty about not having done it or enough of. When I think of physical activity and how that might be different - I think of activity that just happens to be physical. It's FUN, something that I enjoy doing.

I see the club and me doing those stupid things. It's those routines that my trainer set up for me... do this, this, this and this. Physical Activity... I love it and I don't think of it as exercise. I'm out there pruning, weeding, hauling mulch or compost. I'm out there doing lots of physical stuff and I always have been my whole life. I don't think of it as exercise.

I'm not a big fan of the term exercise because to me exercise happens in a gym. It's on a machine and it's something that you have to do. I prefer being active, although I will use the word exercise. For me the word is more about being physically active and riding my bike, taking the stairs, and going for a walk... integrating that into my everyday life. I'm not going to make time for it. I don't have enough time in my day to go to a gym. I certainly can't afford going to a gym either and work with a trainer. That doesn't work for me. But I'm going to be

active and because I'm a cyclist, if I'm going to get somewhere, I'm gonna get to my destination on my bike and get exercise along the way. And so it's just built into my life. I'm active. I don't sit around.... It's the balance thing.

Physical activity is very positive for me and exercise very negative. Exercise I think is... you're doing it for the goal. Physical activity is just enjoyable, I like to move my body. Exercise is kind of this... you do it for a purpose which is different from enjoying the movement and I think that never attracted me. I don't like to exhaust myself. If it is to get to that view up there [points to the mountain],.. Yeah, fine. It offends me a little bit when I go on a nice hike or something and someone says, "Oh, we have some exercise". I have an association that exercise is goal oriented. That's what comes up.

I'm not a good gym person. It's just not my thing. It's taken me a long time to realize that, but it's just not. I'll have a membership and it isn't gonna work for me.

Interestingly, there were no differences between women in the control group versus the intervention group with regard to their sentiment toward physical activity and exercise. How women defined these terms appeared to influence the types of activities they engaged in, the level of intensity, the setting in which they took place, with whom, and whether they adhered to a given activity over time. Women who had an affinity with the term physical activity were less likely to have a gym membership and were more likely to engage in moderate-intensity, leisure-oriented activities such as walking in an outdoor setting either alone or with a buddy. Those who had a buddy were more likely to adhere to a given activity over time and perceived receiving structural and/or functional support.

CHAPTER 6: QUANTITATIVE RESULTS

6.1 Overview

Quantitative results are outlined in this chapter beginning first with descriptive statistics, followed by correlations, and regression analyses.

6.2 Descriptive Statistics

Tables 3 to 5 provide descriptive statistics for the quantitative sample, organized by demographics, medical treatment and health status characteristics, outcome variable (METs) and predictor variables of interest.

6.2.1 Sample Demographics

The majority of women in this study were white (65.2%), married or in a committed relationship (73.3%), employed (70.0%), and college educated (average years = 16.05). 52.4% reported having children <= 18 years old living at home. Participants' age range at baseline interview was between 27 and 57. Sample demographic characteristics are summarized in detail in Table 3 below.

Table 3. Demographic Characteristics

Characteristic	Obs. (N)	%	Mean	Std. Dev.	Min	Max
Race						
White	178	65.2				
Non-white	95	34.8				
Relationship Status						
Married/partnered	200	73.3				
Single	73	26.7				
Children at home						
Yes	143	52.4				
No	130	47.6				
Employed						
Yes	191	70.0				
No	82	30.0				
Education (years)	273	-	16.05	2.50	6.0	20.0
Age	273	-	44.90	5.74	27	57

6.2.2 Sample Treatment & Health Status Characteristics

Participants' treatment characteristics are summarized in Table 4. In terms of surgery type, 19.8% had a mastectomy with reconstruction, 29.7% had a mastectomy without reconstruction, and 50.5 % did not have a mastectomy. Average months since ending chemotherapy was 5.98 and 72.9% had radiation. 59.7% reported receiving drug therapy consisting of Tamoxifen and/or anti-estrogenic drugs while 40.3% did not take drugs related to their cancer treatment. Mean score for physical health was 47.57 with a range between 21.4 and 64.8. Average mental health score was 49.13 with a range between 17.9 and 65.5.

