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PERSONAL AND/OR VICARIOUS EXPERIENCE WITH CANCER AS A PREDICTOR OF PHYSICAL ACTIVITY: MODERATING EFFECTS OF GENDER AND RISK PERCEPTION

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by

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Dedications

I would like to dedicate this manuscript to my parents, Wilfredo Leon and Maribel Garcia – Leon, my brother, Wilfred Leon II, and my loving wife, Bushra Ali-Leon. I truly appreciate all of your support, love, advice, and care.

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Abstract

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Roberta Dihoff, Ph.D
Doctor of Philosophy

Background: Few studies have addressed the relationship between an individual's type of experience with cancer and its relationship with physical activity (PA). Furthermore, studies have not addressed gender and risk perception's ability to moderate the relationship between cancer experience and physical activity. To address this gap in understanding modifiable factors that might help or hinder PA levels, the overarching goal of this study is to: (a) estimate the degree to which an individual's experience of cancer effects PA levels, (b) determine how strongly gender moderates the relationship between the experience of cancer and PA levels, and (c) determine how strongly risk perception moderates the relationship between the experience of cancer and PA levels. Design: The data was gathered from items in the Health Information National Trends Survey (HINTS5), which is a nationally representative survey conducted by the National Cancer Institute (NCI, 2017). Results: One major finding of this study is that personal experiences with cancer had a significant relation with PA. Conclusions: In this particular sample, an individual's gender or risk perception did not increase physical activity levels, but it has been shown in other studies to increase preventive behaviors, such as PA (Wang & Coups, 2010). These results can lead to finding strategies and/or interventions to increase an individual's motivation to engage in physical activity.

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Chapter 1

Introduction

The purpose of this quantitative study is to identify the relationship between an individual's experience with cancer and their physical activity output. This study also looks to see whether or not the difference in the type of experience (vicarious v. personal) with cancer has a relationship with an individual's physical activity. Furthermore, assessing whether an individual has more than one type of experience with cancer and their physical activity output remains largely unstudied, which will be assessed with this national sample. After assessing the relationship between cancer experience and physical activity, this study examines the moderating effects that gender and perceived risk of illness have on the prior denoted relationship, individually. Assessing the impact gender and risk perception has on different cancer experiences and physical activity remain largely unanswered prior to this study.

Cancer Facts

Approximately 607,000 Americans are expected to die of cancer in 2019 and an estimated 1,763,000 new cancer cases will be diagnosed (American Cancer Society [ACS], 2019). This roughly translates to about 1,660 deaths and 4,830 new diagnoses per day. By definition, cancer is a group of more than 100 diseases characterized by their uncontrollable growth and proliferation of deleterious cells (ACS, 2019; Taylor, 2017). Following cardiovascular disease, cancers are the second leading cause of death, overall (Centers for Disease Control and Prevention [CDCP], 2016; Taylor, 2017). Roughly 66.6% of families will have a family member who develops cancer (Taylor, 2017). Even

though the exposure to experiences with cancer remain high, the mortality rates of cancer continuously show a steady decline since 1993 (ACS, 2012a; ACS, 2019; Taylor, 2017). This decline is due to the reduction of individuals dying from lung, breast, colorectal, and prostate cancers, which makes up close to 50% of all US cancer deaths (ACS, 2012a; ACS, 2019; CDCP, 2012; Taylor, 2017). The mortality rate of individuals suffering from cancers has had an overall drop of 27% in the past 25 years, which translates to roughly 2.6 million fewer deaths in 2016 than in 1993 (ACS, 2019). In conjunction with the mortality rates dropping, survivorship continues to increase; approximately 64% of cancer survivors live at least five years (National Cancer Institute [NCI], 2016), approximately 60% are over the age of 65, and many ultimately pass away of unrelated causes (Taylor, 2017).

Brief History of Cancer in the USA

These large positive strides in the health field's unwavering battle with cancer can be primarily attributed to significant improvements in treatment, preventive interventions, as well as early detection (ACS, 2019; Taylor, 2017). In the 1960s, the five-year survival rate was approximately 27%- 39% largely in part to the fact that smoking was very prevalent (ACS, 2019; Drope et al., 2018; Taylor, 2017). Due to the strong tobacco smoking cessation interventions, as well as the strong health promotion propaganda, tobacco smoking has significantly decreased (Drope et al., 2018) as has the mortality rates. Many of these health promotions and preventive interventions targeted misinformation, lack of knowledge on the harmful effects of cigarette smoking, and risk perception/probability of developing illnesses. During this 25 -year cancer mortality decline, individuals engaging in screenings for cancer have also increased significantly,

but continue to fall short of the expected rate for the Healthy People 2020 objectives (Hall et al., 2018).

Healthy People is a program designed around national goals and objectives meant to inform national health promotion and disease/illness prevention, to which increasing cancer screening engagement is one of the objectives (Hall et al., 2018). Despite the strong empirical support of the established health benefits of screening behaviors (i.e. early detection, higher rates of positive treatment outcome, and decreased need for more invasive/aggressive treatments), compliance with the recommended screenings across all cancers remains to be a significant issue (Gurevich et al., 2004; Jemal et al., 2015; Taylor, 2017; Wender et al., 2019). Balmer et al. (2014) noted that participants of prior studies mentioned that self-examination and screening were reliable ways of proactively detecting cancer, yet the participants were not engaged in these examinations regularly. Participants stated that these examinations are good proactive actions, yet they perceived that the appropriate time to utilize these screenings is after symptomology is present (Balmer et al., 2014).

Some possible reasons for the low compliance with screenings can be due to fear of radiation from the screenings, anticipated pain, anxiety, fear, and cost of procedures (Honein-AbouHaidar et al., 2016; Marlow et al., 2015; Taylor, 2017). Furthermore, other possible reasons could be just an overall lack of knowledge of the illness, symptoms, and perceived risk of development of that illness, in this case, cancer (Gurevich et al., 2004; Honein-AbouHaidar et al., 2016; Marlow et al., 2015; Taylor, 2017). This lack of knowledge and low perceived risk of development of illness can be attributable to the shifting demographics of the nation. Differing cultures and religious

beliefs influence an individual's belief and understanding of an illness and its risk potential (Leon et al., 2019). Due to this country's increases in immigration, the population's understanding of risk and beliefs concerning cancer will inevitably change.

Risk Perception

Individuals' risk perception to the development of illness, whether mental, physical, or emotional, has been the focus of much research and many theories (Davis et al., 2016; Dillard, et al., 2010; Montanaro & Bryan, 2014; Rogers, 1975; Rosenstock, 1974; Taylor, 2017; Zajac et al., 2006). Risk perception is defined as "an individual's cognitive appraisal of the likelihood or probability of a harm or noxious event" (Gu et al., 2017, p. E18). In many studies, the evidence has shown that these perceptions of risk motivate individuals to engage, or not engage, in preventive measures, such as physical activity and/or other health behaviors (Leon et al., 2019; Prichard et al., 2015; Wang et al., 2012; Zlot, 2012). In the Health Belief Model, an individual's engagement in a health behavior is contingent upon: (a) the perception of the health threat and (b) whether or not they believe the health behavior will be effective against the health threat (Janz & Becker, 1984; Jones et al., 2015; Rosenstock, 1966; Taylor, 2017). The seriousness and perception of the perceived health threat is influenced by at least three factors: (a) the individual's general health values, (b) the individual's interest and concern about their health, and (c) their beliefs about their personal vulnerability to the disease/illness/disorder (Janz & Becker, 1984; Jones et al., 2015; Rosenstock, 1966; Taylor, 2017). For example, women who perceive they have a higher risk of developing breast cancer will engage in more screening behaviors (e.g. at home self-evaluation or in-office mammograms) than their counterparts who perceive a lower risk of breast

cancer (Dillard et al., 2012).

