

APPROVAL SHEET

Title of Dissertation: The Patient-Centered Medical Home, Healthcare Utilization and Expenditures for Older Cancer Survivors: A Quantitative Analysis

Name of Candidate: Jing Xu
Doctor of Philosophy, 2016

Dissertation and Abstract Approved: Nancy Miller
Nancy Miller
Professor
School of Public Policy
Affiliate Professor
Doctor Program in Gerontology
University of Maryland, Baltimore County

Date Approved: 11/22/16

ABSTRACT

Title of Document: THE PATIENT-CENTERED MEDICAL HOME, HEALTHCARE UTILIZATION, AND EXPENDITURES FOR OLDER CANCER SURVIVORS: A QUANTITATIVE ANALYSIS

Jing Xu, Ph.D., 2016

Directed by: Nancy Miller, Ph.D.
Professor, School of Public Policy
Affiliate Professor, Doctoral Program in Gerontology
University of Maryland, Baltimore County

Purpose: The Patient-Centered Medical Home (PCMH) model has been proposed to improve healthcare delivery and decrease costs. This study examined the associations between receipt of care consistent with a PCMH and the healthcare utilization and expenditures among older cancer survivors.

Design and Methods: Secondary data analysis was conducted using data from the Medical Expenditure Panel Survey (MEPS). The study sample included adults aged 65 and over who had ever been diagnosed with cancer. The analytical datasets were constructed in two ways: a cross-sectional sample of MEPS 2008 to 2013, and a panel sample of MEPS Panels 13 to 17. The prevalence of the PCMH was examined. Multivariable analyses were performed to examine the effects of the PCMH on healthcare utilization and expenditures. Sensitivity analyses were conducted using sample of all older adults.

Results: The prevalence of the PCMH increased with some fluctuation in recent years. Starting from 21.26% in 2008, the lowest prevalence of the PCMH was 20.23% in 2009, and the highest prevalence of the PCMH was 25.07% among older cancer

survivors in 2013. The PCMH was significantly associated with higher likelihood of having ED visits and outpatient visits. Among the PCMH domains, comprehensive care and compassionate care was significantly associated with more outpatient visits, having a usual source of care was associated with more office based visits, and accessibility was significantly associated with less total expenditures and less Medicare expenditures.

Implications: It is important to identify how the PCMH and its components impact healthcare outcomes. Primary care practices may not need to have all PCMH features to achieve improved healthcare outcomes. Future payment reform could consider incentivizing medical practices that adopt part of the cost-saving PCMH features and facilitate the progression of the implementation of a full PCMH model. Since the PCMH model is expected to adapt to a Medicare payment system that values the quality of care, aligns performance measures and incorporates value-based reimbursement, findings of this study inform the Medicare payment reform regarding the effects of the PCMH and its components on healthcare utilization and expenditures among older cancer survivors and older adults.

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AND EXPENDITURES FOR OLDER CANCER SURVIVORS:
A QUANTITATIVE ANALYSIS

By

Jing Xu

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, Baltimore County, in partial fulfillment
of the requirements for the degree of
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Dedication

This dissertation is dedicated to my family, who encouraged me to strive for excellence. Thanks for your unconditional love, great support and continuous care.

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I would like to express my sincerest gratitude to my dissertation committee for their expertise and devotion. A special thanks to Dr. Nancy Miller, who served as my academic advisor and dissertation chair, for the extraordinary mentorship and tremendous support through coursework, independent study, and the dissertation. To Dr. Bruce Stuart and Dr. Thomas Gindling, thank you for the gracious guidance and invaluable suggestions on research methodology and statistical analysis along the journey of my graduate study. And to Dr. John Cagle and Dr. Christine Mair, thank you for your insightful commentary, constant encouragement, and friendship.

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Chapter I. Introduction

According to the Institute of Medicine (IOM), the current cancer care delivery system in the U.S. faces many challenges, including the growing demand for cancer care, the diverse needs of patients and families, and the rapidly rising costs (IOM, 2013). The majority of cancer diagnoses, cancer deaths and cancer survivorship occur among older adults (DeSantis et al., 2014; Parry, Kent, Mariotto, Alfano, & Rowland, 2011). Older cancer survivors usually have complicated conditions that make the care more difficult, for example, functional and cognitive impairment, comorbidities, increased side effects of treatment, and additional needs for communication, care coordination and social support (Nekhlyudov, Levit, Hurria, & Ganz, 2014).

The Patient-Centered Medical Home (PCMH) model has been proposed as a promising model of primary care to improve healthcare delivery and decrease costs, and has been applied in everyday primary care practice (Kaye & Townley, 2013; Rittenhouse & Shortell, 2009). According to the American Academy of Family Practice (AAFP), the American Academy of Pediatrics (AAP), the American College of Physicians (ACP), the American Osteopathic Association (AOA), and the Patient-Centered Primary Care Collaborative (PCPCC), the core principles of the PCMH include personal physicians, physician directed wide-ranging team-based medical practice, whole person orientation, coordinated and/or integrated care across the healthcare system and community, quality and safety, enhanced access and use of alternative communication methods, and innovative payment methods (AAFP, AAP,

ACP, & AOA, 2007; PCPCC, 2015). The PCMH model was originally developed for children with special healthcare needs and has been extended to chronic disease management, such as asthma, diabetes, depression, chronic obstructive pulmonary disease (COPD) and congestive heart failure (CHF) (Arend, Tsang-Quinn, Levine, & Thomas, 2012; Diedhiou, Probst, Hardin, Martin, & Xirasagar, 2010). In 2010, the ACP recommended that cancer patients would benefit from shared care between a PCMH and specialty practices (ACP, 2010). Several studies showed that a PCMH may improve patient satisfaction, processes of care and clinic outcomes, among cancer survivors (Hudson et al., 2012; Sprandio, 2010; Sprandio, 2012; Wheeler et al., 2013).

However, the current PCMH model has not yet been tailored for the needs and preference of older adults (DePuccio & Hoff, 2014; Hoff, 2012). The evidence on effective management of cancer for older adults is scarce (Berlinger & Gusmano, 2011; Hudson et al., 2012; Nekhlyudov et al., 2014). Few studies have demonstrated the impact of the PCMH on healthcare outcomes in large samples of older adults, and the effectiveness of PCMH in older adults' cancer care remains unexplored (Arend et al., 2012; DePuccio & Hoff, 2014; Hoff, 2012).

The overall goal of the study was to assess the associations between receipt of care from a provider offering services consistent with a PCMH and the healthcare utilization and expenditures among older cancer survivors. To accomplish this goal, three specific aims were addressed:

Aim 1: To estimate the prevalence of having a PCMH for all U.S. older cancer survivors in a nationally representative sample.

Aim 2: To examine the relationship between the receipt of care from a PCMH and healthcare utilization, by comparing the annual numbers of emergency department (ED) visits, inpatient hospitalizations, outpatient visits and office visits of older cancer survivors between those with and without a PCMH.

Aim 3: To analyze the influence of having a PCMH on healthcare expenditures among older cancer survivors, by comparing the healthcare expenditures on ED visits, inpatient hospitalizations, outpatient visits, office visits and the annual expenditures of those who have a PCMH and of those who do not.

This study was a secondary data analysis of cross-sectional data from the 2008-2013 Household Component (HC) and panel data from Panels 13-17 of the Medical Expenditure Panel Survey (MEPS). The study sample included cancer survivors aged 65 and older. Quantitative data analyses were performed, including both descriptive statistics and inferential statistics. The trend of the prevalence of the PCMH among older cancer survivors was summarized. In the cross-sectional study, zero-inflated Poisson regression models and negative binomial regression models were used to study healthcare utilization measurements, and generalized linear regression models were used to study healthcare expenditures measurements. In the panel study, fixed effects models were applied to each of the healthcare utilization and expenditures measurements. To further explore the effectiveness of the PCMH, sensitivity analyses were conducted using a sample of all older adults.

This study was closely related to the field of Gerontology. Taking an interdisciplinary approach, Gerontology is a study of old age, the process of aging and the issues related to the aging population (Martin & Gillen, 2014). This study involved a sample of adults aged 65 and over, explored an important subject of older adults' healthcare – cancer care, and addressed the healthcare utilization and expenditures. This study applied the knowledge of Gerontology to analyze the specific health conditions older adults have, which may influence their healthcare needs. The findings from this study may inform the implementation of PCMHs that are tailored for older cancer survivors, and provide evidence and policy implications for future research.

Chapter II presents a literature review with three major sections, which include an overview of older adults with cancer and shared cancer care, an introduction of the PCMH and its application to cancer care, and a systematic review of the effects of the PCMH on older adults' healthcare outcomes. Chapter III describes the conceptual framework for this study -- the Andersen's Behavioral Model of Health Services Use (Andersen, 1995), discusses the application of the model in this study, and proposes the study hypotheses. Chapter IV introduces the methodology, including data source, sample, measurements, statistical analysis, and the human subject review. Chapter V describes the results for Aim 1, Aim 2 and Aim 3 accordingly. Chapter VI presents the results of sensitivity analysis conducted among the all older adult sample. Chapter VII summarizes findings of the study, discusses the findings in the context of the previous

research, reviews the strengths and limitations of the study, discusses policy implications and makes recommendations for future research.

Chapter II. Literature Review

This chapter includes three major sections. First, “Older Cancer Survivors and Shared Cancer Care” presents a discussion of the relationship between aging and cancer, an overview of shared cancer care between primary care physicians and specialists across the disease continuum, and a summary of the recommendations by the IOM about providing accessible, affordable, comprehensive, patient-centered, evidence-based, high-quality cancer care. The Patient-Centered Medical Home (PCMH) has been proposed as an innovative model to improve cancer care for older adults. Second, “Overview of the Patient-Centered Medical Home” discusses the history, the Joint Principles, the core contributions and the applications in cancer care of the PCMH. Third, “The Patient-Centered Medical Home and Healthcare Outcomes for Older Adults: A Systematic Review” is a systematic literature review that focuses on the current evidence regarding the effects of the PCMH on healthcare outcomes for older adults, including patient experiences, clinical quality, healthcare utilization and costs/expenditures.

Older Cancer Survivors and Shared Cancer Care

A cancer survivor is a person diagnosed with cancer, from the moment of diagnosis and for the rest of their life (National Coalition for Cancer Survivorship, 2015). The term “cancer survivor” and “individual with cancer” sometimes are used interchangeably to include individuals whose early-stage cancer was treated, those whose cancer is likely to recur, and those who are living with cancer or cancer related

symptoms and are undergoing chronic treatment (Bellury et al., 2011; Berlinger & Gusmano, 2011; DeSantis et al., 2014; Holmes et al., 2014; Parry et al., 2011). The number of cancer survivors is steadily increasing in the United States, with improvements in early cancer detection and diagnosis, expanding treatment options and the growing aging population (Bellury et al., 2011; DeSantis et al., 2014).

Cancer is generally diagnosed among those aged 65 or older and the majority of cancer survivors are older adults (DeSantis et al., 2014). Older cancer survivors usually have complicated conditions that make their care more difficult, for example, functional and cognitive impairment, comorbidities, increased side effects of treatment, and additional needs for communication, care coordination and social support (Nekhlyudov et al., 2014). Therefore, cancer and cancer care in an aging population have substantial long-term impacts on older adults and the healthcare system (Holmes et al., 2013; Nekhlyudov et al., 2014).

Aging and Cancer

With the development of modern medicine, the cancer survival rate has been improving at a population level in the past decades (DeSantis et al., 2014; Howlader et al., 2009; Lage & Crombet, 2011). In the United States, the 5-, 10-, and 20-year survival rates for all types of cancer were estimated to be 64%, 41%, and 15%, respectively (DeSantis et al., 2014; Howlader et al., 2009). For the most common cancer types, the overall 5-year survival rate is 90.3% for breast cancer, 64.9% for colorectal cancer, 93% for prostate cancer, 77.9% for bladder cancer, and 53.5% for local-stage lung cancer (DeSantis et al., 2014). More than half of individuals living

with cancer are older adults, whereas less than 5% of cancer survivors are younger than 40 years old (DeSantis et al., 2014).

Age is the most important risk factor for the development of cancer (Byers, 2009; Howlader et al., 2011). On average, more than half of the cancer cases (53.8%) were diagnosed among individuals aged 65 or older (Howlader et al., 2011). For the most common cancer types, 72.4% of bladder cancer, 68.5% of lung cancer, 67.4% of pancreatic cancer and 66.8% of colon cancer occur in older adults (Howlader et al., 2011).

The number of elderly cancer survivors will increase significantly as the population ages over the next few decades (Bellury et al., 2011; Smith, Smith, Hurria, Hortobagyi, & Buchholz, 2009). Approximately 14.5 million individuals were living with cancer by January 1, 2014, and the number is expected to increase to 19 million by 2024 (DeSantis et al., 2014). About 1.6 million new cases of cancer are diagnosed every year, and the annual rate will increase to 2.3 million by 2030 (Smith et al., 2009). About 60% of cancer survivors were older adults in 2008: 13% were aged 65 to 69, 25% were aged 70 to 79, and 22% were aged 80 or older (Parry et al., 2011). It is estimated that the number of elder cancer survivors will reach 11 million by 2020, and the years 2030 to 2050 will witness the greatest increase in the number of elderly cancer survivors in history (Parry et al., 2011).

Physical aging affects the cancer treatment options, treatment outcomes, morbidity and mortality (Bellury et al., 2011). Physical decline related to aging includes multiple aspects, for example, decreased homeostatic reserves, declined

adaptation to stressors, and pharmacokinetic and pharmacodynamic alterations (Walko & McLeod, 2014; White & Cohen, 2008). Older adults are more likely to suffer from depression, fatigue, insomnia, nausea and vomiting, osteoporosis, anemia, and febrile neutropenia, which can add complexity and interfere with cancer treatment (Naeim, Aapro, Subbarao, & Balducci, 2014). Physical health status of older cancer survivors should be carefully assessed to make suitable treatment decisions and provide effective supportive care throughout the trajectory of cancer survivorship (Bellury et al., 2011; Cohen, 2007).

From a psychosocial perspective, older adults experience changes in attitudes, beliefs, relationships, roles and responsibilities throughout their life course, which influence their ability to adjust to adverse health events such as cancer (Bellury et al., 2011; Bellizzi, Mustian, Bowen, Resnick, & Miller, 2008). Psychosocial risk factors (e.g. losses, depression, and anxiety) increase the risks of having poor sleep, hearing loss, urinary incontinence and metabolic syndrome (Mehta et al., 2003; Vogelzangs et al., 2007). Social support and engagement are significantly associated with functioning, health and survivorship in the elderly (Mendes de Leon, Glass, & Berkman, 2003; Hurria et al., 2007). Understanding an older adult's psychosocial characteristics is critical in providing cancer care (Bellizzi et al., 2008).

Comorbidity is highly prevalent among older cancer survivors (Bellury et al., 2011). The majority of older adults with a cancer diagnosis have at least two chronic conditions (Holmes et al., 2014). The most common chronic conditions include hypertension, arthritis, high cholesterol, cardiovascular disease and diabetes (Holmes

et al., 2014). Chronic conditions are strongly associated with poor health status; and as the age increases, older cancer survivors tend to report poorer health status (Holmes et al., 2014). Although different results were found for different cancer types, when the comorbid conditions were controlled for, older cancer survivors showed significant physical and mental declines (Reeve et al., 2009). Increased chronic conditions often lead to decreased treatment tolerance, decreased function, increased cancer-related complications, and increased mortality (Garman, Pieper, Seo, & Cohen, 2003; Reiner & Lacasse, 2006; White & Cohen, 2008).

Demographic characteristics play a potential role in elderly survivorship (Deimling, Arendt, Kypriotakis, & Bowman, 2009; Holmes et al., 2014). For functional status, gender, race/ethnicity, and marital status accounted for 13% variance, while age, comorbidity and non-cancer symptoms accounted for 23% variance among older cancer survivors (Deimling et al., 2009). Individuals who were older, male, unmarried, with lower education level and with lower levels of emotional support, were more likely to have poor health status (Holmes et al., 2014). Racial disparities are evident in cancer diagnosis, treatment, survival and quality of life (Green, Hart-Johnson, & Loeffler, 2011; Schootman, Deshpande, Pruitt, Aft, & Jeffe, 2010).

Since there is considerable heterogeneity among older adults at the same age, chronological age alone cannot be an adequate indicator or proxy regarding an individual's health status and tolerance to cancer treatment (Bellury et al., 2011; Caillet et al., 2014; Terret, Zulian, Naiem, & Albrand, 2007). To address the

gerontological concerns in oncology, a comprehensive geriatric assessment (CGA) is recommended as a basis for planning care for older cancer survivors (Balducci & Yates, 2000). The CGA was designed by geriatricians as a multidisciplinary interpretation of a comprehensive assessment that produces an inventory of health problems (Caillet et al., 2014). The CGA has been integrated into oncologic practice since the mid-1990s, and it has explored different aspects of the older population, including functional status, cognitive status, emotion, nutrition, comorbidity, polypharmacy, social environment, and potential geriatric syndrome (Caillet et al., 2014; Terret et al., 2007; White & Cohen, 2008). Studies showed the CGA was capable of identifying a large number of unrecognized problems that could interfere with elderly cancer treatment, and about 21%-49% of treatment decisions were modified based on the CGA (Caillet et al., 2014).

Shared Cancer Care across the Continuum

The care for older cancer survivors requires input from multiple disciplines to address the complexity and heterogeneity in health status, comorbidity, potential interactions of medications, social support, and treatment goals over time (White & Cohen, 2008). According to the IOM, cancer care can be provided by diverse health professionals, including primary care physicians (PCPs), medical oncologists, radiation oncologists, geriatricians, nurses, pharmacists, physician assistants, psychosocial and spiritual workers and other professionals (IOM, 2013). The continuum of cancer care involves a series of care transitions, such as risk assessment, primary prevention, detection, diagnosis, cancer or precursor treatment, follow-up

care and chronic management, and end-of-life care (Taplin, Clauser, Rodgers, Breslau, & Rayson, 2010).

