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HEALTH EFFECTS OF CANCER SURVIVORSHIP AND OTHER CHRONIC ILLNESSES

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ABSTRACT

Cancer survivors have poorer health outcomes than similar individuals without cancer across the same health measures. As the population of cancer survivors grows, increasing importance is placed on health surveillance, as well as interventions to improve long-term health outcomes. This study's objective was to quantify the effects of cancer and other chronic illnesses (including diabetes, heart disease, stroke, and hypertension) on health outcomes that speak to an individual's physical and mental health. Health effects of other chronic illnesses put the burden of cancer on health into perspective. Health variables of interest included work limitations due to physical problems, need for assistive devices, and feeling depressed or downhearted. A sample of 25,226 individuals over the age of 18 was taken from the 2011 Medical Expenditure Panel Survey, conducted by the Agency for Healthcare Research and Quality (AHRQ). Marginal health effects were estimated for cancer survivorship, diabetes, high cholesterol, and hypertension with multivariate linear and logistic regressions. Compared to similar individuals without cancer, cancer survivors are more likely to have cognitive limitations, use of an assistive device, and pain that limits work, as well as work limitations due to mental problems ($p < 0.05$). The deficits in health outcomes provide support for further research on cancer survivorship in order to create interventions to improve long-term health of survivors.

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Chapter I: Introduction

With advancements in medical technology, there has been an increasing population of cancer survivors. The number of new cancer cases and the number of long-term survivors is projected to increase over the next decade. The number of survivors who are less than 5 years from diagnosis will increase from 4.9 million to 6.0 million; while the number of survivors who are greater than 5 years from diagnosis will increase from 8.7 million to 11.9 million (De Moor et al., 2013). As the population of cancer survivors grows, research is needed to better understand and address the medical, psychosocial, and daily living needs associated with cancer survivorship.

The goal of this study is to quantify the effects of cancer survivorship on various health outcomes that describe different aspects of an individual's mental and physical health. In addition, associations between these health outcomes and chronic conditions such as diabetes, heart disease, stroke, and hypertension will be studied in order to put the cancer burden in perspective. In order to carry out this study, data from the Medical Expenditure Panel Survey for a sample of individuals who have been diagnosed with cancer, heart disease, diabetes, hypertension, and stroke will be analyzed. Responses of these individuals to questions about their physical or mental health status will be evaluated to determine the effects of any specific condition on health outcomes.

Background

The number of cancer survivors continues to increase, due to the aging and growth of the U.S. population, as well as improvements in survival rates. In 2012, there were an estimated 13.7 million Americans who had a history of cancer (Siegel et al., 2012), a significant increase from the 3 million cancer survivors in 1971 (Ganz, 2009). Each year there are an estimated 1 million people who are diagnosed with cancer, a number that is expected to increase by the year 2050 (Yabroff, Lawrence, Clauser, Davis, & Brown, 2004). As a result of increasing incidence and longer survival, the prevalence of cancer survivors is expected to grow.

With an increasing population of cancer survivors, there is reason for increasing emphasis on their quality of life. Many survivors require regular monitoring, treatment, and lifestyle modifications, well after being deemed cancer-free (Bradley & Bednarek, 2002). In addition, cancer diagnosis and treatment is likely to affect a survivor's mental and physical health status over the long term. Cancer treatment is linked with a number of long-term health effects that include cardiotoxicity, sexual dysfunction, pain and fatigue, and psychological stress (Guy et al, 2013).

Furthermore, as the number of working age cancer survivors increases, long-term health effects of survivorship can create disparities in productivity and employment between cancer survivors and individuals without a history of cancer. An estimated 40% of cancer survivors in the U.S. are of working age (25-64 years old), which signifies a need to address issues regarding work limitations, work accommodations, and earnings of cancer survivors (Short, Vasey, BeLue, 2008).

As a result of treatment, cancer survivors had total annual medical expenditures estimated at \$4,187 more for males and \$3,293 more for females, compared to those of individuals without

a history of cancer (Ekwume et al., 2014). The increase in medical expenditures provides an impetus for cancer survivors to return to work and remain productive. However, for a third of survivors, long-term effects may interfere with daily tasks outside of work. Many of these survivors return to work in order to maintain insurance coverage as well as pay for cancer treatments not covered by insurance. Furthermore, 30% of cancer survivors are disabled and not able to return to work due to decreased ability to work as a result of mental and cognitive limitations, psychological distress, and loss of physical functioning (Dowling et al., 2013).

The growing number of people diagnosed with cancer has many implications for the future of U.S. health care. Because cancer incidence rates tend to increase with age, an aging population results in more people being diagnosed with and surviving cancer. It is estimated that two thirds of all cancer survivors will be age 65 or older by 2020 (Parr, Mariotto, Alfano, & Rowland, 2011). A growing population of cancer survivors will then put pressure on a health care system with needs for oncology treatment that outweigh the supply of oncologists (Erikson, Salsberg, Forte, Bruinooge, & Goldstein, 2007). An aging population of survivors also poses challenges to the healthcare system because older survivors are more likely to have several chronic diseases and to experience poorer physical functioning than younger survivors (Bellizzi, Mustian, Paresh, & Diefenbach, 2008).

Cancer survivors are a growing population with a demanding need for medical care, physical support, and psychosocial support. It is the hope of this study to inform survivorship research that will result in policies and practices that diminish the health disparities between cancer survivors and individuals without cancer. Through policy implementation, cancer survivors will be better equipped to have a high quality of life, far after becoming cancer-free.

Review of Literature

Physical Effects of Cancer Survivorship

Current research on cancer survivorship focuses on the physical deficits associated with cancer and the loss of productivity that may result. Data from the National Health Interview Study (NHIS), in which over 60% of cancer survivors were five or more years post diagnosis, shows that approximately 30% of the survivors were in fair or poor health (De Moor et al., 2013). Additionally, 58% had one or more functional limitations, and 17% were unable to work as a consequence of their health problems (Hewitt, Rowland, & Yancik, 2003). In sum, survivors are more likely to report poorer health and functioning than people without a cancer history.