Risk perception is not only viewed as a moderator for healthy behaviors but also as a strong mediator for attitudes toward the behaviors (in this case cancer screenings; Ajzen, 1985; Straatmann et al., 2018). Many of these incorrect perceptions of risk are the outcomes of misinformation, as well as an overall lack of awareness, about the true etiology of diseases/illnesses. Consistent throughout many different protective health behaviors (e.g. dieting, physical activity, screenings, etc.), an individual's understanding of the probability of developing chronic illnesses influences their engagement in the aforementioned protective health behaviors (Wang & Coups, 2010). A common belief of chronic illness, such as cancer, is that it will develop regardless of an individual's behavior, such as physical activity or diet, but rather due to chance (Lykins et al., 2008; Prichard et al., 2015). Many times, these conceptions of illness are acquired through the media (Al-Eisa et al., 2016; Kim & Chock, 2015), social norms (Ajzen, 1991; Mimiaga et al., 2009; Neighbors et al., 2013; Patterson, 2001; Ryan & Carr, 2010; Straatmann et al., 2017), which can all be placed under the umbrella of experience (Lykins et al., 2008).

Personal and Vicarious Experience's Influence on Chronic Illness Risk Perception

An individual's cognitive schemas of chronic illness, such as their perceived risk of developing a chronic illness, is influenced by a plethora of factors, but one factor that cannot be overlooked is an individual's experience with the illness. Whether the experience with an illness like cancer is personal or vicarious, there will always be an impact of the illness present. Both personal and vicarious experiences of chronic

illness can influence causal beliefs of chronic illness (Lykins, 2008). These health beliefs about the etiology of disease, overall, include stress, injury, bacteria/viruses, and God's will (Balmer et al., 2014). Usually, the reaction given by an individual in the presence of a perceived health threat is informed by prior experience. The individual will appraise any signs and symptoms through information gathered from their experiences in order to attribute the correct amount of concern for the situation (Taylor, 2017).

Typically, an individual with a personal experience of a disease or illness understands their own vulnerability to the disease/illness (Miller & Maner, 2012). Due to their personal experience, they are more likely to negatively interpret bodily sensations as indications of an ailment (Miller & Maner, 2012) compared to their counterparts with a vicarious experience of illness, who tend to develop more commonsense schemas (Taylor, 2017). Commonsense schemas are implicit beliefs about illness/disease that provide coherence to the way an individual understands the illness experience (Taylor, 2017). Individuals with a personal experience with cancer tend to develop a cancer-related worry that is sustained by their experience with cancer itself and/or the sequela of treatment, such as depression (Knobf, 2011; Steiner et al., 2014), post-traumatic stress disorder (Amir & Ramati, 2002; Knobf, 2011), cognitive impairments (Boykoff et al., 2009), sexuality and self-esteem (Fobair et al., 2006), and end-of-treatment transitions back into everyday life (Knobf, 2011). The cancer worry that many individuals with a personal experience of cancer feel is the worry associated with the cancer returning and the worry about their future health, symptoms, and their ability to go through treatment again (Knobf, 2011). Patients who go into remission are

always at risk of the cancer reappearing, which leaves the patient in a state of worry (Janz et al., 2017).

Individuals with high levels of cancer worry have reported an increase of worry after stopping treatment because undergoing treatment is viewed as an active method of staying in remission (Knobf, 2011). When patients stop treatment, feelings of uncertainty, the anxiety of recurrence, and vulnerability tend to resurface now that they are not actively doing something to prevent the cancer from returning (Knobf, 2011). Also, individuals who have survived cancer treatment are at substantial risk of developing post-cancer ailments (Smith et al., 2011). Even with the substantial empirical evidence of individual's cancer worry, as well as their risk of falling out of remission and/or developing further illnesses, approximately only 13% of cancer survivors are engaging in positive health behaviors (i.e. physical activity; Smith et al., 2011). Similar to individuals with a personal experience with cancer, individuals with vicarious experiences with cancer tend to be more worried but engage in health-promoting behaviors less than their counterparts, potentially due to different cognitive schemas.

Individuals with a vicarious experience of cancer, such as being a caregiver, have been shown to have higher perceptions of risk and worry about cancer, specifically if caring for a close family member (Lykins, 2008; Zajac et al., 2006). Individuals who have survived cancer are more active in monitoring for any signs and symptoms of cancer, closely followed by individuals who had only vicarious experiences with cancer (Benyamini et al., 2003). It is important to note that even

though an individual may not be the one suffering from cancer, their experience of cancer does effect their perceived risk of cancer. Individuals with vicarious experiences of cancer tend to be similar to cancer survivors in that they are more likely to act as if they are at risk of cancer and attribute any abnormal signs and symptoms to the potentiality of the onset of cancer (Benyamini et al., 2003). While the cancer worry is present, individuals without a personal experience with cancer have lower levels of cancer worry and overall worries of general health, less emotional reactions to ambiguous signs and symptoms of illness, and less reactivity to seek out treatment for these signs and symptoms (Benyamini et al., 2003).

Studies have noted that vicarious experiences with an illness produce lower perceived risk due to potential safeguarding through informed experiences (Balmer et al., 2014). Individuals with vicarious experiences of cancer tend to be in a better position to understand early intervention by learning from experience (their exposure to cancer). Many individuals referred to diagnosed family members and friends and experiencing cancer treatments firsthand as some of the most reliable sources of information on the matter (Balmer et al., 2014). However, causal beliefs are different among individuals who had personal experiences with cancer versus those who had exposure to cancer through a family member, close friend, or relative (Lykins, 2008). Individuals who had a family history of cancer held stronger beliefs of the causes of cancers and had an increased likelihood of agreeing to a specific cause of cancer (Lykins, 2008). Individuals with personal experiences with cancer held weak causal beliefs and were more likely to downplay the causes of cancer, especially if a possible cause was through personal choices or behavior (Lykins, 2008). Regardless of both

personal or vicarious experience and the severity of perceived risk, health-promoting behaviors, such as physical activity, are still a significant issue for cancer survivors (Grim et al., 2011) and caregivers (Cuthbert et al., 2018).

Physical Activity (PA) Levels

Low levels of physical activity have become one of the leading risk factors for non-communicable diseases (NCD), such as cancer, and death worldwide (Arat & Wong, 2017; Saraf et al., 2012). Many students have established the benefits of physical activity, such as illness prevention and overall increases in quality of life, yet physical inactivity continues to remain an issue (Egli et al., 2011; Hawkins et al., 2009; Leon et al., 2018; Pauline, 2013). To combat premature death and the development of non-communicable diseases, physical activity recommendations were created through the joint efforts of the U.S. Department of Health and Human Services (HHS) and the American College of Sports Medicine (ACSM)/American Heart Association (AHA; Office of Disease Prevention and Health Promotion [ODPHP], 2017; NHLBI, 2016; AHA, 2014). Physical activity (PA) is defined by the National Heart, Lung, and Blood Institute (NHLBI; 2016) as any body movement that requires a larger expenditure of energy than while at rest. The recommended amount of physical activity for chronic disease prevention and health benefit 150 – 300 minutes a week for moderate-intensity forms of PA, or 75 - 150 minutes a week for vigorous- and moderate-vigorous intensity forms of PA (ODPHP, 2018). Low levels of physical activity are a major contributor to the development of chronic illnesses and are a large concern around the world (Grim et al., 2011).