It is recommended that older cancer survivors should receive shared cancer care, where PCPs and the specialty care physicians participate jointly in making clinical decisions, planning care delivery, exchanging health information and coordinating care transitions (Cohen, 2009; Owusu & Studenski, 2009; Smith, Allwright, & O'Dowd, 2007). The shared care encourages the interdisciplinary team to optimize their own contributions and expertise in a patient-centered approach (Cohen, 2009; Owusu & Studenski, 2009).

To provide high-quality shared cancer care across the continuum, PCPs play a critical role (Cohen, 2009; O'Toole, Step, Engelhardt, Lewis, & Rose, 2009). Before a diagnosis of cancer, the PCP is responsible to work with the patient and family, manage diseases and disorders and encourage the patient to engage in healthy behaviors (e.g. healthy diet, regular exercises, avoiding smoking) (Cohen, 2009). The PCP may assess the patient's health status and cancer risk factors, and conduct cancer prevention and screening (Cohen, 2009; O'Toole et al., 2009). If some conditions, which may be a suspicion of cancer, are reported by the patient or observed by the PCP during a screening process, the PCP will adopt early diagnostic approaches, such as routine laboratory and imaging evaluation (Cohen, 2009). The PCP may start the shared care process by consulting the expertise from the oncologist to make initial diagnostic decisions and provide guidance on the next steps (Cohen, 2009; Nekhlyudov et al., 2014). The PCP is likely to direct the referrals according to the

patient's preference, insurance, geography, and the PCP's previous experience with the specialists (Nekhlyudov et al., 2014).

Along the evaluation and diagnosis process, it will be beneficial to establish an efficient communication pattern among the PCP, the oncologist, and the patient and family members, in order to optimize different expertise and a patient's preference in decision making and care transition (Cohen, 2009; Nekhlyudov et al., 2014). Cancer clinicians from different disciplines may be brought together to discuss the treatment plans, with unique sights provided by the PCP, who has a longstanding relationship with the patient (Cohen, 2009; Nekhlyudov et al., 2014). When a treatment plan is agreed upon, the oncologist assumes a major role in carrying through the plan, while ideally the communication continues, and the patient and family seek advice from both the PCP and the oncologist (Cohen, 2009; Nekhlyudov et al., 2014). This is especially important for older adults, in terms of managing age-related disabilities, psychological issues, and comorbidities (Cohen, 2009; Nekhlyudov et al., 2014).

Upon cancer diagnosis, most individuals receive chemotherapy and radiation therapy, undergo surgery, and take targeted drugs (DeSantis et al., 2014). Cancer survivors are likely to live with side effects of treatment, either acute or chronic (DeSantis et al., 2014). For these individuals, cancer may become a chronic condition with related symptoms, and may recur in the future (Berlinger & Gusmano, 2011; DeSantis et al., 2014). The type and prevalence of the side-effects and the symptoms vary with cancer types, treatment, and patient characteristics (e.g. age, gender, comorbidity), which leads to the unique physical and psychological needs of

individuals with cancer (Berlinger & Gusmano, 2011; DeSantis et al., 2014; Schlairet, 2011).

If a positive outcome is achieved from the initial treatment, the elderly cancer survivor and family often return to their PCP for medical care (Cohen, 2009; DeSantis et al., 2014). The oncologist provides specific information to the PCP and the patient, regarding drug toxicity, the therapeutic modalities, long-term effects of cancer and what to be expected along the way (Cohen, 2009). The PCP conducts ongoing surveillance and chronic cancer management, which includes slowing down disease progression, delay or prevention of complications, management of comorbidities, promoting healthy lifestyles, and maintaining quality of life (Cohen, 2009; DeSantis et al., 2014; Lage & Crombet, 2011; Nekhlyudov et al., 2014). In the case of older adults, interactions between cancer-related symptoms and other comorbidities may complicate the cancer management, which will require input and communication from multidisciplinary medical professionals (Cohen, 2009).

If the initial treatment fails or cancer recurs after a period of time, the elderly cancer survivor may become more vulnerable and at higher risk (Cohen, 2009). A decision will need to be made about treatment choices and the appropriateness (Cohen, 2009). Engagement of the patient and family, the PCP, the oncologist, the geriatricians, the palliative care and end-of-life care experts, and other providers, will help to elucidate the patient needs, values and preferences (Cohen, 2009; Nekhlyudov et al., 2014).

The shared cancer care and the involvement of the PCP across the disease continuum have been valued by both elderly patients and oncologists (O'Toole et al., 2009; Owusu & Studenski, 2009). Better patient experience and higher perceived satisfaction were associated with greater PCP involvement (O'Toole et al., 2009). Oncologists reported that a range of frequent communication with the PCPs facilitated the treatment decision-making and the realization of treatment goals (O'Toole et al., 2009; Owusu & Studenski, 2009).

Challenges to the Healthcare System

The current cancer care system in the U.S. encounters many challenges, including the growing demand for cancer care, the diverse needs of patients and families, and the rapidly rising costs (IOM, 2013). The crisis in cancer care is accelerated by the aging population (Nekhlyudov et al., 2014). Despite the predominance of cancer survivorship, older adults are overlooked, understudied and underserved (Bellury et al., 2011; Nekhlyudov et al., 2014; Parry et al., 2011). Older adults are underrepresented in most of cancer clinical trials that set the standard for cancer care (Scher & Hurria, 2012). Only a low proportion of healthcare providers have specialized training in geriatrics to meet the needs of older cancer survivors and their families (IOM, 2013; Nekhlyudov et al., 2014). The majority of older cancer survivors will need treatment, follow-up care, and chronic conditions management, and the complexity and heterogeneity of elderly health status should be taken into consideration in healthcare practice (Bellury et al., 2011; Parry et al., 2011).

In face of the transformation of cancer from a rapidly fatal disease to a chronic condition, research on chronic cancer care is scarce (Berlinger & Gusmano, 2011; Lage & Crombet, 2011). Healthcare providers lack a shared concept of chronicity and have limited experience with long-term cancer care (Berlinger & Gusmano, 2011). There are several barriers existing in the shared cancer care process, for instance, poor communication and coordination across the primary-oncology care interface, the lack of clearly defined responsibilities, a paucity of formal training in oncology for the PCPs, and a lack of understanding among the oncologists about the role of primary care (Berlinger & Gusmano, 2011; Owusu & Studenski, 2009).

It is estimated that the costs of cancer care comprise approximately 10% of Medicare payments (Potetz & DeWilde, 2009). The United States spent \$124 billion in 2010 for cancer care, and the spending will reach at least \$158 billion by 2020 (Mariotto, Yabroff, Shao, Feuer, & Brown, 2011). The increase in costs reflects the health burden associated with the prevalence of cancer and chronic illness among the older population (Parry et al., 2011). Older cancer survivors and their families constantly suffer from high financial burdens, and the average out-of-pocket spending for each elderly cancer patient was \$4,727 every year (Brooks et al., 2013; Davidoff et al., 2012). However, higher spending on cancer care does not necessarily indicate a better quality of life. Older adults and their families still have to cope with new and expensive self-administrated drugs, long-term functional problems, and constant psychosocial distress (Berlinger & Gusmano, 2011; Deimling et al., 2006; Deimling et al., 2009; DeSantis et al., 2014; Holmes et al., 2014).

It is crucial to enhance multidisciplinary communication, improve care coordination and increase timely access to different treatment options, to provide patient-centered cancer care for the older population in a cost-effective way (Bellizzi et al., 2008; Bellury et al., 2011; Brooks et al., 2013; IOM, 2013; Terret et al., 2007). Future research should address cancer and aging issues on multiple levels, including the inter-individual and intra-individual level, the organizational and provider level, and the policy and population level (Cohen, 2007; Sheinfeld Gorin, Gauthier, Hay, Miles, & Wardle, 2008; Terret et al., 2007).

Recommendations by the Institute of Medicine

The IOM has been studying the quality of cancer care for more than a decade to address the challenges and barriers to achieve excellent cancer care (IOM, 2013). In 2013, the IOM report, *Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis*, outlined a conceptual framework and recommendations to improve cancer care (Nekhlyudov et al, 2014). In the report, the goal of cancer care is defined as “comprehensive, patient-centered, evidence-based, high-quality cancer care that is accessible and affordable to the entire US population” (IOM, 2013, p. 3). It comprises six interconnected components:

Engaged Patient Individuals with cancer should be supported in making informed medical decisions, which are consistent with their needs, values and preferences (IOM, 2013; Nekhlyudov et al, 2014). Cancer care team members should receive formal, comprehensive training in order to provide patients and their family with understandable information regarding cancer prognosis, treatment risks and

benefits, psychosocial support, palliative care and end-of-life care, and costs of care (IOM, 2013).

Coordinated Workforce High-quality cancer care should be provided by a competent, trusted, diverse team of medical professionals, in coordination with non-cancer care (IOM, 2013; Nekhlyudov et al, 2014). The primary care, geriatrics, and specialty care teams should work together to implement the patients' care plans (IOM, 2013).

Evidence-based Care High-quality cancer care should refer to the evidence gathered from clinical trials, which provides comparative information on the effectiveness of various treatment options (IOM, 2013; Nekhlyudov et al, 2014). More research and evidence are needed on older adults with comorbidities, patient characteristics, health behaviors, and healthcare outcomes (IOM, 2013).

Improved Information Technology A learning healthcare information technology system for cancer would collect and analyze data from clinical practice, evaluate patient outcomes, facilitate research and improve performance (IOM, 2013; Nekhlyudov et al, 2014). The existing healthcare information technology system, such as electronic health records and cancer registries, should be integrated and updated to be a true learning system (IOM, 2013).

Measuring the Quality of Care The IOM recommends a formal long-term strategy for publicly reporting quality measurement and assessment for cancer care, in order to facilitate performance improvement (IOM, 2013).

Accessible and Affordable Care High-quality cancer care should be accessible to all patients, including those who are vulnerable, underserved or underrepresented (IOM, 2013). Innovative programs are needed to identify and disseminate effective community interventions (IOM, 2013). In addition, new payment models should be developed, to increase affordability, and reward and reimburse the cancer care team (IOM, 2013; Nekhlyudov et al, 2014).

The IOM recommendations address a broad spectrum of issues across the cancer care continuum (Nekhlyudov et al, 2014). Translating these recommendations into practice will engage multiple organizations and stakeholders, for example, researchers, professional organizations, federal and private payers, hospitals, and patient advocacy groups (Nekhlyudov et al, 2014). Medical professionals will play an active role in the implementation of the recommendations (Nekhlyudov et al, 2014).

The American College of Physicians (ACP) outlined a cancer-comanagement approach for patients to receive shared care from a PCMH and specialty practices (ACP, 2010). The PCMH is a physician-directed, multidisciplinary primary care model, which has been promoted to provide accessible, continuous, comprehensive and coordinated care that is delivered in the context of patients, family and community (Arend et al., 2012; Berenson et al., 2008). For older cancer survivors, the oncology practice may provide ongoing cancer management regarding treatment, risk assessment and surveillance needs, while the PCMH manages the patient's daily medical needs and coordinates the follow-up care (ACP, 2010). With the current cancer care crisis and the growing cancer survivor populations, the shared care

between primary care and oncology will become critical to improve healthcare outcomes and reduce costs (Nekhlyudov et al, 2014).

Overview of the Patient-Centered Medical Home

The U.S. healthcare system is challenged by unsustainable costs (Arend, Tsang-Quinn, Levine & Thomas, 2012). Total health expenditures are projected to grow at an average rate of 5.8 percent each year and increase from \$3.1 trillion in 2014 to \$5.4 trillion in 2024 (Keehan et al., 2015). Despite such spending, healthcare quality and outcomes are often suboptimal (Arend et al., 2012; Jackson et al., 2013). Innovative models are needed to address the changes brought by a rapidly aging population base and the increasing prevalence of chronic illness (Arend et al., 2012; Jackson et al., 2013).

The PCMH is a model of primary care transformation that has been promoted to improve the quality of care, decrease costs, and enhance the experience of patients and providers (Arend et al., 2012; Berenson et al., 2008; Jackson et al., 2013; Rittenhouse, Shortell & Fisher, 2009). The model combines the traditional strength of primary care with newer practice innovations (Arend et al., 2012; Rittenhouse et al., 2009). As a physician-directed healthcare practice, the PCMH is an approach to provide accessible, continuous, comprehensive and coordinated care that is delivered in the context of patients, family and community (Arend et al., 2012; Berenson et al., 2008). Recently, the PCMH has been proposed by the ACP for shared care with oncology, to address the cancer care crisis (ACP, 2010). This section will provide an

overview of the PCMH, including the history of development, the core principles, the contributions of the PCMH to healthcare, and the application of the PCMH in cancer care.

A Brief History of the Patient-Centered Medical Home

The term “medical home” was introduced by the AAP in 1967, to emphasize the role of the primary care pediatric practice as a central source of medical records for children with special health care needs (AAP, 1967; AAP, 1977; Sia, Tonniges, Osterhus, & Taba, 2004). Gradually, the concept was expanded to include primary care that is accessible, coordinated, comprehensive, continuous, family-centered and culturally effective (Medical Home Initiatives for Children with Special Needs Project Advisory Committee, 2002).

In 1978, at the World Health Organization’s (WHO) International Conference on Primary Health Care at Alma Ata, some of the basic tenets of PCMH were outlined (International Conference on Primary Health Care, 1978). The WHO described primary care as the healthcare system using language now incorporated in the PCMH concept, including continuity of care, comprehensiveness and integration, patient education and participation, team-based care, access to care, and support from public policy (Arend et al., 2012; International Conference on Primary Health Care, 1978; Robert Graham Center, 2007).

In the 1990s, the IOM embraced these percepts about primary care, and made specific reference to a “medical home” (Donaldson, Yordy, Lohr, & Vanselow, 1996).

With the influence of the IOM reports, the term “medical home” began to appear in the literature of family medicine and other specialties (Robert Graham Center, 2007).

Another important contributor to the development of the PCMH was the establishment of the Chronic Care Model (CCM) (Arend et al., 2012; Robert Graham Center, 2007). In 1996, Dr. Ed Wagner and colleagues at the MacColl Institute in Seattle promoted the CCM to improve the quality and cost-effectiveness of chronic health care (Wagner, Austin, & Von Korff, 1996). The important elements of the CCM included team-based care, evidence-based care, patient self-management support, and the use of information technology (Wagner et al., 1996).

Based on both the precepts introduced by IOM and the CCM, in 2004, the AAFP called for a “personal medical home for each patient” and advocated that the elements of CCM could be applied more broadly to models of primary care (Martin et al., 2004). In 2006, the ACP supported the AAFP position by publishing a description of the “advanced medical home”, and emphasized the need for reimbursement reform to sustain the medical home function (Barr & Ginsberg, 2006). In 2007, the Joint Principles of PCMH were agreed upon by the AAFP, AAP, ACP and the American Osteopathic Association (AOA) (AAFP, AAP, ACP & AOA, 2007). The Joint Principles of PCMH include: personal physician, physician-directed medical practice, whole person orientation, coordinated and/or integrated care, quality and safety, enhanced access, and payment structures that reflect the value of PCMH (AAFP et al., 2007). The PCMH was soon endorsed by other medical specialty groups (Arend et al., 2012; Berenson et al., 2008).

The PCPCC was founded in 2006, joined by physician groups, national health plans, healthcare quality improvement organizations, national employers, consumer groups, labor unions and others (PCPCC, 2015). The PCPPC was a key advocate for the development of PCMH (Arend et al., 2012). PCMH recognition criteria were drafted by the PCPPC as industry standards to facilitate PCMH provider reimbursement (Arend et al., 2012). The National Committee for Quality Assurance (NCQA) first adopted the PCMH recognition criteria in 2008 and made updates in 2011 (NCQA, 2015). The PCMH recognition criteria of the NCQA can evolve over time based on the ongoing practice feedback and the results of demonstration programs (Berenson et al., 2008). Nowadays, more than 10 percent of U.S. primary care practices are recognized as PCMHs by the NCQA, which are approximately 7,000 PCMHs altogether (NCQA, 2014).

The Joint Principles of the Patient-Centered Medical Home

Though different definitions of the PCMH may exist, most of them are consistent with the Joint Principles (AAFP et al., 2007; Arend et al., 2012; NCQA, 2015).

Personal Physician Each patient establishes a relationship with a personal primary care physician (PCP), who can provide continuous and comprehensive care (AAFP et al., 2007). In the context of medical homes, the patient needs and values are essential (Robert Graham Center, 2007). For a majority of patients, interpersonal continuity is important since their PCPs would have knowledge about them and the ability to communicate their concerns (Pandhi & Saultz, 2006). Having a usual source of care, patients are more likely to receive care in nearly every setting, experience

higher overall satisfaction, and have better health outcomes and lower total costs (Hendryx, Ahern, Lovrich & McCurdy, 2002; Saultz & Albedaiwi, 2004; Starfield & Shi, 2005).

Physician Directed Medical Practice The personal PCP leads a team of medical professionals who collectively take responsibility for the care of patients (AAFP et al., 2007). Each patient may have complex healthcare needs that should be addressed by a multidisciplinary team. Directed by the PCP, the primary care team can provide general clinical care, while specialties, pharmacists, mental health professionals and others can offer expertise on more focused health issues (Robert Graham Center, 2007). The PCMH encourages interactions among medical team members and the patient, in order to provide individualized and integrated care (Robert Graham Center, 2007).

Whole Person Orientation The personal PCP takes responsibility to attend all the patient's health care needs and arrange care with other qualified professionals across all stages of life, including preventive care, acute care, chronic care and end of life care (AAFP et al., 2007). Different from other areas of medicine, primary care attends to a patient in the context of a personal and medical history and life circumstances, rather than focus on a specific disease or a particular part of the body (Safran, 2003). The PCMH "whole person orientation" emphasizes that the PCP and the medical team should deal with both the mental and physical health of the patient and should consider clinical priorities according to personal values (Robert Graham Center, 2007). Ideally, the care from a PCMH should account for social determinants of

health, and be integrated and organized across a variety of settings, such as the person's home and the community (Robert Graham Center, 2007).