Table 4. Treatment and Health Status Characteristics

Characteristic	Obs. (N)	%	Mean	Std. Dev.	Min	Max
Type of Surgery Received						
Mastectomy and reconstruction	54	19.8				
Mastectomy, no reconstruction	81	29.7				
No mastectomy	138	50.5				
Radiation						
Yes	199	72.9				
No	74	27.1				
Anti- Estrogen Drug Therapy						
Yes	100	59.7				
No	173	40.3				
Months Since Ending Chemotherapy	266	-	5.98	4.13	0**	20
MOS Physical Health Component	265	-	47.57*	8.85	21.4	64.8
MOS Mental Health Component	265	-	49.13*	10.99	17.9	65.5

* Score ranges from 0 to 100. Zero is the worst possible score and 100 is the best possible score.

** Less than 4 weeks

6.2.3 Dependent (outcome) and Independent (Predictor) Variables

Results for METs, social network size, emotional support, support for exercise, and self-efficacy are presented in Table 5. The majority of women (81.7%) self-reported achieving the recommended guideline of 500 to 1,000 METs of moderate and vigorous physical activity (combined) per week while 18.3% did not meet the suggested minimum. With regard to the Social Network Index (network size), 17.9% of women perceived having a low network size, 38.5% had medium, 14.3% had medium-high, and 29.3% had high. Average emotional support score was 91.01 and mean score for support for physical activity was 49.76.

Table 5. METs, Social Support Measures, & Self-Efficacy

Characteristic	Obs. (N)	%	Mean	Std. Dev.	Min	Max
Metabolic Equivalents (METS)						
<500	50	18.3				
>= 500	223	81.7				
Social Network Index (SNI)						
Low	49	17.9				
Medium	105	38.5				
Medium-High	39	14.3				
High	80	29.3				
Emotional Support	273	-	91.01*	10.96	25	100
Support for Physical Activity	273	-	49.76*	23.08	20	100
Physical Activity Self-Efficacy	273	-	60.76*	17.15	20	100

* Score ranges from 0 to 100. Zero is the worst possible score and 100 is the best possible score.

6.3 Correlations

Correlation matrices were calculated in order to identify any collinearity issues among the continuous variables to be included in regression models. Typically, correlations above the .80 level are considered collinear. None of the variables included in this analysis were significantly correlated with other variables at a level higher than 0.284. Table 6 below shows correlations between METs and key variables of interest including Social Support Index (SNI), emotional support, support for exercise, physical health, mental health, and self-efficacy. As expected, all statistically significant correlations were positive. METs were significantly correlated with support for exercise ($p<.001$), physical health ($p<.001$), and self-efficacy ($p<.001$) but not with emotional support ($p=.494$), mental health ($p=.205$), or size of network (SNI, $p=.349$). In contrast, support for exercise was correlated with METs, emotional support, and mental health; however, physical health and self-efficacy were not significant. Surprisingly, SNI was not significantly correlated with METS, nor with support for exercise or physical health.

Table 6. Spearman Correlation Matrix

Characteristic		METs	SNI	Emotional Support	Support Exercise	Self-Efficacy	Physical Health	Mental Health
METs	Correlation Coefficient	1.000	.057	.042	.224**	.255**	.260**	.078
	Sig. (2-tailed)	.	.349	.494	.000	.000	.000	.205
	N	273	273	273	272	273	265	265
SNI	Correlation Coefficient	.057	1.000	.265**	.086	.217**	-.083	.157*
	Sig. (2-tailed)	.349	.	.000	.156	.000	.180	.011
	N	273	273	273	272	273	265	265
Emotional Support	Correlation Coefficient	.042	.265**	1.000	.252**	.284**	.067	.283**
	Sig. (2-tailed)	.494	.000	.	.000	.000	.276	.000
	N	273	273	273	272	273	265	265
Support for Exercise	Correlation Coefficient	.224**	.086	.252**	1.000	.048	.101	.188**
	Sig. (2-tailed)	.000	.156	.000	.	.429	.102	.002
	N	272	272	272	272	272	264	264
Physical Activity Self-Efficacy	Correlation Coefficient	.255**	.217**	.284**	.048	1.000	.255**	.189**
	Sig. (2-tailed)	.000	.000	.000	.429	.	.000	.002
	N	273	273	273	272	273	265	265
MOS Physical Health Component	Correlation Coefficient	.260**	-.083	.067	.101	.255**	1.000	.038
	Sig. (2-tailed)	.000	.180	.276	.102	.000	.	.533
	N	265	265	265	264	265	265	265
MOS Mental Health Component	Correlation Coefficient	.078	.157*	.283**	.188**	.189**	.038	1.000
	Sig. (2-tailed)	.205	.011	.000	.002	.002	.533	.
	N	265	265	265	264	265	265	265