Physical activity effects the progression and severity of symptoms and the remission of various cancers (Campell et al., 2019; Moore et al., 2016). Physical activity also significantly reduces the risk of many types of cancers, such as breast cancer and colorectal cancer (Moore et al., 2016). Likewise, higher levels of physical activity are associated with reduced overall mortality in almost all cancers (Bonn et al. 2015; Kushi et al., 2012; Rock et al., 2012). Furthermore, sedentary behavior increases the risk for cancer recurrence (Andersen et al., 2010; Dieli-Conwright et al., 2016; Holmes et al., 2005; Yang et al., 2008), whereas physical activity lowers cancer recurrence after treatment (Garcia & Thomson, 2014; Ibrahim & Al-Homaidh, 2011). Even though this empirical evidence of physical activity is well published and disseminated, individuals who have personally experienced cancer and those who have had secondary exposure to cancer are both lacking in physical activity (Grim et al., 2011; Cuthbert et al., 2018). When discussing physical activity and risk perception, it is crucial to understand the differences between gender and each of the prior constructs due to the significant gender differences in risk perception, illness development beliefs, prevention, and physical activity.

Gender Differences

Perceived Risk

Prior research has strongly delineated the numerous differences in health beliefs, including perceived risk, by gender. For instance, women tend to more likely to seek out health information more (Manierre, 2015), are more perceptive of health threats and risk (Finucane et al., 2000), and tend to see more health practitioners more frequently (Leon et al., 2019). Contrary to women, men are significantly less likely to

engage in seeking out health information (Manierre, 2015) to which can lead to a lower perception of health threats and risks. Women also tend to be more aware of health threats due to certain sex roles instituted in the household (Manierre, 2015). Women tend to spend longer periods in the household caring for sick children and spouses, as well as having more of a pressure to stay vigilant of their bodies usually in part due to reproductive concerns (Wang et al., 2012). While most women are proactive, men tend to be less active due to perceptions of masculinity, toughness, resilience, and strength which have been found to deter help-seeking behaviors for health threats (Manierre, 2015). Conformity to these hyper-masculine values has been shown to decrease an individual's perceived risk of health threats, as well as the need to minimize future health risks (Hooker et al., 2012).

PA Levels

When assessing PA levels, women tend to not meet the recommendations for physical activity and are generally characterized as less physically active than their male counterparts (Baskin et al., 2013; Koyanagi et al., 2018; Linetzky et al., 2013; McCarthy et al., 2014; Wells et al., 2017). This may be due to differences in the forms of activities engaged in (Baskin et al., 2013; Hagströmer et al., 2007) and their self-efficacy for PA (Koyanagi et al., 2018). Regardless of SES, ethnicity, and environment, gender was almost always a strong predictor of physical activity levels in adult populations (Baskin et al., 2013; Linetzky et al., 2013; Shi et al., 2015; Willey et al., 2010). The literature is rich in continuously providing empirical support for the aforementioned predictors of PA (Baskin et al., 2013; Koyanagi et al., 2018; Linetzky et al., 2013; Leon et al., 2018; McCarthy et al., 2014; Wells et al., 2017) but is scarce on

cognitive predictors, such as an individual's perceived risk.

Purpose and Importance of the Study

Few studies have addressed the relations between an individual's experience with cancer and its effects on physical activity. Specifically, studies have acknowledged the relations between gender and physical activity and risk perception and physical activity, but currently, they have not specifically addressed each of these constructs' ability to moderate the relation between cancer experience and physical activity. Understanding these relations will allow the future creation and dissemination of interventions targeting the large population of survivors, caregivers, and affected family members. To address this gap in understanding factors that might facilitate or hinder PA levels, the study was designed to: (a) estimate the degree to which an individual's experience of cancer is associated with PA levels, (b) determine how strongly gender moderated the relation between the experience of cancer and PA levels, and (c) determine how strongly risk perception moderated the relation between the experience of cancer and PA levels.

Hypotheses

Hypothesis 1

Personal experience with cancer will be associated with higher levels of physical activity compared to individuals with a vicarious experience with cancer.

Hypothesis 1a. Having both a personal and vicarious experience with cancer will be associated with higher levels of physical activity compared to only having one form of experience with cancer.

Hypothesis 1b. Personal experience with cancer will be associated with higher levels of physical activity compared to individuals with a vicarious experience with cancer when PA is dichotomized.

Hypothesis 2

Gender will moderate the relations between personal experience and PA levels, such that the magnitude of the positive relation between personal experience and PA levels will be stronger for women with a personal experience of cancer than men who had a personal experience of cancer.

Hypothesis 2a. Gender will moderate the relations between vicarious experience and PA levels, such that the magnitude of the positive relationship between vicarious experience and PA levels will be stronger for women with a vicarious experience of cancer than men who had a vicarious experience of cancer.

Hypothesis 3

Risk perception will moderate the relation between personal experience and PA levels, such that the magnitude of the positive relation between personal experience and PA levels will be stronger for participants with a perceived higher risk of cancer than those who have a lower perceived risk of cancer.

Hypothesis 3a. Risk perception will moderate the relation between vicarious experience and PA levels, such that the magnitude of the positive relation between vicarious experience and PA levels will be stronger for participants with a perceived higher risk of cancer than those who have a lower perceived risk of cancer.

Chapter 2

Methods

Data Source

The data was gathered from items in the Health Information National Trends Survey (HINTS5), which is a nationally representative survey conducted by the National Cancer Institute every few years to collect data on the public's current access to information about cancer care across a continuum from "cancer prevention, early detection, diagnosis, treatment, and survivorship" (NCI, 2017). The NCI collected the data in three waves via phone call surveying or mail-in survey, the first wave of data collection was conducted between January and April of 2017, the second wave was conducted from January to April of 2018, and the third wave was conducted from January to April of 2019. Communities that were high in minority presence were oversampled to "increase the precision of information among minority subpopulations" (NCI, 2017).

Measures

The HINTS5 dataset includes information on an individual's knowledge of cancer information on a continuum, beginning from the acquisition of cancer knowledge to the understanding and application of knowledge about cancer to survivorship (NCI, 2017). The HINTS5 survey looks to assess the degree to which lay individuals understand important information about cancer and cancer prevention (NCI, 2017). Due to the HINTS5 survey being very extensive, only the variables of interest, physical activity, cancer experience, gender, and risk perception, were assessed. The specific questions that were examined were questions that were directed towards an

individual's experience with cancer (personal v. vicarious), perception of risk in developing cancer, as well as their use of protective health behaviors, such as physical activity.

Risk Perception

Within the HINTS5 dataset, a specific variable was denoted to be a risk perception variable and assessed the participants' perceived risk and concern about developing cancer. The question provided was "How worried are you about getting cancer?" (see appendix A for question). The participants responded on a 5 - point Likert Scale about their worry: "not at all", "slightly", "somewhat", "moderately", or "extremely". This question was selected from the HINTs dataset "Risk Perception" grouping variable.