Because physical effects of cancer are important influences on the employment of survivors, employment and disability rates are also examined. The mean rate for cancer survivors to return to work was found to be 62%, while manual work was negatively associated with return to work (Spelten, Sprangers, & Verbeek, 2002). Although cancer survivors usually return to work after treatment, they may face difficulties regaining or maintaining the same level of productivity as in the past. Female cancer survivors were found to have a significant decreased probability of working, probability of working full time, and hours. Male cancer survivors had a decreased probability of full-time employment and decreased hours, but not a significantly decreased probability of working at all (Short, Vasey, Moran, 2008).

An understanding of employment, disability, and productivity for cancer survivors provides useful perspective on the health effects of cancer survivorship. Further examination is

needed to create employment support services, as well as work place accommodations to diminish work disabilities of cancer survivors.

Psychosocial Effects of Cancer Survivorship

Because physical limitations have a greater influence on work life and productivity, they are the focus of many cancer survivorship studies. This leaves a gap in research on the psychosocial effect of cancer survivorship. Psychosocial health also contributes to the quality of life after treatment. A study of Chinese colorectal cancer patients (n=234) found that 67% of cancer survivors scored below a clinical cutoff for anxiety/depressive symptoms between 3 and 12 months after being deemed cancer free (Stanton, 2012). Quality of life in women with a history of gynecologic cancer follows a similar pattern. It was found that 33% of women who have had chemotherapy had high levels of psychological distress and would benefit from psychological support (Auchincloss, 1995). Sexual dysfunction may also arise in cancer survivors depending on their cancer diagnosis and treatment.

Meanwhile, a more comprehensive study of psychosocial effects suggests that distress in cancer patients is above a rate of 30%, while the prevalence of depressive symptoms vary between 10 and 25%. Anxiety symptoms vary between 10 and 30% (Aaronson et al., 2014). Psychosocial effects are difficult to study because symptoms experienced by cancer patients are likely to change over time, while also varying from one person to another. (Lam et al., 2013). In order to create efficient interventions for cancer survivors, a greater effort must be made to understand the nature of depression and anxiety throughout a cancer survivor's life, the risk factors involved, the recovery process, as well as support system involvement.

Current Efforts to Improve Cancer Survivorship Research

While research on cancer survivorship is limited, it is vital to compile a more detailed and all-encompassing picture of the health effects of cancer survivorship. The American Society of Clinical Oncology (ASCO) introduced a “Patient and Survivor” track to its annual meeting in order to recognize the needs of cancer survivors, as well as the role of oncologists in meeting the health care needs of survivors. This initiative further supplements the effort to move the field of cancer survivorship forward and to expand research on the topic (Rowland, Hewitt, & Ganz, 2006). Similarly, in 2011, the Medical Expenditure Panel Survey (MEPS) included an additional stratum based on responses to a cancer related question in the National Health Interview Survey (NHIS) as part of implementing a MEPS cancer supplement. In doing so, MEPS enhanced the sample size of cancer survivors in order to address gaps in cancer survivorship research associated with medical care costs, financial hardship, and other aspects of the burden of cancer survivorship (Mirel & Machlin, 2013). Additionally, MEPS provides a nationally representative sample of cancer survivors, which allows for a greater depth of understanding, as many cancer studies have been regional or limited in numbers. Both ASCO and MEPS represent examples of many research efforts to highlight the needs of cancer survivors, as well as to develop care models that reduce the health deficits of cancer survivors.

Conceptual Framework and Hypothesis

Based on the results of prior studies, it is expected that cancer survivors have poorer physical health than similar individuals who have no history of cancer. Because many studies focus on the economic impact of cancer survivorship, they place a greater emphasis on physical

health. Few studies examine the mental health status associated with cancer survivorship. Because treatment places such a burden on cancer survivors' bodies, it is expected that their thoughts and feelings will also be affected.

In order to delve into the effects of cancer survivorship, standardized variables measuring physical and mental health will be used from the Short Form 12 Survey, a subsection taken from the MEPS. These variables are calculated from responses to twelve questions addressing physical and mental health status, which then provide a holistic view of the health status of individuals in the MEPS sample. While a good deal of research on cancer survivorship focuses on physical health, it is a focus of this study to obtain a greater insight on mental health of cancer survivors.

Although cancer survivorship is the main exposure of interest, it is hard to understand the full implications for health without any tangible basis for comparison. Consequently, this study aims to demonstrate the relative burden of cancer, by including other chronic conditions as a basis for comparison. The chronic conditions include: diabetes, hypertension, stroke, and heart disease. These conditions, including cancer, are among the top 10 most common and costly chronic diseases in the United States (Bodenheimer, Chen, & Bennett, 2009). By using other chronic conditions in this study, the burden of cancer survivorship can be put into a comprehensible perspective.

The conceptual framework depicted in Figure 1 shows the hypothesized relationships between cancer survivorship and other chronic conditions and physical and mental health. Depicted is cancer survivorship having a larger effect on physical and mental health than the other chronic conditions studied.

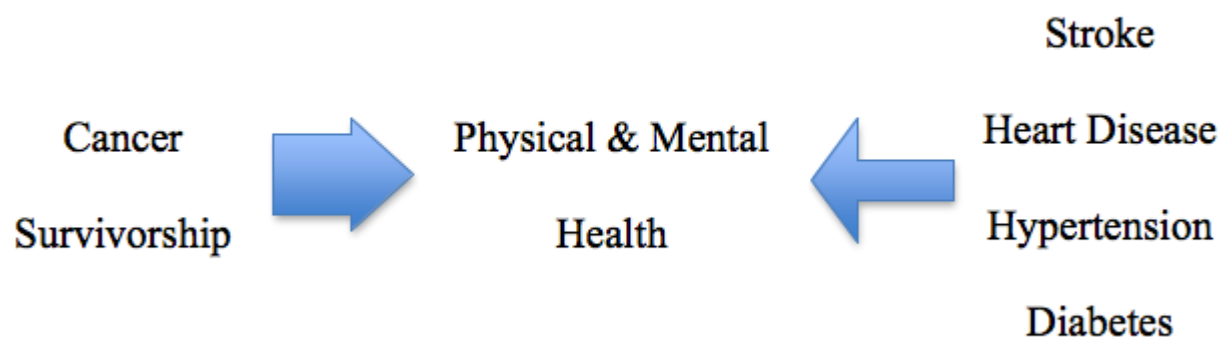


Figure 1. Conceptual Framework

A mathematical model can also be used to describe the hypothesis. Regressions in the following form describe the analysis for this study: $\text{health outcome} = \beta_0 + \beta_1 \text{ cancer survivor} + \beta_2 \text{ heart disease} + \beta_3 \text{ diabetes} + \beta_4 \text{ high cholesterol} + \beta_5 \text{ hypertension} + X\beta_k$. Coefficients will describe the intensity of the effect an indicated condition has on the health outcome variable. Therefore, it is hypothesized that for a given health indicator, $\beta_1 > \beta_2, \beta_3, \beta_4, \beta_5$.