Care Is Coordinated and/or Integrated Across all elements of the healthcare system, care is facilitated by registries, information technology, health information exchange and other means; and the PCMH will provide patients with culturally and linguistically appropriate care at the time and place they prefer (AAFP et al., 2007). In the PCMH model, team-based care and advances in health information technology have enhanced effective referral management and care transition (Arend et al., 2012). The coordination and integration function of PCMH not only assists patients to understand the advice, tests, diagnoses and procedures, but also facilitates continuity and comprehensiveness of care (Robert Graham Center, 2007). For the shared patient populations, the collaborative relationships between PCPs and specialty physicians are more flexible, which improves the quality and efficiency of care (ACP, 2010; Robert Graham Center, 2007).

Quality and Safety As hallmarks of the PCMH, quality and safety are achieved by incorporating a care-planning process between PCPs, patients and family members, a decision-making process guided by evidence-based medicine and clinical decision-supported tools, a continuous quality improvement process, the active participation of patients and family members in decision-making and feedback, the use of information technology, and a voluntary PCMH recognition process (AAFP et al., 2007). One important quality indicator of the PCMH is patient-centeredness, which refers to the partnership among PCPs, patients and family members to ensure

that patients' needs and preferences are respected, and that education and support are provided for patients to make their own decisions and participate in their own care (IOM, 2001). An electronic healthcare record system will need to be promoted, since it will allow information from multiple resources to be put together for collection, analysis and reporting of the clinical decisions and outcomes (Robert Graham Center, 2007). Moreover, systematically collected patient feedback, performance measurements at the provider, team and institutional levels, as well as internally and publicly reported outcomes, are used to promote improvement of quality and safety of care (Arend et al., 2012).

Enhanced Access The PCMH enhances access to care for patients by open scheduling, expanding service hours, and encouraging new communication options between patients, their personal PCPs and practice staff (AAFP et al., 2007). Open scheduling will allow patients to visit their personal PCPs at a short notice. Expanding service hours refers to PCPs being available during evening and weekend hours, and patients having 24-hour access to an on-call provider who is able to retrieve the patients' EHR. New communication options between the patient and medical care team include various types, such as phone consultations, secure electronic messaging, and web-based patient portals for EHRs, appointment scheduling, medication renewals, self-education and disease management, and related community-based resources (Arend et al., 2012).

Payment The payment structure should appropriately reflect the added value provided to patients with a PCMH (AAFP et al., 2007). One of the major challenges

faced by the adoption of the PCMH is that many of the PCMH functions are not supported by traditional payment structures (Arend et al., 2012; Landon, 2014). New financing systems need to recognize the care management and coordination performed outside of face-to-face visits, support new communication options and use of healthcare information, allow for case-mix differences among patient populations, and provide additional payments for achieving quality improvement (AAFP et al., 2007). Current payment reforms fall into five broad categories, including modified fee-for-service systems, blended payment models, shared savings, comprehensive payments and grant-based payments (Arend et al., 2012; McCarthy, Mueller & Wrenn, 2009; PCPCC, 2009; Centers for Medicare and Medicaid Services, 2011). An appropriate payment system need to secure the benefits of the PCMH, improve healthcare outcomes and reduce costs (Robert Graham Center, 2007).

Core Contributions of the Patient-Centered Medical Home

Patient-centered care is one of the six domains of clinical care quality, along with efficiency, effectiveness, equity, safety and timeliness (IOM, 2001). The PCMH is proposed to address the deficiencies of patient-centeredness in the U.S. healthcare system (Berenson et al., 2008). In 2007, a Commonwealth Fund survey adopted four criteria to measure whether an adult has a medical home, including having a usual source of care, experiencing no difficulty contacting the provider by phone, experiencing no difficulty getting medical advice or care during evenings and weekends, and having well organized and timely office visits (Beal, Doty, Hernandez, Shea, & Davis, 2007). The survey found that approximately 70% of working-age

adults did not have a well-functioning medical home when the four were criteria combined, which may lead to serious quality concerns (Beal et al., 2007; Berenson et al., 2008). The PCMH will promote accessible, coordinated and patient-centered care, in order to achieve more positive patient experiences (Berenson et al., 2008).

One of the goals of healthcare reform is to eliminate the healthcare disparities among vulnerable populations, including low-income children, the elderly, racial and ethnic minority groups, the homeless and those with multiple chronic conditions (Lilli-Blanton, 2008). Health care settings with features of a PCMH have the potential to reduce disparities in terms of access to quality care among vulnerable populations, by providing geographically and financially accessible care (Beal et al., 2007). By focusing on the whole person orientation and the integration of care, the PCMH will have the capacity to forge community linkages to promote public health, for example, working with community agencies for available social and clinical resources, sharing data with local health departments for disease epidemics and prevention, and promoting preventive care by addressing behavioral risk factors (Ferrer, Hambidge & Maly, 2005; Robert Graham Center, 2007).

Chronic care, mental health and substance abuse care are among the most challenging aspects of the current healthcare environment (Berenson et al., 2008; Robert Graham Center, 2007). Disease management used to operate in parallel with primary care or based on referrals, rather than being integrated within a practice (Wolff & Boulton, 2005; Robert Graham Center, 2007). The implementation of the PCMH will promote care coordination, support self-management and decision-

making, and call for available community resources for patients with chronic illness, mental health problems and substance abuse issues (Wagner et al., 2001). The PCMH has been applied to patients of different ages and with various health conditions, such as behavioral problems, diabetes, hip fracture, end-stage renal disease (ESRD) and cancer (Bao, Casalino, & Pincus, 2013; Calman et al., 2013; Goyal et al., 2014; Graham, Bowen, Strohecker, Irgit, & Smith, 2014; Porter, 2015; Sepers et al., 2015). The PCMH has positive effects on patient experience and clinical outcomes, and reduced costs and healthcare utilization (Jackson et al., 2013).

Primary care has a relatively low reimbursement from public and private insurance payers, and there is a lack of interest among medical school graduates to undertake primary care careers (Bodenheimer, 2006; Bodenheimer, Grumbach, & Berenson, 2009; Pugno, McGaha, Schmittling, Fetter, & Kahn, 2006). The PCMH provides an option to recognize and support primary care by qualifying the activities for reimbursement under Medicare or private payment policies, including non-visit-associated patient communication, care coordination, and supporting patient self-management (Goroll, Berenson, Schoenbaum, & Gardner, 2007). In the long term, the PCMH could serve as a stepping stone to broader payment reform and strengthen the lifeline for primary care (Bodenheimer et al., 2009; Pham, Peikes, & Ginsburg, 2008).

A major barrier in healthcare system reform exists in Medicare payment reform: the predominant fee-for-service payment system is expensive, fragmental, technically complex, and it does not align payments with performance (Nielson et al., 2016). In 2014, Medicare spending grew 5.5% to \$618.7 billion, and accounted for 20% of the

national health expenditures (Centers for Medicare and Medicaid Services, 2014). It is projected that Medicare spending growth will accelerate after 2015 due to expected increases in use of medical goods and services by the elderly population (Centers for Medicare and Medicaid Services, 2014). In April 2015, the flawed Medicare sustainable growth rate (SGR) payment formula was repealed through the enactment of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) (Clemens & Veuger, 2015; MACRA, 2015). The MACRA will introduce new incentive payment methods which reward physician groups for providing high-value care (Clemens & Veuger, 2015). As of September 2015, the Department of Health and Human Services announced specific and aggressive timeline to shift Medicare fee-for-service toward value-based payment models (Clemens & Veuger, 2015; Nielson et al., 2016).

Research shows the PCMH model of care is associated with consistent cost and utilization improvements, and can well adapt to a Medicare payment system that values the quality of care, aligns performance measures and incorporates value-based reimbursement (Nielson et al., 2016).

The Patient-Centered Medical Home and Cancer Care

Individuals with cancer usually require a comprehensive, patient-centered, long-term cancer management for their complicated health conditions, which includes systematic care planning, surveillance of recurrence, management of comorbidity, and maintenance of quality of life (Cohen, 2009; DeSantis et al., 2014; Hudson et al., 2012; Nekhlyudov et al., 2014). Shared cancer care between the PCPs and the specialty physicians is encouraged, which will benefit the patients and family in

decision making, and care planning, coordination and transitions (Cohen, 2009; Owusu & Studenski, 2009; Smith et al., 2007). Since cancer care used to be fragmented and expensive, there has been particular interest in developing the PCMH for individuals with cancer (ACP, 2010; Sprandio, 2010; Waters et al., 2015).

A delineation of responsibilities between the PCMH and specialty practices has been proposed (ACP, 2010). First of all, for patients with cancer-specific needs, a PCMH and a specialty practice should provide shared management. For example, a patient with cancer may receive ongoing management from an oncology practice while a PCMH manages his/her day-to-day medical needs (ACP, 2010). Secondly, the PCMH may provide principle care to address the patient's cancer-related needs. For example, when a patient has completed active cancer treatment and is under the surveillance phase of care, the PCMH should coordinate all follow-up care while the oncologist provides a written summary of the treatment, risk assessment, and surveillance requirements (ACP, 2010). Thirdly, for a limited period of time, a patient's specialty care clinician can become the principle care clinician. For example, when a patient is receiving active cancer treatment, the oncology practice may provide all care related to treatment and be the first contact for all issues; the oncologist may direct the PCMH to care for the ongoing medical conditions, such as comorbidity; and when the active treatment is completed, the PCMH resumes as the first contact and coordinates any additional follow-up with the oncology (ACP, 2010).

The enrollment in a PCMH is associated with better cancer management (Hudson et al., 2012; Wheeler et al., 2013). Comprehensive and effective cancer management

relies on both the physicians and the patients (Hudson et al., 2012). Patients' coping styles may range from non-activated patients who are in need of enhanced healthcare communication and decision support to highly activated patients who are able to navigate among different healthcare settings based on their needs (Hudson et al., 2012). For patients with cancer, the ability to seek proper healthcare and the activation to conduct self-management of chronic conditions are important (Hudson et al., 2012). Using a patient-centered approach, the PCMH will engage and activate patients by helping them better understand their health conditions, providing guidelines for self-management, addressing their follow-up care needs among multidisciplinary healthcare team members, and coordinating with other specialty care providers (Hudson et al., 2012). The PCMH enrollment is significantly associated with better adherence to cancer surveillance and follow-up care among cancer survivors (Wheeler et al., 2013).

In recent years, the oncology-based PCMH has been proposed as a physician-driven, patient-focused model, which can make a difference for patients, physicians, healthcare utilization and costs (Kuntz, Tozer, Snegokey, Fox, & Neumann, 2010; Sprandio, 2010; Sprandio, 2012; Sprandio, Flounders, Lowry, & Tofani, 2013; Waters et al., 2015). For instance, in 2010, Consultants in Medical Oncology and Hematology (CMOH), as a 9-physician, single-specialty practice in Philadelphia, was recognized by the NCQA as the first oncology practice-based level III PCMH (Sprandio, 2010). The CMOH has achieved significantly reduction in unnecessary resource use: on average, the CMOH has lowered ED visits by 68%, hospital admissions by 51%,

length of stay by 21%, and outpatient visits by 12% every year for each patient with chemotherapy (Sprandio, 2012). Launched in May 2012, the Michigan Oncology Medical Home Demonstration Project has shown that patients' participation in the project is associated with high adherence to follow-up care, advance care planning, and effective symptom management, in addition to cost savings realized by reduced ED visits and hospitalizations (Kuntz et al., 2010). The Community Oncology Medical Home program, which implemented specialty medical homes in seven oncology practices across the country, has demonstrated that patients enrolled in the program may engage in effective patient-physician communication, have less emergency visits and hospitalizations (Waters et al., 2015). The magnitude of reduction in healthcare utilization and costs reflects the healthcare improvement for the individuals with cancer, who are vulnerable and older with multiple chronic conditions and unique psychosocial needs (Sprandio, 2012).

However, the shared cancer care between the PCMH and specialty practice has not been broadly adopted yet, since most of the demonstration programs are regional and preliminary (Kuntz et al., 2010; Sprandio, 2012; Waters et al., 2015). In addition, payment reform is essential, since under the current fee-for service system, the oncology-based PCMH model is not sustainable (Sprandio, 2012; Waters et al., 2015). More research for individuals with cancer is needed, especially for older adults, to illustrate how the PCMH can address their needs and preference, and improve healthcare outcomes (Cohen, 2007; DePuccio & Hoff, 2014; Sheinfeld Gorin et al., 2008; Sprandio, 2012; Terret et al., 2007; Waters et al., 2015).

The Patient-Centered Medical Home and Healthcare Outcomes for Older Adults: A Systematic Review

Introduction

There has been a growing movement to improve healthcare delivery in the United States by transforming primary care into the PCMH (Hoff, 2012; Kay & Townley, 2013; PCPCC, 2015). The Joint Principles of the PCMH are widely adopted as the golden standard for designing, implementing, and measuring PCMH practices, which include a personal physician, physician directed wide-ranging team-based medical practice, whole person orientation, coordinated and/or integrated care across healthcare system and community, quality and safety, enhanced access and use of alternative communication methods, and innovative payment methods (AAFP et al., 2007; PCPCC, 2015).

Older adults may suffer from physical and psychosocial conditions that require chronic management to maintain their quality of life (Dorr et al., 2006; Himelhoch, Weller, Wu, Anderson, & Cooper, 2004). Primary care plays an important role in providing counseling, prevention services, cancer screenings, medication management and specialty referrals (Ferrer et al., 2005; Metlay et al., 2005; Ornstein, Nemeth, Jenkins, & Nietert, 2010; Schonberg, York, Davis, & Marcantonio, 2008). In the context of rapidly increasing healthcare costs driven by an aging population, the PCMH is considered as a promising model to improve the quality of care and reduce costs (Arend et al., 2012; Berenson et al., 2008; Fishman et al., 2012; Jackson et al., 2013; Keehan et al., 2015; Rittenhouse et al., 2009). The Medicare Payment Advisory

Commission (MedPAC) has called for broad demonstration programs to study the capability of the PCMH to achieve better healthcare outcomes for older adults (Fishman et al., 2012). Although several PCMH programs are established in recent years with older adults as the target population, most of the daily PCMH practices have not yet been tailored specifically for the needs of older adults (DePuccio & Hoff, 2014; Fishman et al., 2012; Hoff, 2010; Phillips et al., 2011; Stranges et al., 2015). The extent to which the PCMH can improve the healthcare outcomes for older adults remains unclear.

The purpose of this systematic review is to evaluate the current evidence of the effects of the PCMH on the healthcare outcomes for older adults. Since the elderly population consumes the majority of primary care services and as more primary care practices become PCMHs (Arend et al., 2012; DePuccio & Hoff, 2014; PCPCC, 2015; Wolff, Starfield, & Anderson, 2002), this literature review will identify the development of the PCMH practices for older adults, and provide policy and practice implications about how to align the PCMH with the needs of older adults.

Methods

Research Question This systematic review will describe the findings from PCMH programs that have been studied in the peer-reviewed literature. The research question addressed in this review is: What are the effects of the PCMH on healthcare outcomes for older adults? In this review, the definition of the PCMH is developed based on the Joint Principles of the PCMH (AAFP et al., 2007): to be considered as a PCMH, the primary care practice needs to provide team-based and patient-centered

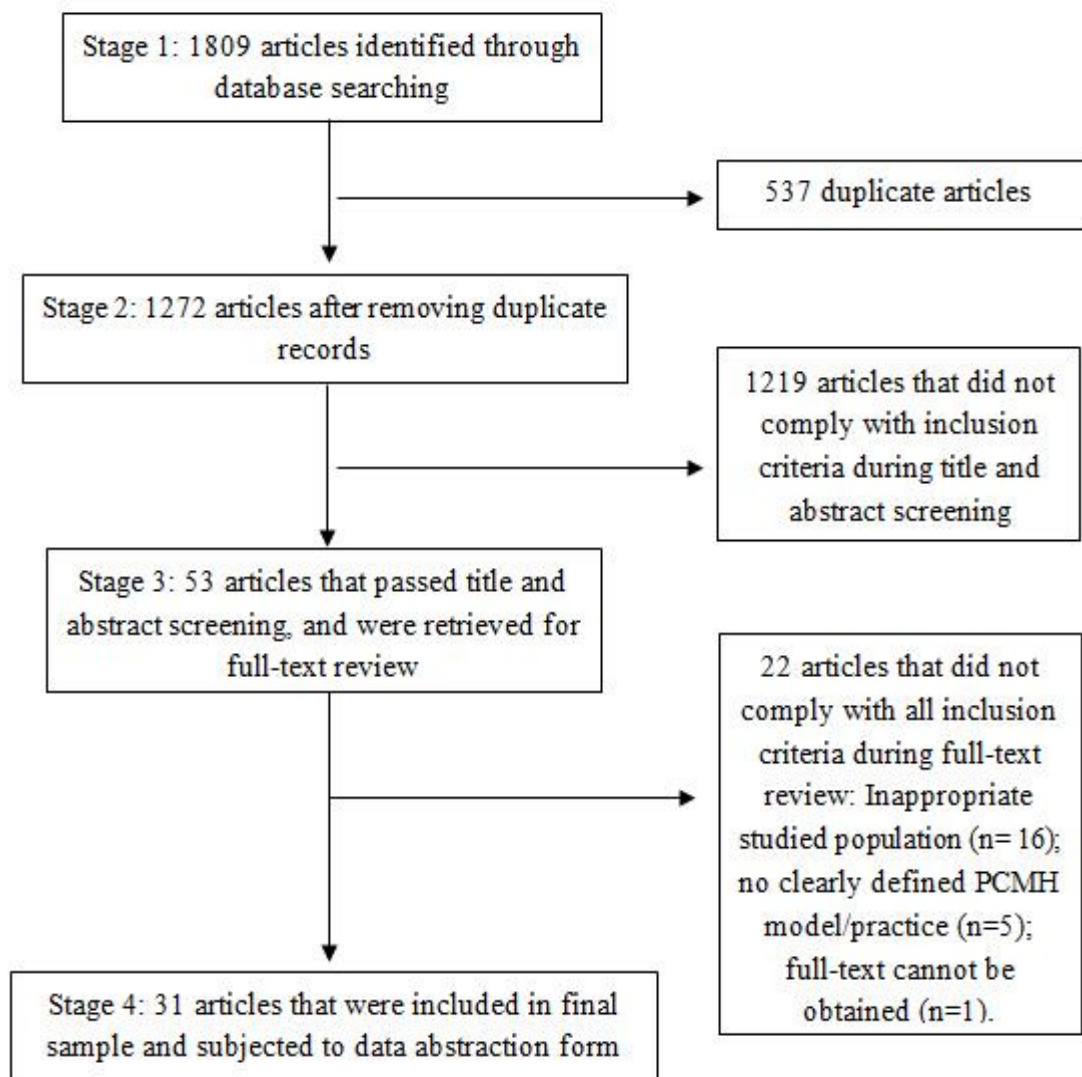
care, to improve care coordination and comprehensiveness, enhance access, and improve quality and safety. Older adults are defined as individuals aged 65 or older; and research that included older adults in the studied population will be reviewed. Healthcare outcomes include patient experiences, clinical quality, healthcare utilization and costs.