Cancer Experience

To assess an individual's personal experience with cancer they were asked whether a doctor had ever diagnosed them with cancer (see appendix A for question). To assess whether or not an individual had vicarious experiences with cancer they were asked about their exposure to individuals with cancer, the extent of their involvement with the individual's treatment, as well as their relationships with the individuals who had cancer (see appendix A for question). The responses to these questions were only considered if they reported caregiving for individuals suffering from cancer in the prior question. The vicarious experience variable was composed of four different groups: caregiving for family members, caregiving for friends, a professional caregiver, and exposure to an individual who suffers from cancer, but they were not a caregiver. Caregiving for family was comprised of answers reporting

caring for children, spouses, parents, or family members. Caregiving for friends was comprised of reporting caring for friends or non-relatives. Furthermore. individuals were asked whether or not their caregiving experience was work-related or not. Lastly, individuals who report having exposure to individuals with cancer, but do not report that they were caregivers were included as a vicarious experience sub-group.

Physical Activity

To assess an individual's physical activity levels, the participants were asked about their moderate physical activity levels in minutes per week (see appendix A for question). Examples of moderate physical activity were given in the prior question "...brisk walking, bicycling at a regular pace, and swimming at a regular pace…" The minutes per week were then calculated to either meet the suggested PA guidelines (>150 min) to not meeting the suggested PA guidelines (<150) as per the ACSM PA Guidelines. This particular variable is being looked at as a dichotomous variable, as well as a continuous variable. When dichotomizing the variable, physical activity is being assessed as to whether they met the minimum suggested PA recommendations (>150). When the variable is continuous, physical activity is being assessed in terms of minutes of PA per week. Physical activity was dichotomized to be consistent with the literature by using the PA cutoff recommendations but was also assessed as a continuous variable to ensure that information in the PA variable was not lost. The physical activity guidelines for considering individuals active or sedentary were provided by the U.S. Department of Health and Human Services (HHS) most recent PA guidelines.

Gender

Participants were asked to denote their gender. The HINTS5 questionnaire only provided either “male” or “female” as responses.

Participants

The sample included in the analyses was comprised of 12,227 participants. Of these 12,227 individuals surveyed, 38.2% (n=4672) were males, 53.3% (n=6521) were females, and 8.5% (n=1034) was unreported. The participants’ ethnic-racial make-up was comprised of: 62.6 % (n=7657) Caucasian or White, 14.3% (n=1754) as African American or Black,13.2 % (n=1618) as Latino, , 4.8% (n=591) as Asian, 3.2% (n=393) as bi-racial, .03% (n=47) as American Indian or Alaska Native, .02% (n=28) as Native Hawaiian or other Pacific Islander, and 8.9% (n=1096) chose not to respond (Table 1). The participants’ (n=12,227) ages ranged from 18–101 (M= 56.56, SD = 16.60; Table 1). The majority of participants (72.8%) who took the survey reported some form of higher education following high school (n=8,896), followed by 17.9% (n=2193) who completed up to high school, 5.1% (n=624) who completed 8-11 years of schooling, 1.7% (n=202) who completed less than 8 years of schooling, and 2.5% (n= 312) who did not report (Table 1). Table 2 delineates all of the forms of cancer reported by this sample, with the highest reported form of cancer being skin cancer with 25% (n=481) followed by 18% (n=348) who reported having multiple forms of cancers and breast cancer 14.6% (n= 282).

Table 1

Demographics

		N	%	M	SD	Range
Gender	Male	4672	41.7			
	Female	6521	58.3			
	Age (years)	11,847		56.56	16.6	18-101
	Age (years) by group:					
	18-34	1460	12.3			
	35-49	2281	19.3			
	50-64	3844	32.4			
	65-74	2583	21.8			
	75+	1679	14.2			
		11,847				
	Total	16,109				
Socio-demographic	Income:					
	$0 to $9,999	889	7.3			
	$10,000 to $14,999	753	6.2			
	$15,000 to $19,999	685	5.6			
	$20,000 to $34,999	1600	13.1			
	$35,000 to $49,999	1597	13.1			
	$50,000 to $74,999	2095	17.1			
	$75,000 to $99,999	1458	11.9			
	$100,000 to $199,999	2153	17.6			
	$200,000 or more	775	6.3			

	N	%	M	SD	Range
Academic Attainment:					
Less than High School	826	6.9			
High School Graduate	2193	18.4			
Some College	3572	30.0			
College Graduate or More	5324	44.7			
	11915				
Caucasian/White	7657	62.6			
Latino / Hispanic	1618	13.2			
African American/ Black	1754	14.3			
Asian	591	4.8			
Bi-racial	393	3.2			
American Indian/ Alaska Native	47	0.03			
Native Hawaiian/ Pacific Islander	28	0.02			

Table 2

Reported Cancer History: Personal and Vicarious Experiences with Cancer

		N	%
Personal Cancer History	Bladder cancer only	25	1.3
	Bone cancer only	7	0.4
	Breast cancer only	282	14.6
	Cervical cancer only	96	5.0
	Colon cancer only	80	4.2
	Endometrial cancer only	40	2.1
	Head/Neck cancer only	14	0.7
	Hodgkin's only	7	0.4
	Renal cancer only	33	1.7
	Leukemia only	29	1.5
	Liver cancer only	5	0.3
	Lung cancer only	37	1.9
	Melanoma only	85	4.4
	Non-Hodgkin only	36	1.9
	Oral cancer only	5	0.3
	Ovarian cancer only	22	1.1
	Pancreatic cancer only	4	0.2
	Pharyngeal cancer only	4	0.2
	Prostate cancer only	173	9.0
	Rectal cancer only	10	0.5
	Skin cancer only	481	25.0
	Stomach cancer only	3	0.2
	Multiple Cancers	348	18.1
	Other cancer only	99	5.1
	Total	1925	
Vicarious Experience with cancer (Caregiver)	Child	43	16.1
	Spouse	69	26.2
	Parent	91	34
	Other Family Member	30	12.7
	Friend, non-family	16	6
	Professional	14	5
Vicarious experience as a non-caregiver:	Non-caregiver	1139	

Analytic Strategy

Preliminary Analyses

Descriptive analyses were performed on the sample. Data was analyzed using SPSS 27 and R-Arbor Day 4.0. Preliminary analyses, such as boxplots, scatterplots, and residual dependence plots, were run to ensure that all variables (i.e. Gender, Cancer, Experience, Perceived Risk, and Physical Activity) met the assumptions for the statistical analyses that were planned. After a visual inspection of the scatterplots and boxplots, physical activity had a positive skew potentially due to an inflation of reports "0"s. Due to an inflation of "0"s, statistical analyses that handle inflation of zeros well were considered for usage. Due to over-dispersion being a concern from the beginning a negative binomial was used. The Negative Binomial Analysis provides an extra factor to consider over-dispersion, which a zero-inflated model, another analysis that can be used for data sets with a high number of "0s", does not. Furthermore, Negative Binomials provide more flexibility due to less restrictive assumptions. Similar to Negative Binomial, a Poisson Regression could have been used due to the inflated number of "0s", but due to Poisson's restrictive assumptions, it is more prudent to use a degree of freedom to earn more flexibility in an analysis. With all of these factors being taken into consideration, a Negative Binomial was the simplest and most effective analysis for this dataset. After the variables were found to meet the required distributional assumptions, they were included in the main analyses. Due to the small number of missing data (n=372) a listwise deletion approach was used. For data to be deleted participants needed to have left the PA question blank.