In addition to cancer survivorship and other chronic conditions, demographic characteristics are hypothesized to influence physical and mental health. Demographic features of interest include sex, age, insurance type, and race. It is hypothesized that there will be little difference in health outcomes in men and women. It is expected that physical and mental health will deteriorate with age. Insurance type dictates availability of health care to an individual so it is expected that those with private insurance will have the resources to care that will provide favorable physical and mental health outcomes in comparison to those with public health insurance. Lastly, it is expected that minority races will have poorer health outcomes than white individuals.

The hypotheses being tested are:

- 1) Cancer survivors will have poorer physical and mental outcomes than similar individuals without a history of cancer.
- 2) Cancer survivors will have poorer physical and mental health than people who have had a chronic condition such as diabetes, hypertension, stroke, or heart disease.
- 3) Physical and mental health outcomes are poorer in individuals that are older, of a minority race, and have public health insurance.

Chapter II: Research Methods

Data

The data used for this study come from the Medical Expenditure Panel Survey (MEPS) Household Component for 2011. MEPS is a nationally representative survey conducted by the Agency for Healthcare Research and Quality (AHRQ) in order to provide data to describe healthcare use, expenditures, and health insurance status of the civilian, non-institutionalized U.S. population (Cohen et al., 1996). MEPS consists of three surveys: the Household component (HC), Medical Provider Component (MPC), and the Insurance Component (IC). The household component, used in this study, contains demographic, health care use, health status, expenditure, and access to medical care data for individuals of all ages (Yabroff et al., 2012).

The MEPS HC conducts interviews using an overlapping panel design in which individuals are interviewed in person five times over 2.5 years. A new panel is introduced each year, and data for each calendar year are derived from two of these panels (first year of one panel, second year of preceding panel). In 2011, MEPS included a Cancer Survivorship Supplement that consisted of an oversample of households with cancer survivors from the National Health Interview Survey (NHIS), as well as a special questionnaire for cancer survivors with comprehensive questions about the burden of cancer, financial issues, employment patterns, productivity, and the psychosocial effect on survivors and their families (Yabroff et al., 2012). Because the MEPS sample is drawn from completed NHIS interviews and MEPS itself involves multiple interviews, a lower overall response rate is to be expected. The calculated response rate for the sample of people with complete data for all of 2011 was 54.9%.

Sample

Because many variables included in this study describe work life, and because health concerns and patterns differ between children and adults, only adults over the age of 18 were considered here. The sample includes 25,226 individuals. Of that total, 11,728 (46%) were male and 13,498 (54%) were female; 70% were white, 20% were black, 7% were Asian, 1% American Indian, 1.5% reported multiple races, and 0.5% were Native Hawaiian. Sample characteristics can be seen below in Table 1:

Table 1. Sample Characteristics

Characteristic	Males (N==11,728)	Females (13,498)
Age		
<25	17%	15%
25-34	17%	17%
35-44	18%	18%
45-54	18%	18%
55-65	15%	15%
>65	15%	17%
Race		
White	72%	68%
Black	18%	22%
American Indian/Alaskan Native	1%	1%
Asian	7%	7%
Native Hawaiian/Pacific	.5%	.5%
Multiple Races Reported	1%	1%
Highest Degree		
No Degree	21%	20%
GED	4%	4%
High School Diploma	43%	45%
Bachelor's	15%	15%
Master's	5%	6%
Doctorate	2%	1%
Other	6%	8%
Diagnoses		
High blood pressure	31%	32%
Heart Disease	6%	4%
Stroke	4%	4%
Cancer	7%	9%
Diabetes	5%	10%

Measures

The prevalence of cancer, heart disease, diabetes, hypertension, and stroke was measured in MEPS by asking respondents, “Has a doctor or other medical provider ever told you that you had [condition]?” In a similar manner, high cholesterol, emphysema, arthritis, and asthma were all grouped together as an indicator of having any condition other than the main chronic illnesses being studied.

The health outcome variables selected for this study encompass multiple dimensions of physical and mental health. Many of these variables originate from the Short Form 12 survey, which is widely used as an overall measure of individual health. The variables used in this study are as follows:

- “Physical Component Summary”
- “Mental Component Summary”

Responses to a series of 12 questions followed a response pattern in which interviewees could respond “All of the Time,” “Most of the Time,” “Some of the Time,” “Little of the Time,” or “None of the Time.” The SF-12 survey then uses these questions to create scores for a Physical Component Summary (PCS) and Mental Component Summary (MCS) using published algorithms. Each summary measure was standardized with a t-score transformation to a mean score of 50 and a standard deviation of 10 (Fleishman, Selim, & Kazis, 2010).

Other health status variables considered in this study encompass limitations in carrying out activities of daily life. These variables were categorical and answered simply in a Yes/No manner. They are listed below:

- “ADL Screener” (any limitations in activities of daily living)
- “Used Assistive Devices”

- “Limitation in Physical Functioning”
- “Any Limitation Work/Housework/School”
- “Work Limitation”
- “Housework Limitation”
- “School Limitation”
- “Social Limitation”
- “Cognitive Limitation”

Analysis Procedure

Covariates were treated as dichotomous; respondents who belonged in a category would be coded as 1. Age was treated as three separate variables: age less than 45, ages 45-64, and then ages 65 and over. Similarly, education was organized into three categories: high school education or less, college degree, or postgraduate degree.