Data Sources and Searches To perform the systematic review, the following 13 databases were searched: Academic Search Complete, CINAHL, EconLit, ERIC, Health Source-Nursing Academic Edition, Medline, PsycArticles, PsycInfo, Public Affairs Information Service International, PubMed, Social Work Abstracts, SocIndex, and Web of Science. To maximize the relevant studies to be identified, three groups of key words were used to filter out the studies that had an emphasis on older adults, healthcare outcomes in each database: (1) “patient-centered medical home” or “patient centered care” or “medical home”, (2) “older adults” or elderly or seniors or geriatrics or aging or age related, and (3) outcomes or utilization or expenditures or costs.

Literature Selection Process Figure 2.1 shows the literature selection process. To be included in this review, the articles had to be published in English between January 2000 and December 2015 (Stage 1). The year 2000 was used as a cutoff to allow for a sufficient time period for older adults medical home research and to capture the most recent studies (DePuccio & Hoff, 2014). After the initial search, duplicate articles were removed (Stage 2). Then, the titles and abstracts of the articles were screened manually to identify studies that matched the following inclusion

criteria (Stage 3): (1) US health system only, (2) peer-reviewed empirical studies using quantitative or qualitative (or both) methods, (3) the studied population included individuals aged 65 or older, and (4) investigating one or more patient-centered or medical home healthcare outcomes of the studied population. The full texts of the articles that passed Stage 3 were obtained and reviewed (Stage 4), and the articles that met all the above inclusion criteria and studied an explicitly defined PCMH model/practice were included in this literature review. Each of the articles was summarized on six aspects, including research design, methods, age group, sample size, outcome measures, and principle findings.

Figure 2.1. Schematic of Article Selection Process for the Systematic Review



Results

Study Selection

The author identified 1,809 articles from all the searched databases. After removing duplicate ones, 1,272 articles were subjected to title and abstract screening. When inclusion criteria were applied, 53 articles passed the screening and were retrieved for full-text review. Of these, 21 articles were excluded due to inappropriate study population or inexplicitly defined PCMH model/practice, and 1 article was

excluded due to unavailable full text online, leaving 31 unique peer-reviewed studies in the final literature review.

Table 2.1 summarizes the research designs, methods, outcome measures and principle findings of the 31 articles. The analysis of each study included patients who were aged 65 or older, and six of the studies focused on an elderly population exclusively. Most of the studies were quantitative, with one study using qualitative methods and one study using mixed methods. Studies were heterogeneous in research designs, for example, cross-sectional study, panel data analysis, longitudinal data analysis, time-series design, and randomized control trial. Ten of the studies conducted primary data collection, and the majority of studies involved secondary data analysis. Data sources of the studies included surveys, billing and medical records, claims data, data collected by healthcare organizations and national representative datasets. Statistical methods were variable, with multivariate analysis as the primary method of analysis.

For the effects of the PCMH on healthcare outcomes for older adults, 7 articles studied patient experiences (e.g. patient satisfaction), 9 articles reported clinical quality (e.g. major bleeding events, amputation rates, blindness, death, care delivery, quality of care), 22 articles analyzed healthcare utilization (e.g. use of consulting calls/secure messages/telephone encounters, use of specialty care, use of preventive services, inpatient/outpatient visits, ED visits, hospitalization, avoidable readmissions), and 17 articles estimated healthcare costs and expenditures.

Patient experiences

One of the goals of the PCMH is to improve the experiences of the patients and staff in healthcare (Jackson et al., 2013). In this domain, evidence suggests benefits for both patients and staff experiences in general (Ferrante, Cohen, & Crosson, 2010; Fishman et al., 2012; Hochman et al., 2013; Nelson et al., 2014; Reid et al., 2009; Xin, Kilgore, & Sen, 2015). Reid et al. (2009) conducted a prospective before and after evaluation at baseline and 12-month for a PCMH intervention: compared with the control clinics, patients reported a higher rating on 6 of 7 patient experience scales, and staff reported less burnout in the PCMH. Similarly, Nelson et al. (2014) found higher patient satisfaction and lower staff burnout in the PCMH in a 1-year observational study of the Veterans Health Administration. Hochman et al. (2013) and Xin et al. (2015) reported higher patient satisfaction among those who had access to the PCMH model. Ferrante et al. (2010) suggested the use of patient navigators for care coordination in the PCMH would foster collaborative care and improve patient and physician experiences.

However, in a 26-month national demonstration program, Jaen et al. (2010) found no significant improvement of patient experiences in the facilitated PCMH practices compared with the self-directed PCMH practices, and argued that the PCMH model might not achieve the intended results in a short term without changing the broader delivery system. In a pilot study about the impact of the PCMH on older adults, Fishman et al. (2012) found that older adults reported a higher rating on only 3

of 7 patient experience scales (i.e. shared decision making, continuity of care, access to care) in the PCMH prototype clinic, compared with the control clinics.

The studies indicate the PCMH has the potential to improve patient and staff experiences, and more long-term studies with a national representative sample are needed to further explore the effects, especially for older adults.

Clinical Quality

Clinical quality encompasses the evidence-based care delivery process and the resulting health outcomes (Jackson et al., 2013). For care delivery, studies showed mixed findings. Reid et al. (2009) found statistically significant improvement of quality of care in the PCMH clinic, compared with the control clinics after 1-year intervention. Nelson et al. (2014) suggested more complete implementation of the PCMH was associated with better performance of clinical quality. Jaen et al. (2010) compared the clinical quality between the facilitated PCMH practices and the self-directed PCMH practices. The facilitated practices received ongoing consultations from a facilitator for issues such as practice economics, health information technology and quality improvement, and were supported by telephone and email; while the self-directed practices were given access to web-based practice improvement tools and services without the assistance from a facilitator. Absolute improvements were observed in condition-specific quality of care, including ambulatory care quality, preventive care and chronic care, after the establishment of the PCMH practices; however, there was no statistically significant difference between the facilitated PCMH practices and the self-directed PCMH practices (Jaen et al., 2010). Fishman et

al. (2012) compared quality composite measures for older adults between the PCMH clinic and other control clinics, and observed improvement in quality for the PCMH, which did not differ significantly with the other clinics.

Evidence suggests the PCMH can improve clinical outcomes for older adults. Pagan and Carlson (2013) examined health outcomes for patients with poor diabetes control using the Cardio-Metabolic Risk dataset, and found that lower proportion of individuals would experience bilateral blindness, foot amputation, myocardial infarction and death under a PCMH model. For patients with coronary heart disease (CHD) in the PCMH prototype clinic, their low-density lipoprotein cholesterol (LDL) levels were significantly lower than those of patients in control clinics after a 2-year intervention (Liss et al., 2013). Rosenthal and colleagues examined quality measures based on Health Effectiveness Data and Information Set (HEDIS), and reported that PCMH was associated with increased rates of breast cancer screening and LDL screening among diabetes patients (Rosenthal, Sinaiko, Eastman, Chapman, & Partridge, 2015). In a multidisciplinary PCMH, a pharmacist-managed anticoagulation clinic significantly reduced major bleeding events and thromboembolic events for older adults (Garwood et al., 2014). The PCMH was associated with lower incidences of amputation among older adults with diabetes or ESRD in a short term; however, no significant improvement was found for older adults with stroke or myocardial infarction, for whom long term interventions and management would be required (Maeng, Graf, Davis, Tomcavage, & Bloom, 2012).

Healthcare Utilization

The most studied effects of the PCMH involve the impact on older adults' healthcare utilization. The studies covered a broad spectrum across the healthcare system. For preventive services, Phillips et al. (2011) conducted a longitudinal data analysis of a specific healthcare system, WellMed, and found significantly improved rates of using primary and secondary prevention for colon cancer screening among older adults. The PCMH principles, which were positively associated with the receipt of prevention services for older adults, included personal physician (e.g. continuity with the same physician, higher number of visits within 2 years), whole-person orientation (e.g. having a well-visit within 5 years, receiving chronic illness treatment), coordinated/integrated care (e.g. having referral systems with the community), and quality and safety (e.g. use of clinical decision support tools) (Ferrante, Balasubramanian, Hudson, & Crabtree, 2010).

To achieve cost-saving in healthcare, the PCMH is expected to reduce inpatient admissions, ED utilization and other expensive or avoidable encounters (Jackson et al., 2013). The PCMH was usually associated with increased patient-physician communication through the use of e-mail, telephone and secure messaging, which influenced the demand on office visits and specialist visits (Fishman et al., 2012; Liss et al., 2013; Liss et al., 2014; Reid et al., 2009; Yoon et al., 2015). For chronically ill patients, the PCMH model reduced inpatient admissions, ED utilization and avoidable hospitalizations, and delayed hospital readmissions (Clarke et al., 2015; David, Gunnarsson, Saynisch, Chawla, & Nigam, 2015; Farrell et al., 2015; Fishman et al.,

2012; Flottemesch, Anderson, Solberg, Fontaine, & Asche, 2012; Liss et al., 2013; Maeng et al., 2015; Nelson et al., 2014; Pines, Keyes, van Hasselt, & McCall, 2015; Randall, Mohr, & Maynard, 2015; Reid et al., 2009; Stranges et al., 2015; van Hasselt, McCall, Keyes, Wensky, & Smith, 2015; Yoon et al., 2013; Yoon et al., 2015). For example, Liss et al. (2013) studied healthcare outcomes among adults with diabetes, hypertension and CHD in a PCMH prototype and other 19 control clinics over a two-year period. The study showed patients in the PCMH changed their primary care utilization, as reflected by 86% more secure message contacts, 10% more telephone contacts, and 6% fewer in-person primary care visits (Liss et al., 2013). Compared with the controls, the PCMH patients had 21% fewer ambulatory care-sensitive hospitalizations, 7% fewer inpatient admissions and 18% fewer ED and urgent care contacts (Liss et al., 2013). Stranges et al. (2015) conducted a cohort study for individuals aged 60 and older, and observed significantly reduced readmission rates and long time to readmission among patients who completed the PCMH intervention. The positive outcomes in healthcare utilization may result from improved care management, enhanced quality of care and better care coordination/transitions under the PCMH model (David et al., 2015; Nelson et al., 2014; Yoon et al., 2015). Older adults may benefit from longer exposure to the PCMH (Maeng et al., 2015).

Although improvement in healthcare outcomes was found in most of the studies, more research is needed for accurate estimations regarding healthcare utilization. For instance, Hochman et al. (2013) observed improved healthcare access and patient

satisfaction, with no changes in ED or hospital utilization over a one-year study period of a PCMH intervention. With the increased use of preventive services, Phillips et al. (2011) found no changes in ED visits, and hospitalization and readmission rates. Reid et al. (2013) discovered that patients in the PCMH had less primary care office visits and ED visits, but the same inpatient admissions during the PCMH implementation and stabilization periods. It is unknown to what extent the PCMH features (e.g. coordination and transitions of care, use of technology) were fully functioning, and a lag may exist between the implementation of PCMH and the observing effects in patients' healthcare utilization (Yoon et al., 2015).

Costs and Expenditures

In theory, the PCMH would be able to reduce healthcare costs and expenditures by avoiding medical complications that leads to ED visits and inpatient admissions (Bodenheimer et al., 2002; DePuccio & Hoff, 2014; Jackson et al., 2013). For older adults or individuals with medically complex conditions, the PCMH was associated with cost savings through lower outpatient costs, lower inpatient costs, and lower total costs (Flottemesch, Fontaine, Asche, & Pawlson, 2011; Flottemesch et al., 2012; Flottemesch et al., 2012; Liss et al., 2013; Maeng et al., 2015; Pagan & Carlson, 2013; Stranges et al., 2015; van Hasselt et al., 2015). Maeng et al. (2015) examined longitudinal clinic-level claims data of elderly Medicare beneficiaries attending Geisinger Health System's PCMH clinics from 2006 through 2013. During that period, total costs associated with the PCMH exposure decreased by about 7.9% (\$53 savings per member per month). The acute inpatient costs accounted for the most

significant source of the total cost savings, which were \$34 savings per member per month and approximately 64% of the total cost savings (Maeng et al., 2015). The longer a primary care clinic was exposed to the PCMH, the greater the cost savings could be (Maeng et al., 2015). Under the PCMH, elderly patients would be able to avoid needing acute and expensive care later on, by receiving timely and efficient primary care (Maeng et al., 2015).

In medical groups with PCMH features, the PCMH practice systems (e.g. healthcare organization, delivery system, clinic information, decision support, self-management) played an important role in reducing the overall costs (Flottemesch et al., 2011; Flottemesch et al., 2012; Flottemesch et al., 2012). Stockbridge and colleagues studied the PCMH features and expenditures by Medicare beneficiaries in the Medical Expenditure Panel Survey (MEPS): having little to no difficulty contacting the usual source of care through telephone during business hours was associated with \$3,736 lower inpatient expenditures and \$2,867 lower total expenditures annually; having access to the usual source of care at night or weekends was associated with significantly lower outpatient, ED and other medical expenditures (\$535, \$103, \$328, respectively); however, other PCMH features only had moderate effects on expenditures (Stockbridge, Philpot, & Pagan, 2014).

The findings on the cost-saving effects of the PCMH were not always uniform. Some studies observed no significant changes in healthcare costs under the PCMH model (David et al., 2015; Fishman et al., 2012; Reid et al., 2009; Rosenthal et al., 2015; Yoon et al., 2013; Yoon et al., 2015). Garwood et al. (2014) concluded that

though the PCMH proved to be a safe and cost-effective model, it was often hard to justify the services from a revenue generating perspective. The PCMH model remained vulnerable under current payment system and healthcare reform (Garwood et al., 2014).

Table 2.1. Research Design, Methods, Outcome Measures and Principle Findings in the Systematic Review