Main Analyses

The main analyses consisted of five negative binomial regressions and six negative binomial moderation regressions. For each of the analyses an exponentiated B (ExpB) was calculated. The ExpB is an odds ratio as per the literature ("Logistic Regression SPSS Annotated Output", n.d.; Field. 2013; Sroka & Nagaraja, 2018), therefore rather than stating it as an odds ratio, the term ExpB will be used. When using R, R calculates all odds ratios as ExpB and is noted to be more useful due to not requiring a logarithmic transformation (Field. 2013). Three negative binomial regressions were conducted on the experience variable: personal experience, vicarious experience, and a combination of both experiences with cancer. It was hypothesized that individuals with a personal experience with cancer will predict higher levels of physical activity compared to individuals with a vicarious experience with cancer. Furthermore, it was also hypothesized that an individual with both types of experiences with cancer will have higher physical activity levels compared to individuals with only one type of cancer experience. The fourth negative binomial regression was conducted to ensure the established relationship between gender and physical activity from the literature was present within this study as well. It was hypothesized that men will have higher physical activity levels than women, which is consistent with the literature. Lastly, two negative binomial regressions were conducted to assess the relationship between an individual's perceived risk and their physical activity levels (continuous and dichotomized).

The last four analyses were conducted to assess the moderating effects gender and perceived risk have on the relations between an individual's cancer experience and

their physical activity levels. The first two two-way interaction models incorporated the individual's gender, their experience with cancer, either vicarious or personal, and the dependent variable (physical activity). It was hypothesized that gender will moderate the relationship between personal (vicarious) experience and PA levels, such that the magnitude of the positive relationship between personal (vicarious) experience and PA levels will be stronger for women with a personal (vicarious) experience of cancer than men who had a personal (vicarious) experience of cancer. The second pair of two-way interaction models incorporated the individual's perceived risk, their experience with cancer, either vicarious or personal, and the dependent variable (physical activity). Lastly, it was also hypothesized that an individual's perceived risk will moderate the relationship between personal (vicarious) experience and PA levels, such that the magnitude of the positive relationship between personal (vicarious) experience and PA levels will be stronger for participants with a perceived higher risk of cancer than those who have a lower perceived risk of cancer.

Chapter 3

Results

Tables 3, 4, 5, and 6 provide information on the physical activity levels. PA was dichotomized using the cutoffs for PA (active v. sedentary). In this sample, 36.3% (n=4299) were considered to be 'active', or meeting the recommended guidelines, while 63.7% (n=7556) were considered to be sedentary, or not meeting the minimum recommended guidelines. The median minutes of PA per week was 90 minutes ranging from 0 – 5880 minutes.

Table 3

Physical Activity Engagement

		N	%	SD	Range
Physical Activity Levels	Active†	4299	36.3		
	Sedentary†	7556	63.7		
	Total (minutes)††	11,855		358.856	0-5880

† Active and Sedentary designations were comprised from PA as a binary variable to note whether or not the participant met the minimum 2019 physical activity guidelines.
†† Total minutes is comprised from PA as a continuous variable.

Table 4

Physical Activity Engagement by Gender

		N	%	Median	SD	Range
Physical Activity Levels	Male	5572	46.1	120	286.16	0-5040
	Female	6511	53.9	90	434.05	0-5880

Table 5

Negative Binomial Regression Models Estimating the Relations of Gender on Physical Activity Engagement as a Continuous Variable

		95% Wald Confidence Interval for Exp(B)		
Parameter	Exp(B)	Lower	Upper	Sig.
Gender	1.586	1.470	1.711	.000*

Note. Odds ratios (ExpB) are reported from the negative binomial regression analyses along with the appropriate confidence intervals.

Table 6

Negative Binomial Regression Models Estimating the Relations of Gender on Physical Activity Engagement as a Dichotomous Variable

		95% Wald Confidence Interval for Exp(B)		
Parameter	Exp(B)	Lower	Upper	Sig.
Gender	1.586	1.470	1.711	.000*

Note. Odds ratios (ExpB) are reported from the negative binomial regression analyses along with the appropriate confidence intervals.

Gender and Physical Activity Levels

There was a statistically significant gender difference in PA level, both with PA as a continuous outcome (ExpB=1.586, 95% CI 1.470-1.711, p =.001) and with PA as a dichotomous outcome (ExpB= 1.306, 95% CI 1.227-1.390, p = .001). These tests indicated that men were 1.3 – 1.5 times more likely to be more physically active than women.

Table 7

Risk Perception: Overall, How Confident Are You About Your Ability to Take Good Care of Your Health?

		N	%
Risk Perception			
	Very confident	5568	46.2
	Completely confident	3056	25.3
	Somewhat confident	2868	23.8
	A little confident	416	3.5
	Not confident at all	149	1.2

Table 7 provides responses to the Likert scale question regarding risk perception. When participants were inquired about their frequency of worry of developing cancer, the majority of participants (58.2%) report feeling “Slightly” worried (n=3892), followed by 18.1% (n=1214) who report feeling “Not at all” worried, 14.6% (n=978)

who report feeling "Somewhat" worried, 6.1% (n=411) who report feeling "Moderately" worried, and 2.9% (n=196) who report feeling "Extremely" worried.

Main Analyses

Cancer Experience and Physical Activity

The first three negative binomial regressions that were conducted on cancer experience (personal, vicarious, and combined) assessed whether an individual's type of experience with cancer predicted their PA levels. When assessing an individual's personal experience with cancer there was a strong relation with PA levels, whether PA was kept as a continuous variable (ExpB= .892, 95% CI 0.808-0.985, p = .024; Table 8) or a dichotomous variable (ExpB= .908, 95% CI 0.835-0.988, p= .024; Table 9). Individuals who had a personal experience with cancer were 0.892-0.908 times as likely to have lower PA levels compared to those without a personal experience with cancer. Furthermore, when assessing an individual's vicarious experiences with cancer there was no significant relation with PA levels (continuous: ExpB= 2.616, 95% CI 0.509-13.449, p = .250 [Table 8]; dichotomous: ExpB= 1.145, 95% CI 0.281 – 4.668, p = .850 [Table 9]) but it was seen that individuals who had vicarious experiences of cancer tend to have 1.1 – 2.6 times higher levels of PA than individuals who did not have a vicarious experience of cancer.

With respect to the sub-variables of vicarious experiences of cancer, findings were similar across levels of vicarious experience, whether PA was dichotomous or continuous. Individuals with experiences as caregivers to non-family members, such as friends, (continuous: ExpB= 1.637, 95% CI 0.585 – 4.582, p = .348 [Table 8]; dichotomous: ExpB= 1.354, 95% CI 0.65 – 2.822, p = .419 [Table 9]), professional

caregivers (continuous ExpB= .499, 95% CI 0.159 – 0.568, p = .234 [Table 8]; dichotomous: ExpB= .789, 95% CI 0.282 – 2.212, p = .653 [Table 9]), or were relatives but not caregivers of someone with cancer (continuous ExpB= .891, 95% CI 0.713 – 1.112, p = .307 [Table 8]; dichotomous: ExpB= .927, 95% CI 0.76 – 1.132, p = .458 [Table 9]) had no significant relation with their PA levels. Individuals who did have caregiving experience with friends had 1.354 – 1.637 times higher PA levels than individuals who did not care-give for friends. In contrast, individuals who were professional caregivers or had a vicarious experience of cancer without the caregiving aspect had less (.499 - .789 times for professional caregivers and .891-.927 times for non-caregivers) PA than their counterparts.