To compare health outcomes for cancer and the other chronic illnesses, a logistic regression of the following form was used to model health outcomes: $\log \text{odds of health outcome} = \beta_0 + \beta_1 \text{ cancer survivor} + \beta_2 \text{ heart disease} + \beta_3 \text{ diabetes} + \beta_4 \text{ stroke} + \beta_5 \text{ hypertension} + X\beta_k$, where X is the vector of other covariates and β_k represents their coefficients. It is important to note that conditions are not mutually exclusive; for example, someone with diabetes may also have hypertension. In such cases, both variables would be coded as 1's. Linear regressions were used to measure the relationship between cancer survivorship or other chronic illnesses and health outcomes that were continuous variables, such as the physical and mental components of the SF-12. Regressions followed the form: $\text{health outcome} = \beta_0 + \beta_1 \text{ cancer survivor} + \beta_2 \text{ heart}$

disease + β_3 diabetes + β_4 stroke + β_5 hypertension + $X\beta_k$. In linear regression, the coefficient on the cancer indicator is the predicted average difference in the health outcome between someone with cancer and someone with none of the conditions considered. The average difference in the health outcome between someone with cancer and an otherwise identical person with another chronic condition is the difference between β_1 and the coefficient for the other condition.

The coefficients in logistic regressions have a different interpretation, because the logistic function is non-linear. For that reason, marginal effects of all right-hand side variables are presented here for logistic regressions. The marginal effects are comparable to coefficients in a linear regression, in that marginal effects correspond to the expected difference in the probability of the outcome for two otherwise identical people who do and do not have an indicated condition.

Chapter III: Results

The analysis was conducted in two phases for both men and women. Linear regression was used to analyze continuous measures of health. Coefficients in linear regressions estimate average differences in health outcomes between people who do and do not have a specified condition. Logistic regression was used to predict “Yes, No” health outcomes, with calculation of marginal effects to predict the expected differences in the probability of the outcome for two identical people who do and do not have an indicated condition.

The Short Form 12 Survey includes 12 questions that ask individuals about their physical and mental health. The responses to these 12 questions are used to compute Physical and Mental Health Component scores (PCS & MCS). Scores range from 0 to 100, where a 0 indicates the lowest health measured and 100 indicates the highest level of health. Both the PCS and MCS are standardized to a mean of 50.0 and standard deviation of 10.0.

Patterns for Men

Linear regression analysis of the PCS and MCS (Table 2) showed that male cancer survivors have poorer physical and mental health than men who have no history of any chronic conditions. A coefficient of -2.7075 for the physical health component score for cancer survivors indicates that they had a lower average measure of physical health when compared to identical men who have no history of cancer or chronic conditions ($p < 0.05$). While not statistically significant, male cancer survivors also had lower mental health scores than men without any conditions. Their average mental health score was 0.6895 lower than the score for

otherwise identical men who have no chronic conditions. Overall, the physical health of cancer survivors is affected more than mental health.

Although male cancer survivors have reduced physical and mental health, their health deficits are not as large as for men who have stroke, heart disease, or diabetes. Men who have had strokes had almost twice the deficit in physical health compared to cancer survivors, -5.1907 versus -2.7075 ($p < 0.05$). Men who have had heart disease or diabetes also had statistically significantly worse physical health with respective deficits in PCS scores of -4.1548 and -3.3339 ($p < 0.05$). Cancer survivors score the best in terms of difference in MCS compared to the other chronic conditions. Men who had stroke have 4.5 times the deficit in mental health compared to cancer survivors. Hypertension and diabetes also resulted in greater deficits in MCS than cancer survivorship, with marginal effects of -1.3694 and -1.2889 respectively. Overall, stroke was found to have the greatest effect on both physical and mental health for males.

Other findings include a negative correlation between age and physical health, as men ages 65 or over scored an average of 2.6307 below similar men younger than age 45. Likewise, men ages 45-64 also scored significantly below similar men under age 45 (-2.1783 points). On the other hand, mental health scores significantly increased as age increased. Men over the age of 65 scored 3.7734 points higher on mental health than men under age 45. Education correlated positively with PCS, as men with college degrees scored significantly higher than men without a college degree ($+2.2673$). Similarly, men with postgraduate degrees had an even greater increase in PCS ($+2.5206$) compared to men without a college degree. MCS increased with education as well. Men with postgraduate degrees were scored 1.0512 higher than men without college degrees.

Table 2. Coefficients from Linear Regressions Predicting Health Outcomes in Males

	Physical Health Component	Mental Health Component
Cancer	-2.7075*	-.6895
Heart Disease	-4.1548*	-.9316*
Diabetes	-3.3339*	-1.2889*
Stroke	-5.1907*	-3.1570*
Hypertension	-2.3898*	-1.3694*
Any Other	-3.4971*	-1.9147*
Age 45-64	-2.1783*	.3682
Age 65+	-2.6307*	3.7734*
College Degree	2.2673*	.1659
Post Grad Degree	2.5206*	1.0512*
White	.0185	-1.3472*
Black	-.5713	-.0845
Private Insurance	1.1031*	1.4836*
Public Insurance	-3.9308*	-2.6223*

Omitted group is no chronic conditions, age 18-45, high school degree, other races, & no insurance

* $p < 0.05$

The physical and mental health differences indicated by the SF-12 were further supported by the analysis of health status variables that provide details on other specific aspects of health (Table 3). These variables were dichotomous with 0 = “No” and 1 = “Yes.” Because these variables indicated deficits in health, a positive coefficient from the logistic regressions signifies an increased need for assistance or increased lifestyle limitations. As the coefficient becomes more positive, even worse health outcomes are suggested for the indicated condition. Negative coefficients have the opposite interpretation, indicating lower rates of health deficits and limitations.

Compared to men without chronic conditions, cancer survivors have significantly increased rates of using assistive devices as well as work, house, social, and cognitive limitations. Despite the increased rate of health problems, cancer survivorship did not have the largest effect on health. Men who had a stroke had the greatest elevation in rates of ADL, work, house, school, social, and cognitive limitations.

An interesting finding was that men ages 65 or over were less likely to have limitations in their lives compared to men ages 45-64; however, only work limitation was statistically significant. Generally, the health outcome differences were less for men who had obtained postgraduate degrees than those who had only obtained college degrees. This implies that rates of limitations follow a U-shaped pattern by education, with higher rates for men without a college degree or with post-graduate degrees.