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Clarke et al., 2015	Matched case-control	Quantitative, secondary data analysis, multivariate analysis, differences-in-differences model, negative binomial regression model	Mean age 59	10522 patients from 14 PCMH practices	ED utilization	Among the PCMH practices, the comprehensive care coordinators intervention group had achieved a 20% greater reduction in its pre-post ED visit rate, compared with the control group.
David et al., 2015	Panel data analysis	Quantitative, secondary data analysis, multivariate analysis, differences-in-differences model, linear probability model, Poisson model, ordinary least-squares regression	50 or older for chronically ill patients, 30 or older for non-chronically ill patients	459,676 patients from 280 PCMH practices	ED utilization and expenditures	The adoption of the PCMH model was associated with lower ED utilization for chronically ill patients, especially for patients with diabetes and hypertension. Reductions in ED utilization may stem from better chronic illness management rather than expanding primary care access.
Farrell et al., 2015	Longitudinal data analysis	Quantitative, secondary data analysis, survival analysis	37% of the patients were 65 or older; age range 20 - 90	118 patients	All-cause 30-day hospital readmission, time to readmission	Transition management services integrated in PCMH settings reduced the all-cause 30-day hospital readmission rate from 17.9% to 8.0%, and delayed the mean time to readmission up to 180 days from 95 to 115.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Ferrante et al., 2010	Qualitative analysis	Qualitative, primary data collection, data coding and analysis	Mean age 72, age range 19 - 105	75	The process of establishing patient navigators; the barriers and facilitators to patient navigators use; patient and physician experiences	Barriers and facilitators existed in the implementation and utilization of patient navigators in community primary care practices. Patient navigators have the potential to foster collaborative care in PCMHs and to help patients overcome challenges in using the complex health system.
Ferrante et al., 2010	Cross-sectional study	Quantitative, primary data collection, surveys, hierarchical linear regression model	50 or older, mean age 64	568 patients from 24 primary care offices	Receipts of preventive services	PCMH features were associated with higher receipts of preventive services, resulting from positive associations with the relationship-centered aspects of PCMH.
Fishman et al., 2012	Two-group, before-and-after evaluation at baseline, 12 months and 24 months	Quantitative, surveys, secondary data analysis	65 or older	Patient experience: 487 in the PCMH clinic, and 668 in the control clinics; Quality and cost: 1,947 in the PCMH clinic, and 39,396 in the control clinics	Patient experience, quality composite measures, utilization, costs (primary care, specialty care, ED and urgent care, inpatient admissions, total costs)	Patients in the PCMH had better quality outcomes overtime, more e-mail, phone, and specialist visits, and fewer emergency services and inpatient admissions compared to the controls. No significant difference in overall costs was found.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Flottemesch et al., 2011	Cross-sectional study	Quantitative, secondary data analysis, multivariate analysis	Mean age 52, age range 18 - 106	65,905 patients from 21 PCMH practices	Costs (total cost, outpatient costs, inpatient costs)	PCMH features were associated with significant decreases in total and outpatient costs among the most medically complex patients.
Flottemesch et al., 2012	Cross-sectional study	Quantitative, secondary data analysis, multivariate analysis, generalized linear regression model	Mean age 54, age range 19 - 75	2008 patients from 27 medical groups	Costs of diabetes-related care (total cost, outpatient costs, inpatient costs)	Certain PCMH practice systems (e.g. health care organization and decision support system) were related to lower costs, especially for total costs.
Flottemesch et al., 2012	Cross-sectional study	Quantitative, secondary data analysis, multivariate analysis, logistic regression model	Mean age 52	58,391 patients from 22 medical groups	Costs (total cost, outpatient costs, inpatient costs); utilization (inpatient days, ED visits)	PCMH features were associated with fewer ED visits and were associated with significantly lower total and outpatient costs for the most medically complex patients.
Garwood et al., 2014	Quantitative analysis	Quantitative, secondary data analysis	65 or older	246	Major bleeding events; thromboembolic events; time in therapeutic range; cost avoidance	The anticoagulation control resulted in lower adverse event rates. The PCMH proved to be a safe and effective model with cost savings; however, it remained vulnerable under current healthcare reform.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Hochman et al., 2013	Cross-sectional study, intervention	Quantitative, primary data collection, multivariate analysis, differences-in-differences analysis, logistic regression model, Poisson regression model	Mean age 51	Pre-intervention: 4296 patients in the PCMH, 7821 patients in the control clinics; post-intervention: 4679 patients in the PCMH, 8899 patients in the control clinics	Patient satisfaction, rates of hospitalization, ED utilization	Compared to baseline, patients at the PCMH intervention clinic had significantly improvement in access and overall satisfaction. The PCMH intervention did not reduce ED or hospital utilization in the study period.
Jaen et al., 2010	Randomized control trial, observational, intervention, cross-sectional evaluations at baseline, 9 months and 26 months	Quantitative, primary data collection, multivariate analysis, generalized linear repeated-measures model	Mean age 55	Baseline: 1067 patients in surveys, 1964 patients in medical record audits; at 26 months: 760 patients in surveys, 1861 patients in medical record audits; 31 PCMH practices: 16 in the facilitated group, 15 in the self-directed group	Patient-rated outcomes (core primary care attributes, patient empowerment, general health status, and satisfaction); condition-specific outcomes (quality of care, delivery of clinical preventive services, and delivery of chronic disease care)	In both the facilitated group and the self-directed group, implementation of PCMH components was associated with modest improvements in condition-specific quality of care (e.g. improved access, better prevention and chronic care) but not patient experiences. No significant differences were found between groups.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Liss et al., 2013	Nonequivalent pretest-posttest control group design	Quantitative, primary data collection, multivariate analysis, Poisson regression model, generalized linear regression model	Mean age 65 (PCMH) Vs. 62 (control group), age range 18 - 105	1181 in PCMH, 36,757 in control group	Clinical outcomes for diabetes, hypertension and coronary heart disease; utilization (monthly in-person contacts, monthly virtual medicine contacts); costs (primary care, specialty care, ED/urgent care, all inpatient admissions, total costs per person per month)	Patients in the PCMH with coronary heart disease had improved clinical outcomes. Reduced utilization was observed at the PCMH, including less ED and urgent care, fewer ambulatory care-sensitive hospitalizations, and fewer total inpatient admissions. Patients at the PCMH had lower inpatient costs and lower total healthcare costs.
Liss et al., 2014	One-group, 48-month interrupted time series design, evaluation at baseline, PCMH implementation and post implementation	Quantitative, primary data collection, multivariate analysis, negative binomial regression model, Poisson regression model	Mean age 64, age range 18 - 85	36,805	Specialty care utilization for individuals with hypertension	Compared to baseline, patients at the PCMH had fewer specialty care utilization.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Liss et al., 2014	One-group, 48-month interrupted time series design, evaluation at baseline, PCMH implementation and post implementation	Quantitative, primary data collection, multivariate analysis, linear regression model	30% of the studied population were 65 or older, age range 18 - 75	18,486	Office visits, use of secure messaging, telephone encounters	The mean quarterly number of primary care contacts increased, driven by the increased use of secure messaging; quarterly office visits declined. Increased use of secure messaging and telephone encounters were associated with increased office visits. Patient-clinician communication affects the demand for office visits.
Maeng et al., 2012	Panel data analysis	Quantitative, secondary data analysis, multivariate analysis, fixed-effects model	65 or older	46,323	Amputation rates among patients with diabetes, end-stage renal disease, myocardial infarction, and stroke	The PCMH patients with diabetes and ESRD had decreased amputation rates. No significant impacts were found for patients with myocardial infarction and stroke.
Maeng et al., 2015	Longitudinal data analysis	Quantitative, secondary data analysis, multivariate analysis, generalized linear model	65 or older	3,181,090 members per month	Costs (inpatient, outpatient, professional, prescription drugs and total costs); acute inpatient admission rates	Patients in the PCMH had decreased total costs and inpatient costs. Longer exposure of the PCMH was associated with lower acute inpatient admission rates. The most significant source of total cost savings was the reduction in acute inpatient care.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Nelson et al., 2014	Observational study	Quantitative, secondary data analysis	Mean age 64	More than 75,000 veteran patients, 5404 primary care personnel	Patient satisfaction, rates of hospitalization, ED use, quality of care, staff burnout	The extent of PCMH implementation was associated with significantly higher patient satisfaction, higher performance of clinical quality, lower hospitalization rates, lower ED use, and lower staff burnout.
Pagan et al., 2013	Simulated controlled trial, longitudinal data analysis	Quantitative, secondary data analysis	32% of the studied population were 65 or older; age range 30 - 85	1961	Health outcomes (bilateral blindness, foot amputation, myocardial infarction, and death); Cost per quality-adjusted life year	The PCMH model has the potential to improve the health outcomes among the population with poor diabetes control in a cost-effective manner.
Phillips et al., 2011	Longitudinal data analysis	Quantitative, secondary data analysis	65 or older	Approximately 17,000 each year on average	Preventive service utilization (rates of health screening, chronic disease control); health outcomes (ED visits, hospitalization rates, discharge rates, readmission rates, crude death rates)	Rates of using preventive services were significantly improved; however, hospitalization and readmission rates and ED visits remained unchanged over time.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Pines et al., 2015	Longitudinal data analysis	Quantitative, secondary data analysis, logistic regression model, differences-in-differences model, weighted least squares, clustered-corrected errors	Over 80% of the studied population were 65 or older	146,410 individuals in 308 NCQA-recognized PCMHs, 446,273 individuals in 1,906 comparison practices	ED use, hospitalizations	Compared with non-PCMH practices, PCMH had lower rate of growth for ED payments per beneficiary, all-cause ED visits and ambulatory-care-sensitive ED visits; no effects were found regarding hospitalizations.
Randall et al., 2015	Longitudinal data analysis, pre-post evaluation	Quantitative, secondary data analysis, multivariate analysis, negative binomial regression model, extended estimating equation model	Mean age 55	696,379 veteran patients	Hospitalizations, primary care visits, specialty care visits, mental health visits, ED visits, urgent care visits for veteran patients with posttraumatic stress disorder	PCMH was associated with decreased hospitalizations and specialty care visits, and increased primary care visits. For veterans aged 65 and older, PCMH was associated with increased primary and specialty care visits, and decreased urgent care visits.
Reid et al., 2009	Two-group, before-and-after evaluation at baseline and 12 months	Quantitative, primary data collection, multivariate analysis, linear regression model, logistic regression model, Poisson regression model	Mean age 53 (PCMH) Vs. 51 (control group)	3353 patients at baseline, and 2686 patients at 12 months for patient experience surveys	Change components, patient experience, staff burnout, quality of care, utilization, costs	PCMH patients had a better patient experience, improved quality, less staff burnout, more use of secure messages and telephone encounters, and less ED visits, compared with control clinics. There was no significant difference in overall costs.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Reid et al., 2013	Interrupted times series design	Quantitative, secondary data analysis, multivariate analysis, generalized estimating equation	18% of the studied population were 65 or older; mean age 43	412,943 patients	Primary care office visits, ED visits, and inpatient admissions (total and ambulatory care-sensitive admissions)	Patients in the PCMH clinics had declined primary care office visits and ED visits at the PCMH implementation and stabilization periods. There were no significant changes for inpatient admissions.
Rosenthal et al., 2015	Longitudinal data analysis	Mixed methods, primary data collection, secondary data analysis, multivariate analysis, differences-in-differences model, propensity score, interrupted time series, generalized estimating equations	Mean age 53 (PCMH) Vs. 51 (control group)	36,531 in 7 PCMH practices, 30,192 in control group.	HEDIS quality measures (preventive care, diabetes care, care for coronary artery disease); utilizations (hospital use, office visits, imaging, lab tests); costs (inpatient, prescription drug, total expenditures)	PCMH was associated with increased rates of breast cancer screening and low-density lipid screening for diabetes patients, and decreased rates for prevention quality indicator. Ambulatory-care-sensitive ED visits, use of imaging, and prescription drug expenditures decreased. Primary care visits, use of lab test, and use of prescription drugs increased.
Stockbridge et al., 2014	Longitudinal data analysis	Quantitative, secondary data analysis, multivariate analysis, generalized linear regression model	65 or older	2387	Expenditures (total expenditures, expenditures, prescription expenditures, other expenditures)	Older adults having a usual source of care with PCMH features had significantly lower expenditures across different expenditure categories.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Stranges et al., 2015	Cohort study	Quantitative, primary data collection, propensity score matching, multivariate analysis, logistic model	60 or older	19,169	30-day all-cause readmission, time to readmission, time to receive the PCMH intervention, cost avoidance	Patients who completed the PCMH intervention had significantly reduced readmission rates, and longer time to readmission. Potential cost avoidance was observed for those who completed intervention.
van Hasselt et al., 2015	Longitudinal data analysis	Quantitative, secondary data analysis, propensity score, logistic regression model, weighted least squares, differences-in-differences linear regression model	Over 80% of the studied population were 65 or older	146,410 individuals in 308 NCQA-recognized PCMHs, 446,273 individuals in 1,906 comparison practices	Hospitalizations, ED visits, 30-day readmissions, physician visits, Medicare payments (acute care hospital, outpatient department, home health, hospice, federally qualified health center, physician, and total payments)	After practices received NCQA PCMH recognition, total Medicare payments, acute care payments and the number of emergency room visits declined. Larger declines were found for practices with sicker than average patients, primary care practices, and solo practices.
Xin et al., 2015	Cohort study	Quantitative, secondary data analysis, multivariate regression, logistic model	20% of the studied population were 65 or older; age range 18 or older	7743	Patient satisfaction	Access to and use of primary care practices with PCMH features were associated with improved patient satisfaction nationwide.

Table 2.1. Continued

Authors	Research Design	Methods	Age Group (Year)	Sample Size	Outcome Measures	Principle Findings
Yoon et al., 2013	Cohort study	Quantitative, secondary data analysis, surveys, multivariate analysis, random effects logistic model, generalized linear mixed model	45% of the studied population were 65 or older	2,853,030 veteran patients from 814 primary care clinics	Avoidable hospitalizations for an ambulatory care sensitive condition, hospitalization costs	PCMH features were significantly associated with lower risk of avoidable hospitalizations. There was no significant relationship between total medical home features and hospitalization costs.
Yoon et al., 2015	Longitudinal data analysis	Quantitative, secondary data analysis, multivariate analysis, multi-level linear regression model, Poisson regression model	46% of the studied population were 65 or older	2,607,902 veteran patients from 796 primary care clinics	Outpatient visits for primary care, specialty care, telephone care and ED care; avoidable hospitalizations for an ambulatory care-sensitive condition; costs of care	PCMH features were associated with fewer primary care visits. Better care coordination or transition was modestly associated with more specialty care visits and fewer ED visits. Quality/performance improvement was associated with more ED visits. None of the PCMH components were significantly associated with telephone visits, avoidable hospitalizations or costs of care.

Discussion

Older adults are usually prone to comorbidity and having medically complex conditions, who consume higher use of healthcare than general populations (Wolff et al., 2002). It is expected that the PCMH will have dramatic impacts on the healthcare outcomes for older adults.

Although a limited number of studies have evaluated the effects of the PCMH, a series of well-developed evidence suggests that the PCMH model has the potential to improve healthcare outcomes for older adults in a cost-effective way. The PCMH is positively associated with better patient and staff experiences, as the studies observed higher patient satisfaction and less staff burnout in most cases. Improvement in clinical quality has been achieved in both quality of care and clinical outcomes. Older adults under the PCMH model are more likely to receive preventive services and comprehensive chronic illness management, resulting in less ED visits, less inpatient admissions and less avoidable hospitalizations. The reduction in acute and expensive healthcare utilization leads to cost savings in multiple aspects.

Evidence showed that older adults would benefit from the multiple PCMH features, since the PCMH is patient-centered healthcare, rather than disease-centered healthcare, and is geared toward care coordination, disease management, shared decision making, efficient patient-provider communications, and expanding access to primary care. The improvement in healthcare outcomes was most evident among those who had diabetes, hypertension, CHD, and other chronic illness. This phenomenon indicates the PCMH may play an important role in chronic illness management, and older adults should have long term exposure to the PCMH for better healthcare outcomes.

Several important research gaps can be identified from this review. First, there seems to be no standardized approach to study the healthcare outcomes for older adults receiving care under the PCMH. Although these peer-reviewed studies adopted relatively rigorous research designs (e.g. randomized controlled trial, before-and-after evaluations, two-group comparisons) and statistical methods (e.g. multivariate analysis, difference-in-difference model), they are heterogeneous in data sources and measurements, making it difficult for comparison and synthesis of the results. However, on the positive side, it is useful for researchers, healthcare providers and policy makers to review the diverse aspects of healthcare outcomes. Primary data collection allows researchers to ask targeted questions and to explore the topics of interests directly, whereas secondary data are easier to obtain and analyze in a timely manner (DePuccio & Hoff, 2014). The variety of findings from future research will be helpful to inform practices and policy. Second, the results of healthcare utilization and costs/expenditures are inconsistent in different studies. Although the studies are broadly representative of the U.S. healthcare system, both in geography and in the complexity of healthcare delivery networks, most of them reported the findings within two years after the implementation of the PCMH. Since there could be time lag between the PCMH implementation and the actual impacts taking place in healthcare outcomes, long-term or follow-up studies are needed to provide more accurate estimations regarding the effects of the PCMH on older adults. Third, few studies have discussed about the use of shared information technology (e.g. electronic health record) or innovative payment methods under a PCMH model. More research is needed since these aspects would be of great importance to make the PCMH successful and sustainable. Fourth, the findings of the studies reveal research areas that are largely

unexplored for the PCMH and older adults. For example, since the PCMH can reduce ED visits, inpatient admissions and costs/expenditures for older adults with some of the common chronic conditions (e.g. diabetes, hypertension, CHD) that require long term management, a case can be made that the PCMH may also have positive impacts on the healthcare outcomes for older adults with other chronic illness, such as cancer. Future research should expand research questions, study the links between the PCMH features and health conditions, and use representative samples and scientific methods, to address the problems faced by the healthcare system.

This systematic review has notable limitations. First, the PCMH is a model of care with considerable flexibility, instead of a narrowly defined combination of components (Jackson et al., 2013). Different professionals and organizations may have different definitions of the PCMH (Vest et al., 2010). The review used an operational definition derived from the Joint Principles of the PCMH (AAFP et al., 2007), however, it did not necessarily require for an enhanced payment model. In addition, healthcare practices may have similar functional characteristics of the PCMH while they do not use the term “PCMH” to describe their models. For example, studies may focus on patient-centered outcomes within community health centers and in hospitals (Anderson et al., 2003; Lasser et al., 2008; Flach et al., 2004). In some cases, subjective judgements needed to be made regarding how the studies conceptualized the PCMH practices. This review only included the studies with an explicit PCMH model. Second, the author used a series of search terms to limit the scope of the searching process. The extensive literature on topics such as chronic illness management and quality improvement in primary care may not be included. Since the purpose of the review is to identify studies that examined the

healthcare outcomes for older adults, a great number of studies were not selected because the sample populations were not appropriate. Third, this review only searched 13 databases and included peer-reviewed articles. As a result, it may not reflect the findings from other databases or in unpublished evaluations conducted by organizations (e.g. consulting firms). Fourth, due to the heterogeneity in research designs, populations and outcome measures of the studies, this review did not conduct standard quantitative summary to synthesize the data.

The PCMH is being wide implemented in the U.S. healthcare systems under the guidance of the Joint Principles (AAFP et al., 2007; Jackson et al., 2013; PCPCC, 2015). This review indicates that the PCMH is a promising approach to improve healthcare outcomes for older adults. The PCMH is positively associated with better patient experience and clinical quality in a cost-effective manner. More research is needed to provide evidence for the effectiveness of the PCMH on healthcare utilization and costs/expenditures. Future research, which studies the linkage between the PCMH features and healthcare outcomes for older adults with chronic conditions, may further inform the healthcare practices and policy.

Summary of Literature Review

After a comprehensive review of the literature, it is evident that the PCMH model has the potential to improve healthcare outcomes for older cancer survivors, by providing comprehensive, patient-centered, coordinated, accessible and affordable shared care and chronic disease management. However, most of the PCMH programs for cancer care are still demonstrations and preliminary. More studies are needed to estimate the economic

effects of the PCMH. It appears there is a gap of knowledge around the relationship between the PCMH features and healthcare utilization/expenditures for older cancer survivors. This study will address the research gaps by assessing the associations between receipt of care from a provider offering services consistent with a PCMH and the healthcare utilization and expenditures among older adults with a cancer diagnosis, using a nationally representative sample.

Chapter III. Conceptual Framework

The conceptual framework in this study is the Andersen's Behavioral Model of Health Services Use (Andersen, 1995). This chapter will describe the Behavioral Model, discuss the application of the model in this study, and propose the study hypotheses.