When assessing for both the combination of vicarious and personal experiences of cancer with PA output, there was a reported significant relation between the two variables (ExpB= .905, 95% CI 0.822 - 0.996, p = .040 [Table 8]) and PA levels when it was a continuous variable, as well as when it was dichotomized (ExpB= .912, 95% CI 0.841 – 0.99, p = .027 [Table 9]). Individuals with a combination of cancer experiences were .905 - .912 times more likely to have low PA levels than individuals who did not have a combination of cancer experiences. Importantly, some of these estimates were associated with wide confidence intervals, indicating lack of precision, which will further be discussed later in this paper. Table 8 displays odds ratios as ExpB, intercept, and confidence intervals for personal cancer experience, vicarious caregiver cancer experience: family, friend, professional, and overall vicarious experiences as a caregiver, vicarious experience but not as a caregiver, and the combination of personal and vicarious experiences with cancer regarding PA as a continuous variable. Table 9

displays odds ratios as ExpB, intercept, and confidence intervals for personal cancer experience, vicarious caregiver cancer experience: family, friend, professional, and overall vicarious experiences as a caregiver, vicarious experience but not as a caregiver, and the combination of personal and vicarious experiences with cancer regarding PA as a dichotomous variable.

Table 8

Negative Binomial Regression Models Estimating the Relations of Personal, Vicarious, or a Combination of Cancer Experiences on Physical Activity Engagement as a Continuous Variable

		95% Wald Confidence Interval for Exp(B)		
Parameter	Exp(B)	Lower	Upper	Sig.
Personal	0.892	0.808	0.985	.024*
Vicarious	2.616	0.509	13.449	0.250
Family	1.07	0.619	1.848	0.809
Friend	1.637	0.585	4.582	0.348
Professional	0.499	0.159	1.568	0.234
Vicarious Experience: Not a caregiver	0.891	0.713	1.112	0.307
Combination	0.905	0.822	0.996	0.04*

Note. Odds ratios (ExpB) are reported from the negative binomial regression analyses along with the appropriate confidence intervals.

Table 9

Negative Binomial Regression Models Estimating the Effect of Personal, Vicarious, or a Combination of Cancer Experiences on Physical Activity Engagement as a Dichotomous Variable

		95% Wald Confidence Interval for Exp(B)		
Parameter	Exp(B)	Lower	Upper	Sig.
Personal	0.908	0.835	0.988	.024*
Vicarious	1.145	0.281	4.668	0.850
Family	1.013	0.716	1.433	0.941
Friend	1.354	0.65	2.822	0.419
Professional	0.789	0.282	2.212	0.653
Vicarious Experience: Not a caregiver	0.927	0.76	1.132	0.458
Combination	0.912	0.841	0.99	0.027*

Note. Odds ratios (ExpB) are reported from the negative binomial regression analyses along with the appropriate confidence intervals.

Risk Perception and Physical Activity Levels

The following negative binomial regression assessed whether an individual's level of perceived risk had any relation with PA levels. An individual's perceived risk had no relation with PA, whether the PA outcome was continuous (ExpB= 1.019, 95% CI .967 – 1.075, p = .482) or dichotomous (ExpB= 1.004, 95% CI .960 – 1.049, p = .872).

Gender, Risk Perception, and Physical Activity Levels: Testing for Moderation

Lastly, six 2-way regression models were utilized to investigate whether gender, or risk perception, had a moderating effect on the relations between cancer

experience and PA. The two predictors and their interaction were entered into a simultaneous negative binomial moderation regression model. It was predicted gender would amplify the positive relationship between an individual's cancer experience and their PA levels. Results indicated that the interaction term of personal cancer experience x gender (ExpB =.928, 95% CI .755 – 1.142, p=.482) and the interaction term of combination x gender (ExpB= 1.002, 95% CI .820-1.225, p = .984) had no relation with PA levels as a continuous variable, nor when it was a dichotomous variable, (ExpB=.987, 95% CI .828-1.176, p=.884) and (ExpB= 1.028, 95% CI .868-1.219, p= .746), respectively. Concerning the interaction term of vicarious cancer experience x gender when PA was continuous (ExpB =7.294, 95% CI .203-262.660, p =.277) or dichotomous (ExpB =5.0E9; 95% CI .000-1.225, p =1.00) the moderation term did not have a significant relation with PA but did have a positive effect on PA levels. Males who had a vicarious experience of cancer were 5.0E9 – 7.3 times more likely to have higher levels of PA than their female counterparts (i.e., women who had a vicarious experience of cancer). Conversely, when males had a personal experience with cancer they were .928- 987 times more likely to have lower physical activity levels then their female counterparts.

Results also indicated that the interaction term of personal cancer experience x risk perception (ExpB =1.073, 95% CI .950-1.211, p =.256), the interaction term of vicarious cancer experience x risk perception (ExpB =.394, 95% CI .097 – 1.595, p =.191, and the interaction term combination x risk perception (ExpB= 1.039, 95% CI .923 – 1.168, p=.529) had no relation with PA levels as a continuous variable, nor when it was a dichotomous variable, (ExpB =.933, 95% CI .840 – 1.037, p = .198)

and (ExpB= .944, 95% CI .853-1.045, p = .267. Individuals who have a higher perceived risk of cancer and report having a vicarious experience with cancer tend to have .394 times lower PA levels than their counterparts. It was predicted risk perception would amplify the positive relationship between an individual's cancer experience and their PA levels, but this was not the case for this sample.

Chapter 4

Discussion

The main purposes of this study were to: (a) estimate the degree to which an individual's experience of cancer effects PA levels, (b) determine if gender moderates the relations between the experience of cancer and PA levels, and (c) determine if risk perception moderates the relations between the experience of cancer and PA levels. The current study was designed to assess whether an individual's reported experiences with cancer, whether they were personal, vicarious, or a combination of both experiences, would predict their PA levels. Results from the negative binomial regression analyses on an individual's reported cancer experience revealed that, for this national sample, individuals who had a personal experience with cancer or a combination of vicarious and personal experiences with cancer were less likely to report engaging in PA, whether PA was assessed dichotomously or continuously. These findings support hypotheses 1, 1a, and 1b, respectively. When looking at an individual's vicarious experience with cancer the data revealed that no relation with PA levels.

The findings for individuals with a personal experience of cancer contradict the findings of multiple studies that noted individuals with a personal experience of cancer did not affect their PA (Grim et al., 2011; Cuthbert et al., 2018). The findings from this study support the current literature that reports vicarious experiences with cancer have little to no relation to PA output (Grim et al., 2011; Cuthbert et al., 2018). As mentioned prior, results of the vicarious experience tests, whether they were within a moderation or a standalone variable, had wide confidence intervals. For this paper a

wide confidence interval will be considered any interval that is .6 or higher, as per the literature (Higgins et al., 2019). Although the variables that had particularly wide confidence intervals were not significant, significance alone is not sufficient enough to discount these variables. The absence of statistical significance does not remove the possibility of finding a treatment effect or clinical significance. This imprecision may be due to the limited number of participants who actually reported vicarious experiences with cancer.