Table 3. Marginal Effects from Logistic Regressions Predicting Health Outcomes in Men

	ADL Screener	Assistive Device	Any Limitation	Work Limitation	House Limitation	School Limitation	Social Limitation	Cognitive Limitation
Cancer	.0022	.0072*	.0211*	.0172*	.0077 *	.0032	.0093*	.0103*
Heart Disease	.0019	.0051*	.0165*	.0107*	.0086 *	.0023	.0046	.0117 *
Diabetes	.0001	.0031	.0109*	.0113*	.0037	.0029	.0028	.0019
Stroke	.0057*	.0013*	.0314 *	.0312*	.0130*	.0098*	.0172*	.0217*
Hypertension	.0026*	.0060*	.0217 *	.0204*	.0125*	.0090*	.0138*	.0124 *
Any Other	.0013	.0136*	.0410 *	.0377 *	.0207*	.0098*	.0220 *	.0147 *
Age 45-64	.0034*	.0096*	.0220*	.0210 *	.0096*	.0043	.0085*	.0067 *
Age 65+	.0044*	.0200*	-.0052	-.0129*	.0054	.0006	-.0026	-.0005
College Degree	-.0014	-.0018	-.0344*	-.0326*	-.0140*	-.0113*	-.0110*	-.0117*
Post Grad Degree	-.0000	-.0054	-.0224*	-.0190*	-.0135*	-.0047	-.0090	-.0037
White	.0024	.0066	.0143*	.0141*	.0027	.0032	.0086	-.0016
Black	.0035	.0097*	.0257 *	.0262*	.0070	.0054	.0092	.0034
Private Insurance	.0027	.0080*	-.0037	-.0065*	-.0021	.0009	.0002	-.0027
Public Insurance	.0097*	.0232*	.0617 *	.0582*	.0218*	.0195*	.0279 *	.0307*

Omitted group is no chronic conditions, age 18-45, high school degree, other races, & no insurance

* $p < 0.05$

Patterns for Women

Women followed similar patterns as men when the SF-12 measures for physical and mental component scores were considered (Table 4). Female cancer survivors had poorer physical health and mental health denoted by the coefficients of -2.6176 and -.9479 respectively. Like men as well, female cancer survivors reported better health when compared to women who had diabetes, hypertension, heart disease, or stroke. Women who had suffered from a stroke again had the poorest health outcomes out of all the chronic conditions. Their PCS was 5.2527 less than the score for women who had no history of stroke, while their MCS was 2.5576 less.

Women over the age of 65 reported poorer physical health, although their mental health was better than that of women ages 45-64. Education was positively correlated with both physical and mental health, as women with postgraduate degrees scored higher than women who only had college degrees. White women scored higher than black women in terms of physical health, but scored lower in mental health. Women with public insurance had lower scores on PCS and MCS than the uninsured, whereas women with private insurance had higher scores.

Table 4. Coefficients from Linear Regressions Predicting Health Outcomes in Women

	Physical Health Component	Mental Health Component
Cancer	-2.6176*	-.9479*
Heart Disease	-5.2041*	-2.8733*
Diabetes	-3.4655*	-1.1714*
Stroke	-5.2527*	-2.5576*
Hypertension	-3.0791*	-1.4822*
Any Other	-4.9945*	-2.4532*
Age 45-64	-1.9295*	.9957*
Age 65+	-2.5568*	5.9502*
College Degree	1.3038*	.5389*
Post Grad Degree	1.8824*	.7456*
White	.9253*	-.6313*
Black	.5342	.4466
Private Insurance	1.2098*	1.7010*
Public Insurance	-3.4920*	-1.7981*

Omitted group is no chronic conditions, age 18-45, high school degree, other races, & no insurance

* $p < 0.05$

The analysis of other health status variables for women can be seen below in Table 5.

Not unlike men, women who have had a stroke were more likely to need assistance with ADL and assistive devices, while facing higher rates of work, housework, school, social and cognitive limitations. Cancer survivorship affected women the second least out of all the chronic conditions. Diabetes had the least effect on all of the health variables examined.

As age increased, rate for need assistance with ADLs or assistive devices was almost double the rate for women ages 45-64. As with the physical and mental health scores, women with private insurance were least likely to need ADL assistance or face work, house, school, social, and cognitive limitations. These differences, however, were not statistically significant. Generally, women with postgraduate degrees had more favorable health outcomes than those with only a college degree.

Table 5. Marginal Effects from Logistic Regressions Predicting Health Outcomes in Women

	ADL Screener	Assistive Device	Any Limitation	Work Limitation	House Limitation	School Limitation	Social Limitation	Cognitive Limitation
Cancer	.0011	.0072*	.0229*	.0196*	.0142*	.0056*	.0132*	.0136*
Heart Disease	.0048*	.0105*	.0260*	.0221*	.0221*	.0071*	.0119*	.0154*
Diabetes	.0006	.0050*	.0160*	.0151*	.0095*	.0053*	.0029	.0041
Stroke	.0080*	.0169*	.0577	.0486*	.0308*	.0178*	.0207*	.0364*
Hypertension	.0023	.0093*	.0200*	.0177*	.0130*	.0050*	.0080*	.0082*
Any Other	.0058*	.0188*	.0703*	.0623*	.0441*	.0223*	.0384*	.0262*
Age 45-64	.0022	.0161*	.0182*	.0146*	.0128*	.0036	.0084*	.0048
Age 65+	.0048*	.0310*	-.0001	-.0139*	.0076*	-.0013	-.0022	-.0038
College Degree	-.0064*	-.0030	-.0137*	-.0151*	-.0036	-.0043	-.0063	-.0075
Post Graduate Degree	-.0023	-.0058	-.0238*	-.0202*	-.0145*	-.0204*	-.0057	-.0228*
White	-.0016	.0043	-.0011	-.0017	.0022	.0005	.0021	-.0018
Black	-.0019	.0046	-.0022	-.0001	-.0001	.0011	.0016	-.0031
Private Insurance	.0010	.0171*	.0060	.0029	.0076	.0085*	.0011	-.0051
Public Insurance	.0090*	.0285*	.0652*	.0585*	.0385*	.0270*	.0288*	.0339*

Omitted group is no chronic conditions, age 18-45, high school degree, other races, & no insurance

* $p < 0.05$

Comparison of Men and Women

There were many similarities in the health deficits associated with chronic illnesses or other demographic factors for men and women. In both cases, stroke affected physical and mental health the most, while cancer survivorship affected them the least. It appears that in terms of physical health, stroke and heart disease have the two strongest effects, while hypertension and cancer survivorship have only a small effect on physical health. No trend could be found in mental health for both men and women.