** Spearman correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

SNI represents Social Network Index

6.4 Regression Results

Logistic regression with a binary outcome variable was performed in order to assess the association between recommended METs (dependent variable) with social support for physical activity (hypothesis 1) and size of social network (hypothesis 2) controlling for demographic, treatment, perceived health status, self-efficacy and measures of social support. Demographic variables included race/ethnicity, age, relationship status, children age 18 or less living at home (yes or no), employment status (yes or no), educational attainment (in years), and age. Treatment controls included mastectomy (yes or no), reconstruction (yes or no), radiation (yes or no), drug therapy (current/former use of Tamoxifen and/or anti-estrogen drugs), and months since completion of chemotherapy at baseline. Perceived health status controls included physical health and mental health. Social support measures included SNI (i.e., size of network), emotional support, and support for exercise. Self-efficacy was also included the analysis. The resulting model in Table 7 was used to test both hypotheses.

Table 7. Logistic Regression Model

Characteristic	β	S.E.	Wald	Sig.	Odds Ratio	95% confidence interval	
						Lower	Upper
						Race/Ethnicity	.538
Relationship Status	.179	.450	.157	.692	1.196	.495	2.890
Children at home	-.388	.402	.929	.335	.678	.308	1.493
Employment Status	.144	.413	.121	.728	1.155	.514	2.595
Education	-.115	.076	2.285	.131	.892	.768	1.035
Age	-.044	.035	1.563	.211	.957	.894	1.025
Mastectomy	.379	.479	.625	.429	1.460	.571	3.735
Reconstruction	.373	.558	.447	.504	1.452	.486	4.337
Radiation	.671	.489	1.880	.170	1.956	.750	5.106
Drug Therapy	.529	.398	1.768	.184	1.697	.778	3.699
Months since ending chemo.	-.014	.050	.079	.778	.986	.895	1.087
Physical Health	.067	.021	9.999	.002*	1.069	1.026	1.114
Mental Health	-.004	.018	.052	.820	.996	.961	1.032
SNI	.141	.192	.539	.463	1.151	.791	1.676
Emotional Support	.005	.039	.018	.894	1.005	.931	1.086
Support for Phys. Activity	.030	.010	8.985	.003*	1.030	1.010	1.051
Physical Activity Self-Efficacy	.018	.013	1.978	.160	1.018	.993	1.043

*p<.01 is significant

6.5 Statistical Analysis Results

Results from statistical analysis revealed that race/ethnicity ($p=.170$), being married or in a committed relationship ($p=.692$), having children living at home ($p=.335$), employment status ($p=.728$), education ($p=.131$), age ($p=.211$), and mental health ($p=.820$) were not significantly associated with obtaining recommended levels of METs per week. Mastectomy ($p=.429$), reconstruction ($p=.504$), radiation ($p=.170$), drug therapy ($p=.184$), and months since completion of chemotherapy ($p=.778$) were also not significant. While physical activity self-efficacy was significant in correlation analyses, it was not in regression analyses ($p=.160$), particularly when physical health and mental health were added to the model.

Physical health ($\beta=.067$, $p=.002$, C.I.=1.026- 1.114) was highly significant and positively associated with meeting the recommended physical activity guidelines. As the model indicates, for every unit increase of perceived physical health, the odds of achieving ≥ 500 METs per week are 1.069 times as great. In terms of social support, emotional support was not significant ($p=.894$); however, support for physical activity was highly significant ($\beta=.030$, $p=.003$, C.I.=1.010-1.051). For every unit increase in social support for physical activity, the odds of getting the recommended METs per week was 1.03 times as great. Given this result, hypothesis 1 is supported. Social network size (SNI) was not significant ($p=.463$) and thus hypothesis two is unsupported. Overall quantitative findings suggest that physical health and support specific to

physical activity are highly associated with meeting recommended physical activity guidelines. The model was significant ($p < .001$) and the Nagelkerke R-squared was considered adequate at .239. Qualitative and quantitative findings and implications for practice are discussed in the next chapter.

CHAPTER 7: DISCUSSION OF FINDINGS

7.1 Discussion

This study explored the role of social support for physical activity among young survivors of breast cancer through the use of mixed methods. The qualitative research questions raised were:

1. Does social support influence physical activity among young survivors of breast cancer?
2. How do women find support for being physically active?

Hypotheses tested included:

1. Women who self-report having social support for physical activity are more likely to have higher MET minutes per week of moderate and vigorous activity than women who do not, holding all other variables constant.
2. Women with large social networks are more likely to report higher MET minutes per week of moderate or vigorous activity than those who do not, holding all other variables constant.