With this caveat in mind, the effect size of this test remains noteworthy, suggesting the potential clinical significance of this relation and the need for further investigation. When an individual reports having a vicarious experience of cancer, their PA levels seemingly do not have any relation with one another, but the effect size potentially shows something different. Throughout the literature, vicarious experience has been shown to have no relation with physical activity, which held true in this sample in regard to statistical significance. When looking at the effect size, vicarious experience shows that it can either be effected positively, such as when gender moderates its relationship, or negatively, such as when risk perception moderates an individual's vicarious experience. The vicarious variable and its sub-variables each had a different effect size, along with very wide confidence intervals. These different outcome effects along with these wide intervals indicate the knowledge we have of these true effects are very little and more information needs to be collected.

With such a large gap in the confidence interval it is difficult to ascertain whether or not vicarious experience, or its sub-variables, of cancer either decreases an individual's overall risk or increases it – which is a very important piece of

information that can guide intervention. We are 95% confident that the relative risk of decreased PA in persons with vicarious experience of cancer compared to individuals with no vicarious experience of cancer is between 0.509 and 13.449. With an increase in sample size the confidence interval will become smaller and the data will be able to provide more precise estimates of the true relation between vicarious experiences and PA.

Due to the outcomes presented, it may be assumed that for this sample the direct physical and emotional impact of cancer, rather than its indirect (vicarious) impact had a more significant relation with PA levels. Although, when assessing an individuals' odds ratio, participants who did have a vicarious experience of cancer have a higher likelihood of having higher PA levels than their counterparts. The outcome of this first aim can potentially be explained through the Health Belief Model and the Commonsense Model of Illness (Leventhal, Leventhal, & Breland, 2011; Taylor, 2017). As mentioned previously, an individual appraises their need for protective behaviors against illness through the perception of the health threat, as well through the feasibility and effectiveness of trying to prevent the illness. This perception is typically founded upon an individual's general health values, their concern about their health, as well as their perceived vulnerability. Consistent among many different protective behaviors, an individual's understanding of the probability of developing chronic illnesses, as well as the etiology of the disease/illness, influences their engagement in protective behaviors such as PA, cancer screenings, etc. (Wang & Coups, 2010). Individuals hold cognitive representations about illnesses and diseases that affect their engagement, or lack thereof, in health behaviors.

The commonsense model of illness posits that individuals have implicit commonsense beliefs about their illnesses and/or diseases, which in turn develop into schemas that allow the individual to create a coherent comprehension of the illness (Leventhal, Leventhal, & Breland 2011). These schemas influence an individual's understanding of the illness and can prevent positive health behaviors, adherence to treatment, treatment outcome, as well as the overall experience with the illness and/or disease (Kaptein et al., 2010; Mann, Ridder, & Fujita, 2013; Petrie & Weinman, 2012). It has been shown in previous studies that individuals understand the role of negative behaviors increasing the risk of cancer, yet there is a lack of awareness and belief of the cancer benefits associated with PA (Neiderdeppe & Levy, 2007; Sullivan et al., 2010; Ramirez et al., 2013; Cunningham et al., 2019). It is has been shown that individuals with a vicarious experience of cancer tend to have more common sense belief systems such as the old tale that there is a cancer-prone personality type, which there is little evidence to support this stereotype (Lemonge et al., 2013) or the "them, not me" protective belief. Therefore, with these beliefs, individuals may see preventive behaviors as a fruitless endeavor.

The study was also designed to determine whether or not gender moderates the relationship between the experience of cancer and PA levels. The findings of gender as a moderator revealed that it had no moderating effect on the relation between an individual's cancer experience/cancer experience type and their PA output. Although the output was non-significant, the odds ratio of the analyses showed that men who have a vicarious experience with cancer have a higher likelihood of higher PA than

their female counterparts. Even though gender was not a moderator within the cancer experience and PA model, as a stand-alone variable it showed to have a relation with PA. Gender differences were included within the model due to the literature's strong support of gender being a strong factor in PA. This finding supports the literature which reports notable gender differences in PA levels (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013). Many studies have noted that men tend to be more physically active than women across most age groups (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013), as was the case in this study as well. Men showed an average of 85 more minutes of weekly PA compared to women. Even though men are consistent in showing higher PA levels in the literature, women's PA levels are continuously going up. Some recent studies have shown that women are beginning to show a closing of the gap between genders and PA (Leon et al., 2017). A possible reason for an increase in women reporting higher levels of PA can be due to more accurate reporting of PA levels in their day-to-day lives. A study conducted by Hagströmer et al. (2007) explains that historically women underreported PA due to women not reporting activities such as cleaning, child-rearing, etc. as PA out of misinformed beliefs. Therefore, with clearer definitions of PA in more recent studies, women are reporting higher PA levels because they are accurately reporting their PA behaviors.

Lastly, the study was designed to determine whether or not risk perception moderates the relationship between the experience of cancer and PA levels. Similarly, to the gender variable, risk perception did not have a moderating effect in

the relation between cancer experience and PA. Unlike gender, risk perception had neither a moderating effect or a relation with PA. Studies have shown that individuals with higher levels of perceived risk tend to engage in more preventive behaviors (Cunningham et al., 2019). In this study, it seems that an individual's perception of risk did not impact their preventive behaviors, i.e. PA. A large portion of this sample reported high levels of optimism regarding their health which could lead to lower levels of perceived risk. Studies have shown that optimistic health tendencies have been seen to predict lower engagement in preventive behaviors (DeSantis et al., 2016; Islami et al., 2017), which could explain the low levels of report PA in this sample and in the general public overall. This study has provided information into the understanding of cancer experience and its effect on PA outcome, as well as the role, or lack thereof, gender and risk perception have in moderating the aforementioned relationship. Results from this study have shown that an individual's personal experience along with a combination of cancer experiences does have an impact on PA levels, whereas an individual's vicarious experiences, their perceived risk, and their gender do not have a strong, significant impact on PA output. The importance of these findings shows that early intervention with individuals who have a personal experience with cancer can potentially lead to high PA levels. Furthermore, this study shows the significant impact multiple forms of experiences with cancer can have on PA levels. Using this information, clinicians can target populations who are at-risk for exposure to multiple occurrences of cancer and begin to facilitate treatment, such as behavioral activation or psychoeducation. There are some limitations that future research should take into consideration when

studying this topic and population.

Limitations/ Future Directions

Due to this study's national sample being collected via mail and telephone, there were some shortcomings in the outcomes of the study that can be addressed in future studies. One of the first limitations of the study is the limited questions of risk perception. The inclusion of more risk perception questions, or a specific validated risk perception questionnaire would be able to collect more meaningful and direct information. Furthermore, due to the single question of risk perception, an alpha was not able to be calculated, which lends itself more to the argument of using a risk perception questionnaire rather than a sole question.

A second limitation is regarding the accurate completion of the survey. Many individuals input “0”s, specifically for the PA question, and those “0”s may not be an accurate response. Potentially applying some safeguards specifically for questions where an omission or a “0” would more than likely not be an accurate or correct response.