Physical health decreased with age in both sexes, roughly by 25% as age increased from the youngest age group to the oldest. Mental health scores, however, increased dramatically with age for both men and women. In men, the MCS for ages 45-64 was 0.3682 above the average score for the youngest age group, whereas the MCS for men ages 65 and over, was +3.7734 above the average for men under 45. The MCS of women ages 45-64 increased by 0.9957, with another very big jump (+5.9502) as women moved into the oldest age group.

In both sexes, education positively affected health, as those with more education reported higher physical and mental health scores. Insurance type was also associated with big health differences, as those with private insurance had much better physical and mental health than those with public insurance.

Table 6 presents Z-scores used to determine whether or not the differences between coefficients for PCS and MCS were statistically significant between men and women. Z-scores greater than $|1.96|$ were statistically significant with $p < 0.05$. Applying this cut-off suggests that hypertension has a greater effect on women's physical health than men's, $z = 2.20$. All other chronic conditions seemed to be associated with similar deficits in physical health for women compared to men.

For mental health, the condition producing the biggest deficit for women was heart disease (coefficient of -2.8733). In stark contrast, heart disease had only a small effect on the mental health of men (with a coefficient of -0.9316). The increased effect of heart disease on the mental health of women was statistically significant ($z = 2.92$).

Age also affected the mental health of men and women somewhat differently, as was seen in a Z-score of -4.50 for the coefficient on age 65 and over. Women in the oldest age category reported an improvement in mental health score of $+5.9502$ compared to women under age 45, while the improvement for men was $+3.7734$. In conclusion, women over the age of 65 enjoy a bigger improvement in mental health status compared to younger women than do older men compared to younger men.

Table 6. Z-Scores For Difference Between Coefficients of Men and Women

	Physical Health Component	Mental Health Component
Cancer	-0.19	0.50
Heart Disease	1.74	2.92*
Diabetes	0.31	-0.25
Stroke	0.09	-0.79
Hypertension	2.20*	0.33
Any Other	5.14*	1.68
Age 45-64	-0.84	-1.92
Age 65+	-0.17	-4.50*
College Degree	2.78*	-0.98
Post Grad Degree	1.36	0.59
White	-2.21*	-1.58
Black	-2.32*	-1.01
Private Insurance	-0.33	-0.61
Public Insurance	-1.07	-1.83

Omitted group is no chronic conditions, age 18-45, high school degree, other races, & no insurance

* $p < 0.05$

Chapter IV: Discussion

Due to advancements in technology and an aging of population, there is a growing population of cancer survivors. Because greater than 60% of new cancer cases occur in people aged over 65 years, a greater portion of the survivors are older individuals (Avis & Deimling, 2008). As survival rates for cancers increased, more and more concern is placed on the reintegration of cancer survivors in society as well as surveillance on their long-term health. The primary goal of this study was to quantify health outcomes attributable to cancer in a cohort of cancer survivors. To put in perspective the burden of cancer survivorship, cancer survivors were also studied along with individuals with diabetes, heart disease, stroke, and hypertension.

It was found that cancer survivors reported poor physical and mental health when compared to individuals with no history of chronic conditions. This finding was consistent with those of prior studies. However, when compared to the other chronic conditions, cancer survivors had health deficits that were smaller in magnitude. For both women and men, stroke was the cause of the greatest deficits in physical and mental health.

A partial reason for this finding is the improved results in cancer care and screening. In 1975, the 5-year survival rate for cancer was 48.9%. With advancements in care, that rate increased to 68.5% in 2006 (Howlader et al., 2014). Greater health deficits may occur in stroke survivors merely due to the nature of the condition. With a loss of blood flow to the brain, stroke victims face immediate physical and mental health changes, whereas in cancer, the deterioration in health is slower and can depend on the severity of the disease and treatment.

An unsurprising finding of this study is that health declines with age. However, mental health actually improved with age. A possible reasoning for this is that as people get older, they

gain a greater awareness that death is inevitable. Compared to younger people, they have lived long, accomplished lives. As a result, their state of mind is not affected to the same extent as younger people when they have had cancer or another type of chronic condition.

Health Policy Implications

Because of the deficits in physical and mental health needs, cancer survivors may need for rehabilitation services in order to maintain a high quality of life. Many cancer patients report the need for at least one rehabilitation service with physical therapy reported as the most frequently needed (Thorsen et al., 2011). Additionally, up to a third of cancer survivors indicate either an unmet need for psychosocial support or current use of psychosocial services (Ernstmann et al., 2009).

While it is important to invest in rehabilitative services, there are other impediments that need addressing in order to reduce the deficits in the health of cancer survivors. Other factors contributing to the cancer health deficits include access to care due to lack of insurance or undersurance, lower socioeconomic status, and lower quality of cancer care. The Affordable Care Act (ACA) was implemented in 2010 in an effort to decrease the number of uninsured Americans through the expansion of Medicaid coverage and private, “marketplace plans.” Since it was signed into law, the ACA has been less successful in expanding coverage than hoped. In June 2012, the U.S. Supreme Court ruled unconstitutional the mandate for states to fully comply with the Medicaid expansion to receive any federal funding (Kumar & Moy, 2013). As of 2014, half of the states have forgone Medicaid expansion, leaving millions of low-income individuals without insurance (Lyon, Douglas, & Cooke, 2014). For many cancer survivors living in those

states, the pathway to coverage or reduced financial burden becomes more challenging because of their states' reluctance to embrace ACA's Medicaid expansion.

Despite its limited implementation, the ACA extends Medicaid to individuals up to 133% of the federal poverty level, which will add 16-20 million people to Medicaid. According to the Congressional Budget Office, the ACA will expand health insurance coverage to a total of 32 million individuals by 2019 (Moy et al., 2011). This expansion of coverage is important, as the lack of health insurance leads to lower rates of cancer care and screening. A study comparing states that expanded Medicaid with adjacent states that did not showed a decrease in mortality by approximately 6% (Sommers, Baicker, & Epstein, 2012). Improved access to care will allow cancer survivors, in states that expand Medicaid coverage, to gain better treatment that ultimately gives them an opportunity to have a high quality of life.