Social support specific to physical activity was clearly significant in both quantitative and qualitative analysis. The quantitative findings in particular suggest that social support for physical activity including be having a buddy, someone offering to participate in physical activity with you, getting helpful reminders to be active, or encouragement to be active is more important than one's network size and emotional support alone. A key finding in qualitative analyses was that of the pivotal role a buddy may have on survivors' physical activity behaviors in general. Qualitative results suggest that having someone with whom to engage in physical activity may be a prerequisite to participation in or adherence to a given activity for some individuals. Buddies ranged from family and friends, to pets, personal trainers, or health coaches. Participation by oneself in group classes at a gym or use of a virtual personal trainer in the form of computer software also had the same positive influence.

As qualitative findings indicate, in many instances, participation in physical activity with a buddy focused on the camaraderie, reciprocity, and mutuality experienced while engaging in the activity rather than the salutary benefits of the activity per se. Women also felt a strong sense of obligation to meet her buddy as planned and thus were more likely to continue participating in a given activity. The degree to which physical activity was integrated into participants' lifestyles and/or whether she needed extrinsic motivation had some bearing on whether or not she sought a buddy. For women who rely on walking, cycling or other forms of activity as a

mode of transportation, it appears that social support in general, or a buddy specifically, may not be necessary in order for them to maintain their physical activity behaviors.

While social support positively influenced young survivors' physical activity behaviors in general, as the qualitative results suggest, there may be instances where it has the opposite effect and thus has unintended negative consequences. The examples of anti-support presented in this study underscore the need for sensitivity when encouraging survivors to adopt or maintain physical activity behaviors. Qualitative findings also suggest that support from fitness professionals urging women to exert themselves beyond their physical capabilities may compromise their quality of life and thus poses more of a hindrance than help. When seeking support from certified fitness professionals, it is paramount that these professionals are adequately trained to assist survivors and that a thorough assessment of pre-existing conditions (e.g., hypertension) or debilitating side-effects attributed to cancer treatment be conducted. Following this assessment, realistic, step-wise goals based on survivors' expressed needs and physical limitations should be developed. Lastly, findings indicate that interpersonal communication that is intended to be supportive but ultimately perceived as unhelpful may engender ambivalence or feelings of resentment toward being active and thus reduce the likelihood of women participating in any form of physical activity. Findings are consistent in part with the work of Manne [148] and Helgesen [149] documenting problematic aspects of supportive communication. While focused on psychological processes related to cancer in general, their work provides some insight into how communication perceived as unhelpful may serve as a deterrent to the adoption or maintenance of physical activity behaviors among survivors.

Neither relationship status nor having children living at home was significant in quantitative analyses. The finding with respect to relationship status in particular deviates from much of the literature which shows that women who have a partner have more support in general and higher perceived health status [90, 101]. In qualitative analyses, women who were married or have a partner tended to prioritize the needs of their families before their own personal fitness goals and were simply not able to participate in a favorite activity without instrumental support (i.e., childcare). These conflicting findings are intriguing and merit further exploration.

An unanticipated result of this study was the way in which women define the terms physical activity and exercise. How women define these terms may be an important precursor to social support as it influences the level of intensity, the setting in which it takes place, with whom, and whether they adhere to a given activity over time. Exercise had a negative connotation, was thought to be goal-oriented and thus not enjoyable, whereas physical activity was perceived to be fun, leisure-oriented, and something that takes place in an outdoor setting either alone or with a friend. Accordingly, women often engaged in a broad range of moderate-intensity activities outdoors with a buddy. Those who had a buddy were more likely to adhere to a given activity over time. The way in which women define physical activity versus exercise and the importance of having a buddy are both interesting findings. These findings may not have emerged had this study focused on quantitative methods alone. Findings also underscore

the many advantages of mixed methodologies in enhancing researchers' ability to investigate complex problems and contextualize results.

The majority of women in this study (81.7%) reported meeting the recommended guideline of achieving 500 or more METS of moderate and vigorous physical activity per week. Regression analyses showed a strong positive association between having social support specific to physical activity and meeting recommended MET guidelines ($\beta=.030$, $p=.003$, C.I.=1.010-1.051). This key finding bolsters qualitative results and suggests that having a buddy may have direct bearing on whether or not survivors achieve the recommended levels of physical activity. Not surprisingly, physical health ($\beta=.067$, $p=.002$, C.I.=1.026- 1.114) was highly significant and positively associated with meeting the recommended physical activity guidelines. Intuitively this result makes sense, suggesting that women who feel better are more likely to be active. This result is consistent with other studies that have shown that women who exercise report greater mental health and physical functioning [36, 37].