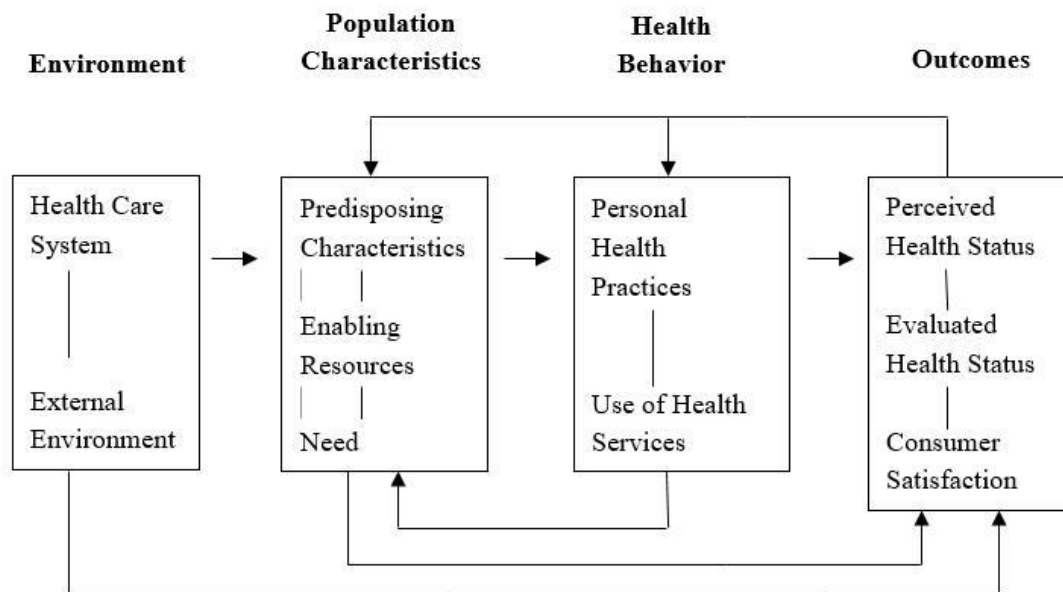
The Behavioral Model of Health Services Use

The conceptual framework of this study was developed based on the Andersen's Behavioral Model of Health Services Use. The Behavioral Model was originally designed in 1968 to understand the families' use of health services, to define and measure healthcare access, and to assist the policy development for equitable access (Andersen, 1968). After several phases of modifications in the past decades, the Behavioral Model provide a comprehensive approach to analyze the multiple factors involved in health services use, at individual level, household level, provider level, environmental level and policy level (Andersen, 1995; Andersen, 2008; Pescosolido & Kronenfeld, 1995; Phillips, Morrison, Andersen, & Aday, 1998). It has been extensively adopted in studies investigating health service utilization and expenditures, and the findings of the studies have served various purposes for researchers, healthcare providers and policy makers (Andersen, 2008; Babitsch, Gohl, & von Lengerke, 2014).

Andersen's emerging model of the Behavioral Model (Figure 3.1) includes four main constructs: the environment, population characteristics, health behaviors and outcomes (Andersen, 1995). The environment consists of the healthcare system and external environment, which acknowledges the important inputs from health policy, health reform, and physical, political and economic components, for understanding use of

health services. Population characteristics include predisposing characteristics, enabling resources and need factors. Predisposing characteristics refer to demographic characteristics (e.g. age, gender), social structure (e.g. education, ethnicity, occupation), and health beliefs (e.g. attitudes, values). Enabling resources include personal resources (e.g. income, health insurance) and community resources (e.g. type of healthcare providers, organizational factors). Need factors describe individuals' health status, perceived needs and evaluated needs. Health behavior refers to personal health practices and use of health services. The outcome includes perceived health status, evaluated health status and consumer satisfaction (Andersen, 1995). The Behavioral Model posits the environmental factors and population factors have dynamic influences on use of health services and health status; and outcomes, in turn, can affect subsequent population characteristics and health behaviors (Andersen, 1995).

Figure 3.1. Andersen's Behavioral Model of Health Services Use (1995)



The Behavioral Model has been applied to identify the predictors of health service use and health outcomes among a broad range of populations of interests, for example,

children (Diedhiou et al., 2010), young adults (Jorm, Parslow, Christensen, & Jacomb, 2002), older adults (Surood & Lai, 2010), individuals with mental health conditions and other comorbidity (Broyles, McAuley, & Baird-Holmes, 1999; Dhingra, Zack, Strine, Pearson, & Balluz, 2010; Stockdale, Tang, Zhang, Belin, & Wells, 2007), immigrants (Chen, Kazanjian, & Wong, 2008; Hochhausen, Le, & Perry, 2011), and low-income or homeless population (Andersen et al., 2002; Brown et al., 2004; Gelberg, Andersen, & Leake, 2000; Hochhausen & Le, 2011). Most of the studies were based on secondary data analysis for data collected from organizational, regional, or national surveys (Andersen, 2008; Babitsch et al., 2014).

Similarities can be found among the studies for the application of the Behavioral Model. First, although a wide variety of health service use predictors were investigated, most research focused on similar sets of main variables. For instance, the predisposing variables usually included age, gender, education and ethnicity; the enabling factors mainly included income, health insurance and having a usual source of care; and the need variables mainly focused on health status and specific health conditions (Babitsch et al., 2014). Second, due to the lack of data and analytical difficulties, environmental variables were omitted in many of the studies (Phillips et al., 1998). Environmental variables may include healthcare delivery system characteristics, external environment, community-level characteristics, and policy (Andersen, 2008; Phillips et al., 1998). The most frequently used environmental variables were urban/rural locations or region, which were measured at the individual level instead of the aggregate level (Phillips, 1998). Third, although there is not a separate category for provider characteristics in the Behavioral Model, provider characteristics were usually studied as enabling factors (Phillips, 1998).

The most frequently examined provider-related variable was whether an individual had a usual source of care (Babitsch et al., 2014; Phillips et al., 1998). The inclusion of contextual factors (i.e. environmental variables and provider characteristics) would reduce the biased and misleading results and enhance the understanding of healthcare utilization behaviors (Phillips et al., 1988).

This study applied the Behavioral Model to older cancer survivors to examine the effects of PCMH on healthcare utilization and expenditures. The influence of the environment on health behaviors and outcomes was recognized. Under the current health policy reform, more and more individuals may have access to a PCMH; however, it is difficult to quantify the healthcare system components across the United States. The external environment was described by geographic region, which served as proxies for supply of services or access to care (Phillips et al., 1998).

According to the Behavioral Model, predisposing characteristics suggest the likelihood that an individual will need health services (Andersen, 1995; Hulka & Wheat, 1985). In the present study, predisposing characteristics included the older adult's age, gender, race/ethnicity, marital status, and household size, since these factors potentially accounted for the variances in health status and services utilization among older cancer survivors (Andersen, 1995; Deimling et al., 2009; Green et al. 2011; Hermosillo-Rodriguez et al., 2013; Holmes et al., 2014; Schootman et al., 2010; Stockbridge et al., 2014).

Enabling resources are the social aspects or determinants that can strongly associate with health behavior changes and facilitate the use of desired health services (Andersen, 1995). Enabling resources in this study included health insurance coverage, education

level, poverty level, and the presence of the PCMH. Since the study focused on older adults aged 65 or older, Medicare would be the predominant health insurance among the studied population. Older adults may have private insurance or be Medicare-Medicaid dual eligible, which can influence their health services utilization (Stockbridge et al., 2014). Social economic status (i.e. education level and poverty level) play a critical role in seeking healthcare services (Blackwell, Martinez, Gentleman, Sanmartin, & Berthelot, 2009).

The healthcare organized according to the Joint Principles of the PCMH is expected to reduce barriers in access and enhance the quality of health services for older cancer survivors (AAFP et al., 2007; DePuccio & Hoff, 2014; Hudson et al., 2012; Sprandio, 2012). The effects of the PCMH on older adults' healthcare utilization and expenditures have been explored by previous studies, and the PCMH can improve healthcare outcomes in a cost-effective manner (Maeng et al., 2015; Liss et al., 2013; Stockbridge et al., 2014; Stranges et al., 2015). In this study, the PCMH model was constructed based on provider characteristics and was included in the analysis as an important enabling factor (Phillips et al., 2008; Beal, Hernandez, & Doty, 2009; Romaine & Bell, 2010).

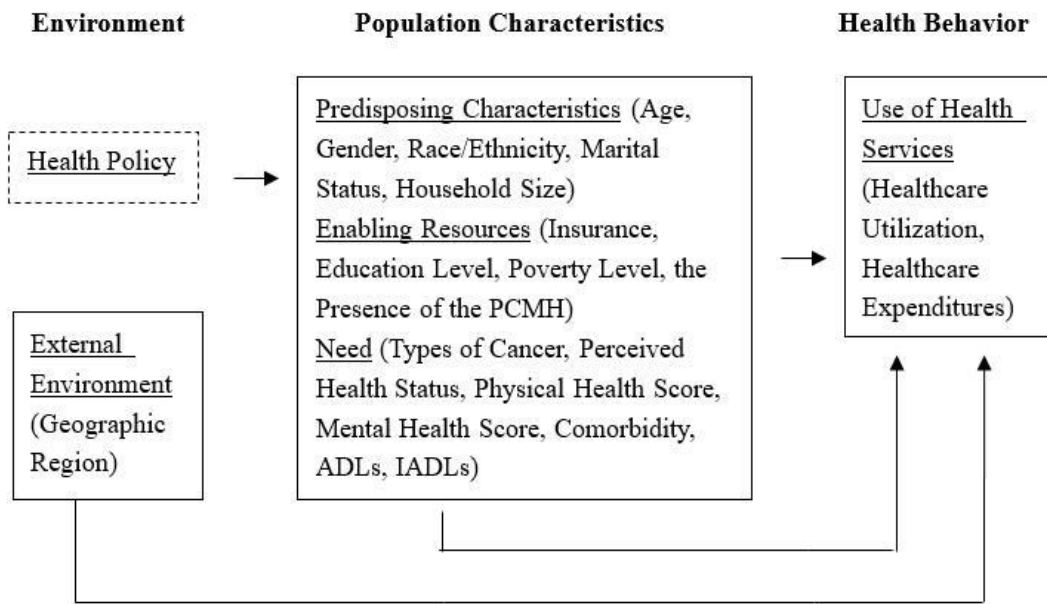
Need factors reflect the individual's health conditions and needs for which healthcare services are obtained (Andersen, 1995). Older cancer survivors are likely to report poor health status, suffer from physical and mental decline, and have multiple chronic conditions (Bellury et al., 2011; Holmes et al., 2014; Holland et al., 2015; Reeve et al., 2009). The need factors in this study included cancer types, perceived health status, physical health score, mental health score, comorbidity, and difficulties in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), which are

associated with older adults' healthcare services utilization and expenditures (Holland et al., 2015; Stockbridge et al., 2014). The common cancer types among older cancer survivors include skin cancer, breast cancer, prostate cancer, and colon cancer (DeSantis et al., 2014). The common comorbid conditions for older cancer survivors include diabetes, hypertension, heart conditions, cerebrovascular disease, COPD or asthma, arthritis or joint disorders, and mental disorders (Smith et al., 2008).

For the purpose of this study, the components in the outcomes construct of the Behavioral Model were not evaluated in this study; and the use of healthcare services among older cancer survivors was examined, which included healthcare utilization (i.e. ED visits, inpatient hospitalizations, outpatient visits and office-based visits) and healthcare expenditures (i.e. expenditures for ED visits, inpatient hospitalizations, outpatient visits and office-based visits, and all-source annual healthcare expenditures and Medicare expenditures).

A modified version of the Behavioral Model for the current study is shown in Figure 3.2. The main constructs consist of environment, population characteristics and health behavior. The feedback loops in Andersen's (1995) Behavioral Model were not included due to the design of this study (i.e. a cross-sectional data analysis and a panel data analysis), and one-time associations between the PCMH and the use of healthcare services were explored.

Figure 3.2. Modified Behavioral Model of Health Services Use



Aims and Hypotheses

The overall goal of the proposed study is to assess the effects of the PCMH on healthcare utilization and expenditures among older adults with a cancer diagnosis. According to the Behavioral Model, the hypotheses for each of the study aims are as below:

Aim 1: To estimate the prevalence of having a PCMH for all U.S. older adults with a cancer diagnosis in a nationally representative sample.

Hypothesis 1: The prevalence of the PCMH would increase in more recent years.

Aim 2: To examine the relationship between the receipt of care from a PCMH and healthcare utilization, by comparing the annual numbers of ED visits, inpatient hospitalizations, outpatient visits and office visits of older adults with a cancer diagnosis between those with and without a PCMH.

Hypothesis 2: Among older cancer survivors, those who received care from a PCMH would have fewer ED visits and inpatient hospitalizations, and more outpatient visits and office visits, compared to those who did not have a PCMH.

Aim 3: To analyze the influence of having a PCMH on healthcare expenditures among older adults with a cancer diagnosis, by comparing the healthcare expenditures on ED visits, inpatient hospitalizations, outpatient visits, office visits, total expenditures and Medicare expenditures of those who have a PCMH and of those who do not.

Hypothesis 3: Among older cancer survivors, those who received care from a PCMH would have lower expenditures on ED visits inpatient hospitalizations, total expenditures and Medicare expenditures, and would have higher expenditures on outpatient visits and office visits, compared to those who did not have a PCMH.

Chapter IV. Methodology

This chapter will discuss the methodology used in this study, including data source, sample, measurements, statistical analysis, and the human subject review.

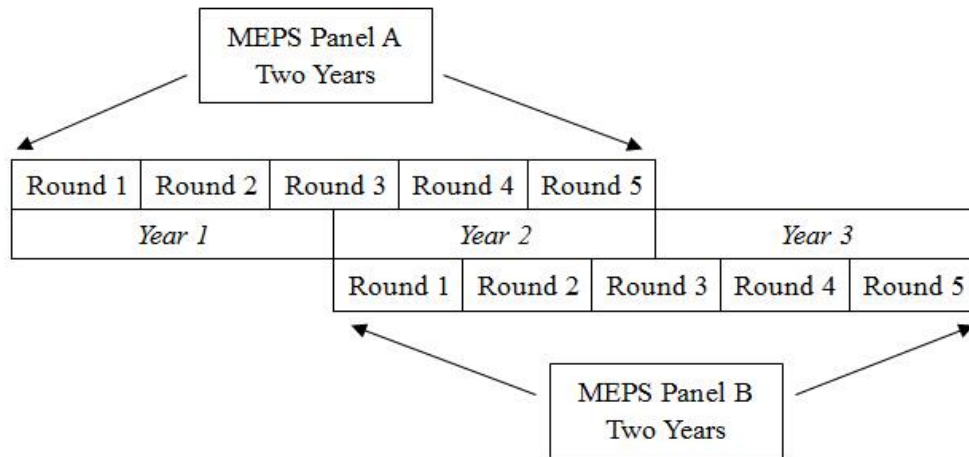
Data Source

The study conducted secondary data analysis using data from the Medical Expenditure Panel Survey (MEPS), a nationally representative survey of U.S. families, noninstitutionalized individuals, medical providers and employers (Agency for Healthcare Research and Quality, 2016). Initiated in 1996 by the Agency for Healthcare Research and Quality (AHRQ) and the U.S. Department of Health and Human Services (DHHS), the MEPS was designed to provide annual and longitudinal estimations of healthcare utilization, expenditures, payments and health insurance coverage (Ezzati-Rice, Rohde, & Greenblatt, 2008). The major components of MEPS include the Household Component (HC), the Insurance Component (IC) and the Medical Provider Component (MPC). The MEPS-HC collects detailed information for each individual in the household, including demographic characteristics, health status, health conditions, healthcare utilization, charges and source of payments, access to care, healthcare satisfaction, insurance coverage, income and employment (AHRQ, 2016). The MEPS-IC collects data from a sample of private and public sector employers on employer-based health insurance plans, regarding number and types of private insurance plans, premiums, eligibility requirements, benefits, contributions by employers and employees, and employer characteristics (AHRQ, 2016). The MEPS-MPC collects supplemental

information about hospitals, physicians, home health care providers and pharmacies identified by the MEPS-HC respondents (AHRQ, 2016).

The data for this study came from the MEPS-HC, which is available on the AHRQ website in downloadable data files. The National Health Interview Survey (NHIS) is a large-scale ongoing health survey conducted by the DHHS and the National Center for Health Statistics of the Centers for Disease Control and Prevention. The sample of MEPS-HC is drawn from the respondents that participated in the previous year's NHIS, following a stratified multistate probability sample framework (Ezzati-Rice et al., 2008). Data were collected using computer-assisted personal interviews (CAPI) with a family respondent, who reports for himself/herself and for other family members (AHRQ, 2016). The annual sample size consists of approximately 14,000 families and 33,000 individuals in recent years (AHRQ, 2016). The MEPS-HC adopts an overlapping panel design (Figure 4.1). Each year, a new panel is added, and each panel consists of a series of 5 rounds of interviews to yield annual utilization and expenditures data for two calendar years (AHRQ, 2016). The first round, the third round and the fifth round usually consist of similar survey questions, whereas the second round and the fourth round consist of similar survey questions (AHRQ, 2016). To obtain an annual estimation, data for each calendar year are combined from the panel in its first year of data collection and the panel in its second year of data collection (Ezzati-Rice et al., 2008).

Figure 4.1. Panel Design of the MEPS-HC



The survey design of MEPS-HC has several advantages. First, in addition to annual estimates, the overlapping panel design allows researchers to conduct longitudinal estimates for each panel over two consecutive calendar years to examine person-level changes (Ezzati-Rice et al., 2008). Second, the MEPS oversamples policy relevant population subgroups (e.g. Hispanics, Blacks, and Asians, low income households) to allow for increased statistical power of health policy related estimates (Ezzati-Rice et al., 2008). Third, the MEPS data can be linked to the previous year's NHIS data to provide additional information for longitudinal analytic purposes (Ezzati-Rice et al., 2008). Fourth, due to the multistage sampling design, the survey creates variables that account for clusters, stratifications, oversampling and missing data, which permits the researchers to generate unbiased national estimates (Ezzati-Rice et al., 2008).