While the ACA has the potential to take leaps forward in reducing health disparities in cancer care, it is not without faults. Continued reforms must be made in order to keep moving forward. For one thing, providers may be unwilling to take on additional Medicaid patients due to low reimbursement. Expanding access to care brings about issues in the quality of care, as current supply of oncologists may not meet the needs of its patients. Nevertheless, the ACA provides a new foundation for making progress in the eradication of health deficits in cancer survivors, especially for previously underserved or minority populations.

Strengths and Limitations

Because MEPS, a nationally representative data source, was used for this study, the results describe the population of the United States. Many prior studies were limited in scope

due to small sample sizing or regional samples. Likewise, a key feature in this study was the use of standardized variables that describe physical and mental health. Because there was a set of questions asked prior to the calculation of PCS & MCS, the results describe a holistic outlook of physical and mental health.

Despite these strengths, there are a number of limitations in the study. Because the study relied upon household-reported data, it allowed for potential reporting biases from individuals including cancer survivors. Additionally, the use of population based survey data may understate the health effects of rare cancers or cancers with short survival. Another limitation of this study is that the term “cancer survivor” can be misinterpreted. Cancer survivors are defined as “individuals alive following the diagnosis of invasive disease” (Pollock et al., 2005). Therefore, one may still have cancer and be classified as a cancer survivor until the day they die. As a result, some of the reductions in average health reported of this study may reflect the health deficits of individuals who currently have cancer or have had recurrence.

Suggested for Future Research

This study merely focused on cancer as a type of chronic condition and did not delve into the specific types of cancers and their respective effects on health. Different types of cancers will affect individuals differently based on prevalence, treatments, and survival rates. For example, among females, breast cancer is the most common, accounting for 41% (Siegel et al., 2009). With early screenings and detection, breast cancer may have less of an effect on long-term health than a rare cancer type. Likewise, the intensity of cancer treatment and the resulting long-term effects will depend on the stage of cancer at diagnosis. Another area that can be

examined is years from diagnosis. While age was an area of focus of this study, it did not delve into the duration of time that survivors were cancer free. Health outcomes may generally be poorer directly after a cancer diagnosis than 10 years later.

Conclusion

Cancer survivors are associated with poorer physical functioning and mental health in comparison to individuals with no chronic conditions suggesting the need for rehabilitative services that reduce health deficits. Despite this, the deficit of physical and mental health for cancer survivors is less than that of individuals with the other chronic conditions examined. Generally, there were not many differences in health between similar type males and females. Age correlated with poorer physical functioning in men and women. Public insurance status was also associated with greater attributed to physical and mental health deficits in both men and women.

BIBLIOGRAPHY

- Aaronson, N. K., Mattioli, V., Minton, O., Weis, J., Johansen, C., Dalton, S. O., . . . van de Poll-Franse, L. V. (2014). Beyond treatment – Psychosocial and behavioural issues in cancer survivorship research and practice. *European Journal of Cancer Supplements*, 12(1), 54-64.
- Auchincloss, S. (1995). After treatment. Psychosocial issues in gynecologic cancer survivorship. *Cancer*, 76(10), 2117-2124.
- Bellizzi, K., Mustian, K., Palesh, O., & Diefenbach, M. (2008). Cancer survivorship and aging. *Cancer*, 113(12), 3530-3539.
- Bradley, C., & Bednarek, H. (2002). Employment patterns of long-term cancer survivors. *Psycho-Oncology*, 11, 188-198. Retrieved March 22, 2015.
- Bodenheimer, T., Chen, E., & Bennett, H. (2009). Confronting The Growing Burden Of Chronic Disease: Can The U.S. Health Care Workforce Do The Job? *Health Affairs*, 28(1), 64-74.
- De Moor, J., Mariotto, A., Parry, C., Alfano, C., Padgett, L., Kent, E., . . . Rowland, J. (2013). Cancer Survivors in the United States: Prevalence across the Survivorship Trajectory and Implications for Care. *Cancer Epidemiology Biomarkers & Prevention*, 22(4), 561-570.
- Dowling, E., Chawla, N., Forsythe, L., Moor, J., Mcneel, T., Rozjabek, H., . . . Yabroff, K. (2013). Lost productivity and burden of illness in cancer survivors with and without other chronic conditions. *Cancer*, 119(18), 3393-3401.

- Erikson, C., Salsberg, E., Forte, G., Bruinooge, S., & Goldstein, M. (2007). Future Supply And Demand For Oncologists : Challenges To Assuring Access To Oncology Services. *Journal of Oncology Practice*, 3(2), 79-86.
- Ernstmann, N., Neumann, M., Ommen, O., Galushko, M., Wirtz, M., & Voltz, R. et al. (2009). Determinants and implications of cancer patients' psychosocial needs. *Supportive Care In Cancer*, 17(11), 1417-1423. doi:10.1007/s00520-009-0605-7
- Fleishman, J., Selim, A., & Kazis, L. (2008). Deriving SF-12v2 physical and mental health summary scores: A comparison of different scoring algorithms. *Quality of Life Research*, 19(2), 231-241.
- Ganz, P. (2009). Survivorship: Adult Cancer Survivors. *Primary Care: Clinics in Office Practice*, 36(4), 721-741.
- Guy, G., Ekwueme, D., Yabroff, K., Dowling, E., Li, C., Rodriguez, J., . . . Virgo, K. (2013). Economic Burden of Cancer Survivorship Among Adults in the United States. *Journal of Clinical Oncology*, 31(30), 3749-3757.
- Hewitt, M., Rowland, J., & Yancik, R. (2003). Cancer Survivors in the United States: Age, Health, and Disability. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 58(1), 82-91.
- Howlader N, Noone AM, Krapcho M, Garshell J, Miller D, Altekruse SF, Kosary CL, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds). SEER Cancer Statistics Review, 1975-2011, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2011/, based on November 2013 SEER data submission, posted to the SEER web site, April 2014.