A surprising outcome of this work was the lack of association between the Social Network Index (SNI) and achieving recommended levels of physical activity (hypothesis 2). This finding is contrary to much of the work on social support which shows that people who have larger social networks are healthier overall and self-report a greater sense of wellbeing than people who have smaller social networks [76, 150]. In this study, the lack of association may be interpreted such that while survivors may perceive having a large social network, if people in that network do not engage in physical activity or encourage others to be active, women may not receive the type of support needed in order for them to meet recommended guidelines. Regression analyses also showed no association between emotional support and meeting physical activity guidelines. There is no literature to bolster or refute this finding; however, qualitative findings in this study provide some guidance in how to interpret this result. In qualitative interviews, women clearly gave examples of emotional support within the context of their buddy relationships; however, it was clear from the way in which they talked about it that emotional support specifically was not a factor in their initial motivation to be active but rather evolved from interactions with their buddies over time. Thus, emotional support may be an added benefit of the buddy relationship and factor in continued participation but is not a precursor in meeting recommended physical activity guidelines. Results from this study suggest that while women may perceive having emotional support or friends or family in their network, only support specific to physical activity is important in motivating some women to be physically active.

Overall, results in both sets of analyses are extremely encouraging. A review of the literature indicates that no prior research of this nature has been conducted in any population and thus this study is the first to show associations between social support and achieving recommended guidelines of physical activity among young survivors. As such, this study is a unique contribution to the literature on physical activity and survivorship.

7.2 Limitations

Strengths of this study include the use of mixed methods to explore the research questions and the fact that it is the first to investigate the influence of social support in the context of physical activity participation among young survivors of breast cancer. While results illuminated key areas of interest, a few limitations must be addressed. The referent group in this research is not a population in general, but rather a population of pre-menopausal women with breast cancer from the Registry from which they were drawn. Further, women in this study may be more interested in physical activity than survivors in general and as a result more likely to participate in the parent study. Participants in this study were also primarily white, highly educated, and had a partner and thus are not representative of all US women.

The potential to generalize from qualitative study findings is limited by the small size and purposive nature of the sample. While Bone Health pre-test and post-test data on METs informed the qualitative component of this study, qualitative data collection in this research preceded the completion of post-test data analyses of measures other than METs by the parent study. Because of this, only pre-test data were available in their entirety for regression analyses. In terms of quantitative analyses, an unanticipated and potentially serious limitation of this study was how physical activity was measured. Data were self-reported and thus there was the potential for over reporting. One possible reason for over reporting may have been the desire to present oneself in a positive light by giving social desirable responses [144]. The survey protocol may also have been problematic. Respondents were asked to report an average time spent per day on each activity performed. If physical activity was reported for more than one day, women were asked to report an average time spent per day. It is possible that respondents reported this mean time by using the day they performed an activity the most. Further, the fact that participants had to report mean minutes/hours per day over a broad range of activities may have increased the chance for over reporting.

As documented in the literature, measurement of self-reported levels of physical activity is an ongoing methodological challenge that may affect the integrity of many studies related to physical activity in general [144]. As Courneya notes, objective monitoring of physical activity is an evolving area of inquiry and holds great promise for future epidemiological studies [56]. She further notes that a combination of monitors (e.g., pedometer, heart rate monitor) and self-report methods to provide contextual information is likely to become the trend in future physical activity research. Lastly, results of this study are limited to young survivors and may not be applicable older survivors, women without cancer, or men.

7.3 Implications for Practice

Results of this study raise questions with regard to the translation of theory into practice. Many clinical trials and observational studies employ the use of supervised, gym-based interventions. These structured interventions typically involve timed workouts on a specific number of days per week over a period of time (e.g., 30 minutes, 4 times per week for up to 12 months). While such interventions have generally shown positive associations between physical activity and health outcomes, the fact that many women in this study expressed a strong preference for

being active in an unstructured environment suggests that not all women may be interested in or willing to adhere to a physical activity regimen in a gym-based setting. For others, having a buddy is a prerequisite for engaging in any activity. Results of this study suggest that beyond developing interventions aimed at improving health outcomes, researchers must incorporate opportunities for support and focus on activities that women are likely to adhere to in the long-term.