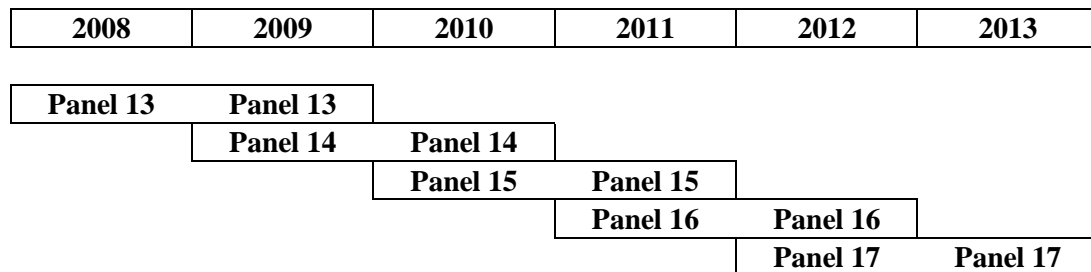
Sample

The study sample included adults aged 65 and over with cancer. There are two ways to identify individuals with cancer in MEPS. First, individuals with ongoing cancer conditions can be identified by codes for medical conditions. The medical conditions in MEPS are coded and recoded based on ICD-9-CM system. AHRQ uses Clinical Classification Software (CCS) to cluster the ICD-9-CM diagnoses and diseases into a number of clinically meaningful policy-relevant categories (Machlin, Soni, & Fang, 2010). The cancer diagnosis is defined as CCS codes from “011” to “045”, which include bladder cancer, blood cancer, breast cancer, colon cancer, lung cancer, skin cancer and other types of cancer (AHRQ, 2016; Machlin et al., 2010). Second, cancer survivors can be identified by the variable “CANCERDX”, which ascertains whether the individual has ever been diagnosed as having cancer or a malignancy of any kind (AHRQ, 2016). This study used the second way to obtain the sample of older cancer survivors, since individuals may live with cancer or cancer-related symptoms for the rest of their life from the moment of diagnosis. Cancer survivors may include individuals with ongoing cancer conditions undertaking active treatments, individuals whose cancer was in remission but requires long-term management, and individuals who live with cancer or cancer related symptoms and are having chronic treatment (Bellury et al., 2011; Berlinger & Gusmano, 2011; DeSantis et al., 2014; Holmes et al., 2014; National Coalition for Cancer Survivorship, 2015; Parry et al., 2011).

For the purposes of this study, the study sample were constructed in two different ways – a cross-sectional sample and a panel sample. The cross-sectional sample included data from 2008 to 2013, since MEPS started to collect cancer survivor information

(“CANCERDX”) in 2008 (i.e. the second year of Panel 12 and the first year of Panel 13), and MEPS 2013 was the latest available data by the end of year 2015 (AHRQ, 2016). The panel sample included MEPS Panel 13 to Panel 17, which were complete panels that shared the same survey time period (i.e. 2008 to 2013) with the cross-sectional sample. Figure 4.2 illustrates the MEPS data reference periods (AHRQ, 2016). For example, in terms of the data collection by year, data for the year 2009 consists data collected from Rounds 3-5 of Panel 13 and Rounds 1-3 of Panel 17. In the cross-sectional sample, each older cancer survivor had one observation. In the panel sample, each older cancer survivor had two observations, one for the first year of a panel survey which was constructed based on data collected from Rounds 1-3, and the other for the second year of a panel survey which was constructed based on data collected from Rounds 3-5.

Figure 4.2. MEPS Data Reference Periods



Multivariate analyses were limited to individuals with no missing data on variables of interests. By constructing a cross-sectional dataset that combined MEPS 2008-2013, the sample size of older cancer survivors was 5,507. By constructing a panel dataset that combined MEPS Panel 13 to Panel 17, the sample size of older cancer survivors was 1,991.

Measurements

Independent Variable The key independent variable was whether or not the older adult with a cancer diagnosis has a PCMH. As an important enabling resource of the use of healthcare services in Andersen's Behavioral Model, the PCMH was operationalized using 27 survey items from the Access to Care and the Self-Administered Questionnaire of MEPS (Andersen, 1995; Beal et al., 2009; Bethell, Read, & Brockwood, 2004; Phillips et al., 1998; Romaine & Bell, 2010; Stockbridge et al., 2014; Xin et al., 2015). Relevant survey items were selected according to the principles of the PCMH. The PCMH domains that were measured include (Table 4.1): 1) having a usual source of care (USC) - the patient had a person or a person-in-facility as a USC, and the facility is not a ED, 2) the role of the USC in total care -- the patient went to the USC for new health problems, ongoing health problems, preventive health care and got referrals to other health professionals, 3) accessibility -- the difficulty of contacting USC by phone, after hours, at nights or on the weekends, 4) patient-centered care -- effective communication and patient involvement in decision making, 5) comprehensive care -- when needed, the patient could get care from a specialist, a clinic, an ED, or a doctor's office in an efficient way, and 6) compassionate care -- the provider showed respect for what the patient had to say (Beal et al., 2009; Bethell et al., 2004; Romaine & Bell, 2010). However, the coordinated care feature of the PCMH could not be measured with MEPS since there were no appropriate survey items that align with the Joint Principle conceptualizations (AAFP et al., 2007; Romaine & Bell, 2010). Point values from 0 to 100 were assigned to each valid survey item response, and each of the selected survey items were aggregated into a binary indicator of having a PCMH based on previously published approaches

(Bethell et al., 2004; Romaine & Bell, 2010). For example, for the item “Any difficulty accessing provider by phone”, value 0, 25, 75, 100 represented “very difficult”, “somewhat difficult”, “not too difficult” and “not at all difficult”, respectively. For the survey items included in PCMH domains, the indicators “don’t know” were recoded as follows. If the respondent did not know whether the older adult had a USC, the older adult was coded as having no USC. For questions with a yes/no response, “don’t know” was coded as “no”, with the assumption that an individual was more likely to recall if certain care experiences occurred. Under the assumption that negative experiences with care were more likely to be recalled, for questions about difficulties or problems receiving care, “don’t know” was coded as “not at all difficult” or “not a problem” (Romaine & Bell, 2010). For each domain that was measured, an average score was calculated; if the score is 75 or higher, the individual was considered to have that domain of a PCMH (Romaine & Bell, 2010).

Table 4.1. MEPS Survey Items, Response Categories and Point Values Assigned for Calculating the PCMH Measure, by PCMH Domains (Beal et al., 2009; Romaine & Bell, 2010)

<p><i>Usual Source of Care (USC)</i></p> <p>Was there a particular doctor's office, clinic, health center, or other place that the person usually goes to if he/she was sick or needs advice about his/her health? No Yes</p> <p>What type of USC does the person have? A facility A person A person-in-facility</p> <p>The location of USC Office Hospital, not ER Hospital, ER</p>
<p><i>The Role of the USC in Total Care</i></p> <p>1. Did the person go to the USC for routine or minor health problem? No (0) Yes (100)</p> <p>2. Did the person go to the USC for preventive health care? No (0) Yes (100)</p> <p>3. Did the person go to the USC for referrals? No (0) Yes (100)</p> <p>4. Did the person go to the USC for ongoing health problems? No (0) Yes (100)</p>
<p><i>Accessibility</i></p> <p>1. How difficult was it to contact the USC by phone? Very difficult (0) Somewhat difficult (25) Not too difficult (75) Not at all difficult (100)</p> <p>2. Did the USC have office hours at nights or on the weekend? No (0) Yes (100)</p> <p>3. How difficult was it to contact the USC after hours? Very difficult (0) Somewhat difficult (25) Not too difficult (75) Not at all difficult (100)</p> <p>4. How difficult was it to access the USC by travel? Very difficult (0) Somewhat difficult (25) Not too difficult (75) Not at all difficult (100)</p>

Table 4.1. Continued

<p><i>Patient-Centered Care</i></p> <p>1. How often did healthcare providers listen carefully to the person? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>2. How often did healthcare providers explain things in a way that was easy to understand? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>3. How often did healthcare providers spend enough time with the person? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>4. Did the healthcare providers ask about prescription medications and treatments other doctors might give? No (0) Yes (100)</p> <p>5. How often did healthcare providers show respect for medical, traditional, and alternative treatments that the person was happy with? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>6. How often did healthcare providers ask the person to help make treatment decisions? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>7. Did the healthcare providers explain all treatment options to the person? No (0) Yes (100)</p>
<p><i>Comprehensive Care</i></p> <p>1. Did the person need to see a specialist? No Yes</p> <p>If needed a specialist, was it easy to access the specialist? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>2. Did the person have an illness, injury or condition that needed care right away from a clinic, ED or doctor's office? No Yes</p> <p>If needed care right away, how often did the person get the care as soon as wanted? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>3. Was there any appointment made with a doctor or clinic for health care? No Yes</p> <p>If appointment was made, how often did the person get the appointment as soon as wanted? Never (0) Sometimes (25) Usually (75) Always (100)</p> <p>4. Did healthcare providers or the person believe the person needed any care, tests or treatment? No Yes</p> <p>If needed care or treatment, how often it was easy to get care, tests or treatment you or a doctor believed necessary? Never (0) Sometimes (25) Usually (75) Always (100)</p>
<p><i>Compassionate Care</i></p> <p>How often did healthcare providers show respect for what the person had to say? Never (0) Sometimes (25) Usually (75) Always (100)</p>

Having a PCMH was defined as the individual had a USC and scores 75 or higher in each of the measured domains, or qualify for a legitimate skip for that domain.

Legitimate skips occurred when an older adult did not have need for the specific type of care being assessed, for example, if an older adult did not have an illness, injury or condition that needed care right away in the last 12 months, the older adult qualified as a legitimate skip for the question that asked about seeing a clinic, ED or doctor's office for immediate care (Beal et al., 2009; Romaine & Bell, 2010).

For the cross-sectional dataset, variables for the PCMH and each of the PCMH domains were constructed for each individual annually. For the panel dataset, variables for the PCMH and each of the PCMH domains were constructed separately for the first year and the second year covered by each panel for each individual using survey questions from Round 2 and Round 4; that is, each individual had two sets of PCMH variables which represented whether he or she had a PCMH or not in each of the two years covered in one panel survey.

Preliminary data analysis showed approximately 40% of the individuals had no usual source of care, and over 25% of individuals had usual source of care with four of the other domains of the PCMH. Since the PCMH measure was a proxy measure which aggregated six PCMH domains based on survey questions instead of an actual enrollment of a PCMH, there could be lack of contrast between the sample groups with or without the PCMH. Thus, another category -- "Partial PCMH" -- was created to include individuals whose usual source of care had some of the PCMH features but not all of the features. The characteristics of the source of care were categorized into "No USC", "Partial PCMH", and "PCMH", which served as an independent variable in the cross-

sectional dataset for all dependent variables to explore the effectiveness of the PCMH. However, in the panel dataset, it was difficult to make reliable comparisons by using “Partial PCMH” category, since it could involve different PCMH domains over the two years of a panel survey. This study compared the change of PCMH status based on the aggregated PCMH measure that summarized all of the six PCMH domains.

Dependent Variables Variables that indicated the management of cancer care and access to care were of particular interest, since the PCMH model aims to improve the healthcare delivery and reduce the costs (David et al., 2015; Pines et al., 2015; Sprandio, 2010; Sprandio, 2012). According to the conceptual framework in this study, the dependent variables focused on the use of healthcare services among older cancer survivors, which included the numbers of ED visits, days of inpatient hospitalizations, the number of outpatient visits and the number of office-based visits, as well as the healthcare expenditures on ED visits, inpatient hospitalizations, outpatient visits, and office-based visits. Since the sample in this study focused on older adults, the total annual expenditures were analyzed for all sources of payments and for Medicare specifically. All the expenditure variables were adjusted for inflation to 2013 levels of expenditures using the MEPS price index (AHRQ, 2016).

For the cross-sectional dataset, annual dependent variables were constructed for each individual in each year. For the panel dataset, each individual had two sets of dependent variables representing the utilization and expenditures in each of the two years covered in one panel survey.

Control Variables Based on Andersen’s Behavioral Model, the control variables in this study, which potentially confounded the use of healthcare services and the healthcare

expenditures, included external environment, predisposing characteristics, enabling resources and need factors (Andersen, 1995).

External environment included the major U.S. Census region: Northeast, Midwest, South, and West.

Predisposing characteristics included the older adult's age, gender, race/ethnicity, marital status and household size. Age was categorized into three groups: 65-74, 75-85, and 85 and older. Gender categories were male and female. Race categories were constructed as White, Black, and other; and ethnicity categories included Hispanic and Non-Hispanic. Marital status included married, widowed, divorced, separated, and never married. Household size was calculated based on "Dwelling Unit ID" and was used as a continuous variable that counted the number of individuals living in the same dwelling unit.

Enabling resources included health insurance coverage (categorized into Medicare only, Medicare and private insurance, Medicare and other public insurance and uninsured); education level (categorized as follows: less than high school, GED or high school graduate, some college, 4-year college or Bachelor's degree, and Master's or Doctorate or professional degree); and poverty level (categorized into poor, near poor, low income, middle income, and high income).

Need factors included self-reported health conditions and health status: types of cancer, perceived health status, physical health score, mental health score, comorbidity, and disability status. Types of cancer were categorized into skin cancer – nonmelanoma or unknown, skin cancer – melanoma, breast cancer, prostate cancer, colon cancer, and other. Perceived health status was categorized into excellent, very good, good, fair, poor.

Based on the responses to the self-administrated questionnaire Short-Form 12, physical health score and mental health score were computed in MEPS using the scoring algorithms (AHRQ, 2016). Comorbidity included diabetes, hypertension, heart conditions, cerebrovascular disease, COPD or asthma, arthritis or joint disorders, and mental disorders, which were identified and merged from the Medical Condition file of MEPS-HC. Disability status were described as whether the older adult needed help in ADLs or IADLs.

Table 4.2 shows a list of variables that were used for analyses according to the Behavioral Model constructs and the operational definitions of the variables.

Table 4.2. The Constructs of the Behavioral Model of Health Services Use, and Variable Operational Definitions

The Behavioral Model Constructs	Variable Operational Definition
Environment	<p><i>Geographic Region</i> Northeast, Midwest, South, West</p>
Population Characteristics	<p><i>Predisposing Characteristics</i> <i>Age</i> 65-74, 75-84, 85 and older</p> <p><i>Gender</i> Male, Female</p> <p><i>Race</i> White, Black, Other</p> <p><i>Ethnicity</i> Hispanic, Non-Hispanic</p> <p><i>Marital Status</i> Married, Widowed, Divorced, Separated, Never Married</p> <p><i>Household Size</i> 1-12 persons</p>
Enabling Resources	<p><i>The Presence of the PCMH (Independent Variable)</i> Yes, No</p> <p><i>Insurance</i> Medicare only, Medicare and Private Insurance, Medicare and Other Public Insurance, Uninsured, Insurance Other Than Medicare</p> <p><i>Education Level</i> Less Than High School, GED or High School Graduate, Some College, 4-Year college or Bachelor's Degree, and Master's or Doctorate or Professional Degree</p> <p><i>Poverty Level</i> Poor, Near Poor, Low Income, Middle Income, High Income</p>
Need Factors	<p><i>Types of Cancer</i> Skin Cancer (Nonmelanoma or Unknown), Skin Cancer (Melanoma), Breast Cancer, Prostate Cancer, Colon Cancer, Other</p> <p><i>Perceived Health Status</i> Poor, Fair, Good, Very Good, Excellent</p> <p><i>Physical Health Score</i> Composite Score</p> <p><i>Mental Health Score</i> Composite Score</p>

Table 4.2. Continued

<i>Need Factors</i>	<i>Comorbidity</i> Diabetes, Hypertension, Heart Conditions, Cerebrovascular Disease, COPD or Asthma, Arthritis or Joint Disorders, Mental Disorders <i>ADLs</i> Yes, No <i>IADLs</i> Yes, No
Health Behavior	<i>Healthcare Utilization (Dependent Variables)</i> ED Visits, Inpatient Hospitalizations, Outpatient Visits, Office-based Visits <i>Healthcare Expenditures (Dependent Variables)</i> Expenditures of ED Visits, Inpatient Hospitalizations, Outpatient Visits, and Office-based Visits; All-source Annual Healthcare Expenditures; Medicare Annual Expenditures

For the cross-sectional dataset, the control variables were constructed for each individual in each year. For the panel dataset, each individual had a set of control variables for each of the two years covered by a panel survey.

Statistical Analysis

The datasets of this study were constructed by SAS 9.4. Statistical analysis was performed using SAS 9.4 (SAS Institute Inc., 2013) and STATA 14 (StataCorp, 2015). Generally, individuals within a survey’s sampling cluster may have more similarities with each other than with those in other clusters, resulting in correlated error terms. If the correlation at the cluster level is not considered, the variance will be underestimated and the significance of the estimation will be overestimated. The analysis of this study accounted for the complex multistage sampling design of the MEPS using person-level weight, variance for primary survey unit and variance for strata, which were included in the original datasets of MEPS (Ezzati-Rice et al., 2008).

For Aim 1, the proportion of older cancer survivors who had a PCMH was calculated and the prevalence of PCMH was measured. A trend of yearly prevalence of PCMH among this population for 2008-2013 was summarized using the cross-sectional dataset.

For Aim 2 and Aim 3, descriptive statistics of the variables for external environment factors, predisposing characteristics, enabling resources, and need factors were conducted and compared between older cancer survivors who have a PCMH and those who do not. The T-test was used for continuous variables and the Pearson chi-square test was used for categorical variables, to analyze the differences of the covariates between those with and without a PCMH.

To further examine the effectiveness of a PCMH, multivariate regression analysis was conducted for each of the dependent variables in both the cross-sectional dataset and the panel dataset, controlling for the covariates; the specific form varied by dependent variables.