- Lam, W., Soong, I., Yau, T., Wong, K., Tsang, J., Yeo, W., . . . Fielding, R. (2013). The evolution of psychological distress trajectories in women diagnosed with advanced breast cancer: A longitudinal study. *Psycho-Oncology*, 22(12), 2831-2839.
- Lyon, S., Douglas, I., & Cooke, C. (2014). Medicaid Expansion under the Affordable Care Act. Implications for Insurance-related Disparities in Pulmonary, Critical Care, and Sleep. *Annals ATS*, 11(4), 661-667. doi:10.1513/annalsats.201402-072ps
- Mirel, L., & Machlin, S. (2013). Enhancing the Medical Expenditure Panel Survey through Data Linkages.
- Moy, B., Polite, B., Halpern, M., Stranne, S., Winer, E., Wollins, D., & Newman, L. (2011). American Society of Clinical Oncology Policy Statement: Opportunities in the Patient Protection and Affordable Care Act to Reduce Cancer Care Disparities. *Journal Of Clinical Oncology*, 29(28), 3816-3824. doi:10.1200/jco.2011.35.8903
- Parry, C., Kent, E., Mariotto, A., Alfano, C., & Rowland, J. (2011). Cancer Survivors: A Booming Population. *Cancer Epidemiology Biomarkers & Prevention*, 20(10), 1996-2005.
- Pollack, L. A., Greer, G. E., Rowland, J. H., Miller, A., Doneski, D., Coughlin, S. S., . . . Ulman, D. (2005). Cancer Survivorship: A New Challenge in Comprehensive Cancer Control. *Cancer Causes & Control*, 16(1), 51-59. doi:10.1007/s10552-005-0452-x
- Rowland, J., Hewitt, M., & Ganz, P. (2006). Cancer Survivorship: A New Challenge in Delivering Quality Cancer Care. *Journal of Clinical Oncology*, 24(32), 5101-5104.
- Siegel, R., Naishadham, D., & Jemal, A. (2012). Cancer statistics, 2012. *CA: A Cancer Journal for Clinicians*, 62(1), 10-29.

- Short, P., Vasey, J., & Belue, R. (2008). Work disability associated with cancer survivorship and other chronic conditions. *Psycho-Oncology*, 17(1), 91-97.
- Short, P., Vasey, J., & Moran, J. (2008). Long-Term Effects of Cancer Survivorship on the Employment of Older Workers. *Health Services Research*, 43(1), 193-210.
- Sommers, B., Baicker, K., & Epstein, A. (2012). Mortality and Access to Care among Adults after State Medicaid Expansions. *New England Journal Of Medicine*, 367(11), 1025-1034. doi:10.1056/nejmsa1202099
- Spelten, E., Sprangers, M., & Verbeek, J. (2002). Factors reported to influence the return to work of cancer survivors: A literature review. *Psycho-Oncology*, 11(2), 124-131.
- Stanton, A. (2012). What Happens Now? Psychosocial Care for Cancer Survivors After Medical Treatment Completion. *Journal of Clinical Oncology*, 30(11), 1215-1220.
- Thorsen, L., Gjerset, G., Loge, J., Kiserud, C., Skovlund, E., Fløtten, T., & Fosså, S. (2011). Cancer patients' needs for rehabilitation services. *Acta Oncol*, 50(2), 212-222. doi:10.3109/0284186x.2010.531050
- Yabroff, K., Dowling, E., Rodriguez, J., Ekwueme, D., Meissner, H., Soni, A., ... Virgo, K. (2012). The Medical Expenditure Panel Survey (MEPS) Experiences with Cancer Survivorship Supplement. *Journal of Cancer Survivorship*, 26(27), 407-419.
- Yabroff, K., Lawrence, W., Clauser, S., Davis, W., & Brown, M. (2004). Burden of Illness in Cancer Survivors: Findings From a Population-Based National Sample. *JNCI Journal of the National Cancer Institute*, 96(17), 1322-1330.

ACADEMIC VITA

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Education

The Pennsylvania State University, Schreyer Honors College

University Park, PA

Bachelor of Science in Health Policy and Administration, May 2015

Honors and Awards

Dean's List: Fall 2011-Spring 2015

President's Freshman Award, 2011

Rick and Sherry Dandrea Family Trustee Scholarship

The Fasola Family Honors Scholarship

Luisa Y. Charbonneau Trustee Scholarship

Honorable Mention, Information Literacy Award, 2015

Work Experience

Aesculap, Inc., Center Valley, PA

Surgical Technologies Marketing Intern

June 2014-August 2014

- Developed cross reference database validating over 2500 endoscopy products
- Researched market to develop informational email blasts and product infographics
- Presented cumulative project work in presentation to entire marketing department

Lehigh Valley Health Network, Allentown, PA

Risk Management Intern

June 2013-August 2013

- Conducted risk analyses of 3 local physician practices determining causes for possible litigation
- Researched the effectiveness of risk assessments on patient safety using data from 2007 and 2011
- Developed database using Microsoft Excel to document network-wide risk cases
- Drafted script for patient safety video regarding wrong site surgery used throughout entire network

Vatsalya Children's Village, Jaipur, India

Volunteer

July 2012-August 2012

- Lived in a rural orphanage with 46 children contributing labor, domestic care, and daily English teaching at school
- Aided health clinic provide eye care for impoverished residents of Jaipur
- Built expansion to children's school with 5 individuals

Student Support Services Program, State College, PA

CHEM 110 & 111 Tutor

January 2012-May 2012

- Assisted student in learning fundamentals of general chemistry
- Trained student in appropriate lab techniques and demonstrated relevancy of theory involved

Wingate by Wyndham, Allentown, PA

Front Desk Ambassador / Maintenance

June–August 2009-2011

- Provided hospitality while registering guests, assigning rooms, and reported various maintenance issues
- Installed light fixtures in hotel rooms, managed swimming pool & spa, performed plumbing repairs, cleaned carport, and alleviated electrical issues

Presentations

Modi, N. (2015) “Effect of Cancer Survivorship on Health Outcomes.” Penn State Undergraduate Research Exhibition, 2015

Involvement & Leadership

Penn State Relay for Life, State College, PA

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Technical Skills

Microsoft Office Word, Excel, PowerPoint

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