7.4 Future Research

Despite the potential positive impact that a buddy may have on a survivor's physical activity behaviors, a review of the literature reveals that virtually no peer-based interventions have been conducted among cancer patients or survivors of any type of cancer. This is noteworthy and suggests that there may be an opportunity to conduct research in this area. Based on qualitative findings, it appears that women are more likely to be interested in interventions aimed at leisure walking. The preference for leisure walking is no surprise given that walking is the most popular form of physical activity among healthy adults [151]. In addition to its popularity, walking has the advantages of not requiring any special equipment or skills, can be done individually or with others, be tailored to any fitness level in terms of intensity and duration, and is free [151]. Given these benefits and participants' expressed preference for leisure walking, the development of home or community-based interventions may be an effective way to encourage women to be active and adhere to recommended physical activity guidelines. For example, while not specific to cancer, a randomized trial by Fisher and Fuzhong [152] evaluated a 6-month randomized walking program for older adults. The intervention did not require specific equipment or a dedicated facility to perform the activity, but rather worked with the existing environments within each of the 56 neighborhoods. Significant improvements on measures of physical and mental functioning as well as actual amounts of walking were documented in the intervention neighborhoods compared to control neighborhoods. This study is a stellar example of a low-cost, community-based intervention that can improve activity levels and perceived quality of life for entire communities. Similar interventions adapted to the needs of cancer survivors have the potential to enhance social support and increase physical activity levels in this population.

As participants suggested, walking interventions in which women are paired with a fellow survivor with the same fitness level could be immensely helpful. A meet-up type of walking intervention in which women show up on a given day and time to participate in a group walk led by a facilitator was also suggested in qualitative interviews. A variation of the meet-up concept might involve women having a choice between two walks of varying intensity (e.g. hills vs. flat terrain) and engage in the activity accordingly. An important caveat in designing interventions aimed at increasing physical activity must be acknowledged in that careful consideration should be given to the intended outcome or health behavior being promoted. For example, walking may be sufficient to help improve one's mental health; however, may not be sufficient on its own to measurably improve bone health. As such, researchers may also need to

design interventions that focus on leisure walking exclusively or in combination with other activities such as stretching, or cross training in addition to incorporating aspects of social support.

The divergent findings with respect to the effect of employment status, children living at home and relationship status on physical activity in separate quantitative and qualitative analyses suggests one possible goal of future research is to elucidate what relationship (if any) one's relationship status and parental status has on the ability to engage in physical activity at recommended levels. Toward the same end, future research should explore differences in racial and ethnic groups. Indeed, research in this realm may reveal the need for tailored interventions specific to working mothers, single women, or specific racial and ethnic groups. Ideally, interventions geared toward working mothers should incorporate instrumental support or potentially focus on family-oriented activities in which the entire family can participate (e.g. walking or Wii Fit). While divorced women in this study expressed a desire to have a buddy, they did not perceive having friends or family who were interested in being active. As such, interventions that promote social support may be especially beneficial to these women. Further, interventions aimed at single women may need to be peer-based in order to be effective.

One's choice of buddy is also an important question that merits further exploration. Spouses, friends, and colleagues are all potential buddies; however, the ideal buddy is unique to each individual and may be dependent on a variety of factors that are not well understood. As findings in this study suggest, it is possible that multiple buddies may be appropriate for some women in order for them to be active. Lines of influence within supportive relationships are also of interest. Specifically, understanding who initiates the buddy relationship, how women negotiate the kinds of activities they engage in and when they participate in them would further elucidate the role of support in physical activity behaviors. Other key areas for research include the development of scales that assess aspects of social support with greater precision such as the specific types and sources of support that are most beneficial physical activity behaviors.

7.5 Conclusion

This research represents a first step in understanding the role of social support for physical activity among young survivors of breast cancer. Nonetheless, findings broaden our understanding of its influence and suggest that when considering correlates of physical activity, social support specific to physical activity may be important or even pivotal in assisting survivors to adopt and/or maintain participation in physical activity at recommended levels. Results clearly show that women should be encouraged to engage in physical activity with others and that aspects of social support be incorporated in interventions aimed at increasing physical activity in this population. Consideration to physical health should also be given in the development of interventions. As findings show, not all support for physical activity may be beneficial and thus careful consideration must be given to differentiating those aspects that are most helpful from others that may be problematic. Given that qualification, development of

interventions that leverage social support could be a beneficial strategy in promoting physical activity behaviors among young survivors. Such interventions have the potential to improve both quality of life and longevity.

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