Another limitation of the study was that the study was the subjective nature of the study. This study was designed using a self-report questionnaire and all data collected was an estimation of the data requested by the individual reporting the information. Future studies would benefit from using more objective measures if possible, specifically for the PA variable. Using objective measures of PA would allow for a more accurate recording of minutes of PA, as well as drastically limit the false “0”s reported. Within the same breadth, the subjective nature of this study does not allow for causal inferences. A more objective study with an experimental group would

be able to establish causality making the impact of the findings of this study much more valuable. Ethical considerations will need to be taken highly into consideration due to the sensitive nature of the cancer population.

Lastly, this survey was created to assess an individual's knowledge of cancer care and information across a continuum, but this survey also collected data on the perception of health benefits, risks, and beliefs. A questionnaire assessing a theoretical model, such as the Health Belief Model, would provide rich information on the potential reasons individuals are or are not engaging in healthy behaviors. The inclusion of an HBM questionnaire would have provided important information on a profile of what may or may not encourage or discourage PA. Due to the lack of an HBM questionnaire, this model was only able to be used as a theoretical foundation, rather than truly be incorporated into the analyses.

Conclusions

Health promotion efforts can increase motivation in the population and break down barriers through education. A strong relation supported in this paper, as well as in prior literature, was between an individual's experiences and their PA levels. Finding methods to use an individual's experiences to increase understanding and awareness of the risk and minimize perceived barriers of PA is paramount in increasing PA levels. This understanding can be used to further strengthen intervention efforts in the health care system, specifically primary care. Primary care offices typically are more accessible and able to provide services to the general population. Using primary care offices as a point of access to address at-risk populations through the use of health psychology and/or behavioral health consultations can allow greater contact with vulnerable populations. Using the information from this study can allow for quicker and more accurate identification for at-risk populations, such as those who have personal and/or a combination of experiences with cancer. In conjunction with quicker and more accurate identification, this information can be used to increase patient retention by using target specific interventions, such as motivational interviewing. Professionals can use this information to create interventions to increase the importance of understanding the probability and risk of developing an illness for individuals with experiences of cancer. In this particular sample, an individual's gender or risk perception did not increase PA levels, but it has been shown in other studies to increase preventive behaviors, such as PA (Wang & Coups, 2010). These results can assist in intervention development regarding finding strategies to increase an

individual's motivation to engage in PA.

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Appendix

Selected Questions from HINTS5

Physical Activity Question:

I1. In a typical week, how many days do you do any physical activity or exercise of at least moderate intensity, such as brisk walking, bicycling at a regular pace, and swimming at a regular pace (do not include weightlifting)?

- 0 None → **GO TO I3 below**
- 1 1 day per week
- 2 2 days per week
- 3 3 days per week
- 4 4 days per week
- 5 5 days per week
- 6 6 days per week
- 7 7 days per week

TimesModerateExercise

I2. On the days that you do any physical activity or exercise of at least moderate intensity, how long do you typically do these activities?

☐☐☐ **Minutes per day**

HowLongModerateExerciseMinutes

Personal Experience with Cancer:

M1. Have you ever been diagnosed as having cancer? EverHadCancer

- 1 Yes
- 2 No → **GO TO N1 on the next page**

M2. What type of cancer did you have?

Mark all that apply.

- 1 Bladder cancer CaBladder
- 1 Bone cancer CaBone
- 1 Breast cancer CaBreast
- 1 Cervical cancer (cancer of the cervix) CaCervical
- 1 Colon cancer CaColon
- 1 Endometrial cancer (cancer of the uterus) CaEndometrial
- 1 Head and neck cancer CaHeadNeck
- 1 Leukemia/Blood cancer CaLeukemia
- 1 Liver cancer CaLiver
- 1 Lung cancer CaLung
- 1 Lymphoma (Hodgkin's) CaHodgkins
- 1 Lymphoma (Non-Hodgkin's) CaNonHodgkin
- 1 Melanoma CaMelanoma
- 1 Oral cancer CaOral
- 1 Ovarian cancer CaOvarian
- 1 Pancreatic cancer CaPancreatic
- 1 Pharyngeal (throat) cancer CaPharyngeal
- 1 Prostate cancer CaProstate
- 1 Rectal cancer CaRectal
- 1 Renal (kidney) cancer CaRenal
- 1 Skin cancer, non-melanoma CaSkin
- 1 Stomach cancer CaStomach
- 1 Other – Specify → CaOther CaOther_OS

Cancer_Cat

Risk Perception of Cancer:

N1. How worried are you about getting cancer?

FreqWorryCancer

- [1] Not at all
- [2] Slightly
- [3] Somewhat
- [4] Moderately
- [5] Extremely

Vicarious Experience with Cancer:

E1. Are you currently caring for or making health care decisions for someone with a **medical, behavioral, disability, or other condition?**

Mark all that apply.

- [1] Yes, a child/children Caregiving_Child
- [1] Yes, a spouse/partner Caregiving_Spouse
- [1] Yes, a parent/parents Caregiving_Parent
- [1] Yes, another family member Caregiving_AnotherFam
- [1] Yes, a friend or other non-relative Caregiving_Friend
- [1] No → **GO TO E11 on page 10** Caregiving_No

CaregivingWho_Cat

E2. Do you provide any of this care professionally as part of a job (for example, as a nurse or professional home health aide)?

Caregiving_Professional

- [1] Yes
- [2] No

Gender:

O14. Starting with yourself, please mark the sex, and write in the age and month of birth for each adult 18 years of age or older living at this address.

	Sex	Age	Month Born (01-12)
SELF	[1] Male [2] Female	SelfAge	SelfMOB

SelfGender

Demographics

O6. What is the highest grade or level of schooling you completed?

Education

- [1] Less than 8 years
- [2] 8 through 11 years
- [3] 12 years or completed high school
- [4] Post high school training other than college (vocational or technical)
- [5] Some college
- [6] College graduate
- [7] Postgraduate

O10. Are you of Hispanic, Latino/a, or Spanish origin? One or more categories may be selected.

Mark all that apply.

- [1] No, not of Hispanic, Latino/a, or Spanish origin NotHisp
- [1] Yes, Mexican, Mexican American, Chicano/a Mexican
- [1] Yes, Puerto Rican PuertoRican
- [1] Yes, Cuban Cuban
- [1] Yes, another Hispanic, Latino/a, or Spanish origin OtherHisp

Hisp_Cat

O11. What is your race? One or more categories may be selected.

Mark all that apply.

- [1] White White
- [1] Black or African American Black
- [1] American Indian or Alaska Native AmerInd
- [1] Asian Indian AsInd
- [1] Chinese Chinese
- [1] Filipino Filipino
- [1] Japanese Japanese
- [1] Korean Korean
- [1] Vietnamese Vietnamese
- [1] Other Asian OthAsian
- [1] Native Hawaiian Hawaiian
- [1] Guamanian or Chamorro Guamanian

O17. Thinking about members of your family living in this household, what is your combined annual income, meaning the total pre-tax income from all sources earned in the past year? IncomeRanges

- [1] $0 to $9,999
- [2] $10,000 to $14,999
- [3] $15,000 to $19,999
- [4] $20,000 to $34,999
- [5] $35,000 to $49,999
- [6] $50,000 to $74,999
- [7] $75,000 to $99,999
- [8] $100,000 to $199,999
- [9] $200,000 or more