For Aim 2, in the cross-sectional dataset, since ED visits, days of inpatient hospitalizations, outpatient visits and office-based visits were nonnegative count variables, Poisson regression model (PRM) and negative binomial regression model (NBRM) were explored (Diedhiou et al., 2010; Hochman et al., 2013; Liss et al., 2013; Liss et al., 2014). The choice of the regression model depended on the dispersion of the data. Since statistics showed the outcome variables ED visits, days of inpatient hospitalizations and outpatient visits had probability of zero exceeding the usual Poisson distribution, zero-inflated Poisson regressions were preferred (Diedhiou et al., 2010; Long & Freese, 2006). The ZIP generates two separate models: a logit model predicting

whether or not the older cancer survivor would have certain zero healthcare utilization, and a PRM predicting the counts of healthcare utilization among those who used healthcare services. In this study, when the ZIP models were performed in STATA, the same covariates were included in the PRM and the logit model (Long & Freese, 2006). For the outcome variable office-based visits, statistical test showed the data had over dispersion and the NBRM was a better fit, which improved the estimation in the PRM by increasing the conditional variance without changing the conditional mean (Long & Freese, 2006).

For Aim 3, in the cross-sectional dataset, since healthcare expenditures for ED visits, inpatient hospitalizations, outpatient visits, office-based visits, and the annual healthcare expenditures (including all-source expenditures and Medicare expenditures) were continuous variables, generalized linear regression models (GLM) with a gamma distribution and a log-link function were used, which accounted for the skewness of the dependent variables (Liss et al., 2014; Maeng et al., 2014; Stockbridge et al., 2014). To avoid dropping the observations with zero expenditures from the analysis due to the use of the log-link function, a small positive constant (0.01) was added to all expenditures variables (Maeng et al., 2014).

A year dummy variable was included in the regressions of the cross-sectional data to capture unmeasured differences from one time period to the next, which would be common across all individuals.

To validate the influence of PCMH on healthcare utilization and expenditures, a fixed effects model was used in the panel dataset for Aim 2 and Aim 3. In the panel dataset, each of the older cancer survivors had two observations, one for the first year and

the other for the second year of a panel survey. Since the older cancer survivor could have or not have a PCMH in either year of a panel, a fixed effects model would focus on the impacts the variation in PCMH status, and control for the observable or unobservable individual factors that influenced healthcare outcomes.

In addition, another cross-sectional dataset was constructed based the panel dataset, where each older cancer survivor included in the panel dataset had one observation. The analyses used the second-year outcome measures as the dependent variables, and the two-year status of the PCMH as the independent variable. The category of the PCMH status included: 1) PCMH = 0 (reference group), indicating “without PCMH in year 1 and year 2”; 2) PCMH =1, indicating “with PCMH in year 1 and without PCMH in year 2”; 3) PCMH = 2, indicating “without PCMH in year 1 and with PCMH in year 2”; and 4) PCMH = 3, indicating “with PCMH in year 1 and year 2”. ZIP regressions were conducted for ED visits, inpatient hospitalization and outpatient visits, NBRM was conducted for office-based visits, and GLM was conducted for all the expenditure variables, controlling for the covariates.

To figure out which of the PCMH domains had the strongest influence on healthcare utilization and expenditures, the PCMH domains were used as independent variables in regression models for each of the dependent variables in the cross-sectional dataset and the panel dataset. Two sets of models were explored: 1) using six PCMH domains as six independent variables in one regression model (preliminary data analysis showed the correlations among the six domains were less than 0.5); and 2) using “having usual source of care” or “having usual source of care with one of the PCMH features” (e.g.

having usual source of care that was compassionate) as an independent variable and analyzing six separated regression models.

To account for possible existing omitted variable bias, simultaneity, and reverse causality, the study explored an instrumental variable for the PCMH. For example, the variable “whether the older adult was living in a metropolitan area” could serve as an instrumental variable for it could indicate the supply of primary care services. Since this variable was only collected in MEPS before 2013, an analysis was conducted using MEPS 2008 to 2012 and Panel 13 to 16. However, statistics showed the variable “whether the older adult was living in a metropolitan area” was poorly correlated with the dummy variable “PCMH” and could not be used as an instrumental variable. No regressions with instrumental variable were conducted in further analysis.

About the Human Subjects Review

The study used publicly accessible MEPS-HC datasets, which were downloaded from the AHRQ website (AHRQ, 2016). No data user agreement (DUA) or approval from the Institutional Review Board (IRB) was required.

Chapter V. Results

This chapter presents the major findings from the data analysis described in Chapter IV, in the order of the three aims. For Aim 1, a trend of yearly prevalence of PCMH among older cancer survivors is summarized. For Aim 2 and Aim 3, descriptive statistics of the characteristics are presented and compared for older cancer survivors who had a PCMH and those who did not, and adjusted associations for the key independent variables are presented for each of the dependent variables for both the cross-sectional dataset and the panel dataset.

For each dependent variable in the cross-sectional dataset, three sets of regression results are described: 1) using the variable that categorized the source of care into “No USC”, “Partial PCMH”, and “PCMH” as the independent variable; 2) using six PCMH domains as six independent variables in one regression model; and 3) using “having a USC” or “having a USC with one of the PCMH features” as an independent variable and analyzing six separated regression models.

For each dependent variable in the panel dataset, three sets of regression results are described: 1) using the summarized dummy PCMH measure as the independent variable; 2) using six PCMH domains as six independent variables in one regression model; and 3) using “having a USC” or “having a USC with one of the PCMH features” as an independent variable and analyzing six separated regression models. In addition, a cross-sectional dataset was constructed from the panel dataset, using the second-year outcome measures as dependent variables, and the two-year status of the PCMH as the independent variable; and results of the multivariate analysis performed for each of the outcome measures are reported.

Aim 1: The Prevalence of the PCMH among Older Cancer Survivors

The first aim of this study is to estimate the prevalence of having a PCMH for all U.S. older adults with a cancer diagnosis in a nationally representative sample. To achieve this aim, the percentage of older cancer survivors was calculated and weighted using person-level weight, variance for primary survey unit and variance for strata, to provide an unbiased estimation that adjusted for the complex survey design and oversampling. Older cancer survivors with a person weight greater than zero were included in the estimation, indicating they were members of the civilian, noninstitutionalized population for that year. Individuals with a person weight equal to zero were excluded, who might serve in the military, spend part of the year outside the U.S. or be institutionalized during part of or entire of the year (AHRQ, 2016). In MEPS 2008-2013, the number of older cancer survivors was 6,058, and 5,929 (97.9%) of the older cancer survivors had a person weight greater than zero, representing 12,489,812 individuals of the U.S. population.

In this study, having a PCMH was defined as the individual had a USC that was accessible, patient-centered, comprehensive, compassionate and played a critical role in total care. Having a partial PCMH was defined as the individual had a USC that presented some but not all of the PCMH features.

Table 5.1 shows the number of older cancer survivors, the number of older cancer survivors having a PCMH, the number of older cancer survivors having a partial PCMH, the prevalence of the PCMH, and the prevalence of the partial PCMH within this population. The U.S. older cancer survivor population increased steadily each year. From

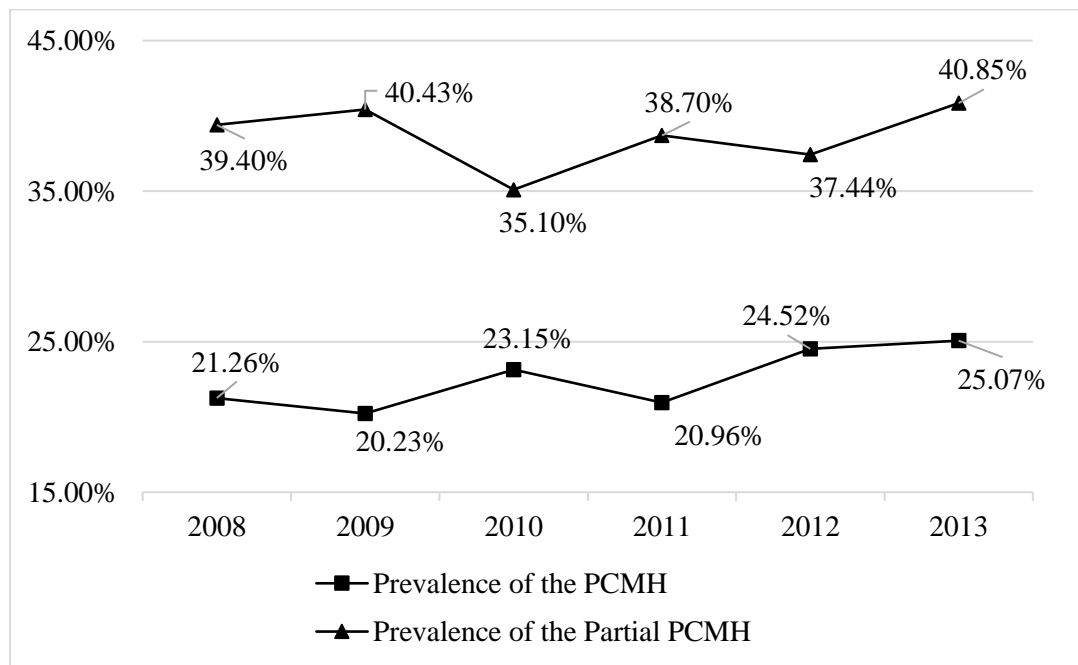
2008 to 2013, the number of older cancer survivors in the U.S. increased by 17.19%, from 11,444,160 to 13,411,921. Among the older cancer survivor sample in MEPS 2008-2013, 1,244 (20.98%) of the individuals had a PCMH, representing 2,823,737 of the U.S. population. The weighted percentage of the PCMH was 22.60% on average during the studied six years. The prevalence of the PCMH among this population was 21.26%, 20.23%, 23.15%, 20.96%, 24.52%, and 25.07% from 2008 to 2013, respectively. Approximately 40% of the sample had a partial PCMH, representing 4,829,250 of the U.S. population. From 2008 to 2013, the prevalence of the partial PCMH was 39.40%, 40.43%, 35.10%, 38.70%, 37.44%, and 40.85%, respectively. The percentage of older cancer survivors without a USC stayed stable around 40% from 2008 to 2011, decreased to 38.04% in 2012, and reached the lowest at 34.08% in 2013.

Table 5.1. Prevalence of the PCMH among Older Cancer Survivors, MEPS 2008-2013

Year	Number of Individuals		Number of Individuals with a PCMH		Prevalence of the PCMH		Number of Individuals with a Partial PCMH		Prevalence of the Partial PCMH	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
2008	874	11,444,160	174	2,433,234	19.91%	21.26%	348	4,508,859	39.82%	39.40%
2009	990	11,988,787	201	2,424,734	20.30%	20.23%	388	4,847,231	39.19%	40.43%
2010	953	12,106,883	200	2,802,683	20.99%	23.15%	347	4,249,938	36.41%	35.10%
2011	1,040	12,722,438	207	2,666,438	19.91%	20.96%	394	4,923,752	37.88%	38.70%
2012	1,103	13,264,683	250	3,252,697	22.67%	24.52%	417	4,966,617	37.81%	37.44%
2013	969	13,411,921	212	3,362,637	21.88%	25.07%	400	5,479,101	41.28%	40.85%
Total	5,929	12,489,812	1,244	2,823,737	20.98%	22.60%	2,294	4,829,250	38.69%	38.67%

Figure 5.1 shows the trend of the prevalence of the PCMH and the prevalence of the partial PCMH among older cancer survivors. The prevalence of the PCMH increased with some fluctuation in recent years. Starting from 21.26% in 2008, the lowest prevalence of the PCMH was 20.23% in 2009, and the highest prevalence of the PCMH was 25.07% in 2013. The prevalence of the partial PCMH fluctuated in recent years, with the lowest prevalence being 35.10% in 2010, and the highest prevalence being 40.85% in 2013.

Figure 5.1. The Trend of the Prevalence of the PCMH among Older Cancer Survivors, MEPS 2008-2013



Aim 2: The PCMH, Healthcare Utilization and Older Cancer Survivors

The second aim of this study is to examine the relationship between the receipt of care from a PCMH and healthcare utilization, by comparing the annual numbers of ED visits, inpatient hospitalizations, outpatient visits and office visits of older cancer survivors between those with and without a PCMH. Cross-sectional analyses were limited to individuals who had no missing data on variables of interests; the most common variables with missing values were physical health score and mental health score. By constructing a cross-sectional dataset that combines the previous 6-year data, the sample size of older cancer survivors was 5,507, which included 92.88% of the total older cancer survivors who had a positive person weight in MEPS 2008-2013, representing 11,702,738 of the U.S. population. The sample in the panel dataset included older adults with a cancer diagnosis since the first year of a panel survey who had no missing data on variables of interests in both years of the panel survey; by constructing a panel dataset that combined MEPS Panel 13 to Panel 17, the sample size was 1,991, representing 10,163,136 of the U.S. population.

Cross-Sectional Study

Characteristics of Older Cancer Survivors

Characteristics of older cancer survivors (N=5,507) by receipt of care consistent with a PCMH in MEPS 2008-2013 are shown in Table 5.2. Among older cancer survivors, 37.75% of them did not have a USC, 39.44% of them had a USC with some but not all of the PCMH features (i.e. a partial PCMH), and 22.80% of them had a PCMH. Nearly half of the older cancer survivors were aged between 64 and 74, about 51% were female, and the majority were non-Hispanic White older adults. More than half

(56.33%) were married while 27.83% were widowed. The average household size was less than two (Mean 1.86, SD 1.54). Less than one percent (0.86%) of the older cancer survivors were uninsured, about one third (34.17%) had Medicare only, 57.79% had both Medicare and private insurance, and 7.17% had both Medicare and other public insurance. Nearly a third (33.76%) of older cancer survivors had GED or high-school degree, and about 30% graduated from 4-year college or had a bachelor's, master's, doctorate or professional degree. Approximately 40% of the older cancer survivors had high income, about 30% had middle income, and less than 10% (7.28%) were poor. The most common diagnoses of cancer (more than 6%) were skin cancer (nonmelanoma or unknown), skin cancer (melanoma), breast cancer, prostate cancer and colon cancer; and 28.16% of older cancer survivors were diagnosed with other types of cancer. About 80% of older cancer survivors perceived their health status to be good or better. The average physical health score and mental health score are 40.65 (SD 18.27) and 52.20 (SD 13.97), respectively. Nearly two thirds (66.74%) of the older cancer survivors had hypertension, more than half (55.26%) had arthritis or joint disorders, about 40% had heart conditions, 24.19% had mental disorders, and 22.10% had diabetes. Less ten percent (9.41%) needed help in ADLs, and about 17% needed help in IADLs.

Approximately 22.80% of older cancer survivors received care consistent with that of a PCMH. The characteristics of older cancer survivors receiving care consistent with a PCMH differed systematically from those who did not have a USC (Table 5.2). For the predisposing characteristics, older cancer survivors with a PCMH were more likely to live in Northeast or West, and be younger and White. Enabling resources were associated with the receipt of PCMH care, for example, older cancer survivors with a PCMH were

more likely to have both Medicare and private insurance, and have at least education level of GED or high school. Among the need factors, older cancer survivors with a PCMH had similar proportions of the diagnoses of cancer and comorbidity with those who had no USC. Older cancer survivors with a PCMH were less likely to perceive their health status to be fair, and were more likely to perceive their health status to be excellent. In addition, older cancer survivors with a PCMH had higher physical health score and mental health score, and fewer of them needed help in ADLs and IADLs than those without a USC.

About 38.67% of older cancer survivors received care from a partial PCMH, that is, a USC with some but not all of the PCMH features. Compared to those who had no USC, older cancer survivors with a partial PCMH were less likely to living in Midwest and being aged 65 to 74, but were more likely to being aged 75 to 85, female, widowed and have smaller household size. Having both Medicare and other public insurance was associated with receiving care from a partial PCMH. Older cancer survivors who had a partial PCMH were more likely to have colon cancer, diabetes and hypertension, and lower physical health score, and a higher proportion of them needed help in IADLs than those had no USC.

Table 5.2. Characteristics of Older Cancer Survivors (N=5,507), Total and by Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Covariates	Weighted Percentages and Weighted Means ^a			
	Total	No USC (37.75%)	Partial PCMH (39.44%)	PCMH (22.80%)
External Environment				
<i>Geographic Region (%)</i>				
Northeast	17.78	14.05	18.18	23.27*
Midwest	23.17	25.59	19.76*	25.03
South	38.32	36.66	41.39	35.77
West	20.73	23.70	20.67	15.93*
Predisposing Characteristics				
<i>Age (%)</i>				
65-74	48.10	51.14	43.10*	51.74
75-84	36.78	33.52	40.03*	36.53
85 and Older	15.12	15.33	16.87	11.73*
<i>Gender (%)</i>				
Female	50.82	47.89	55.15*	48.18
Male	49.18	52.11	44.85*	51.82
<i>Race (%)</i>				
White	93.20	92.58	92.73	95.04*
Black	4.95	5.60	5.36	3.15*
Other ^b	1.85	1.82	1.91	1.81
<i>Ethnicity (%)</i>				
Hispanic	3.08	2.89	3.22	3.14
Non-Hispanic	96.92	97.11	96.78	96.86
<i>Marital Status (%)</i>				
Married	56.33	56.99	53.04	60.93
Widowed	27.83	25.89	31.28*	25.09
Divorced	11.20	12.07	10.69	10.62
Separated	0.82	0.80	1.09	0.39
Never Married	3.82	4.25	3.90	2.97
<i>Household Size (SE)</i>	1.86 (1.54)	1.89 (1.28)	1.82 (1.21)*	1.88 (1.06)

Table 5.2. Continued

Enabling Resources				
<i>Insurance (%)</i>				
Medicare Only	34.17	34.28	36.26	30.39
Medicare and Private Insurance	57.79	58.17	54.42	63.01*
Medicare and Other Public Insurance	7.17	6.54	8.61*	5.72
Uninsured	0.86	1.01	0.71	0.88
<i>Education Level (%)</i>				
Less Than High School	15.36	15.65	17.07	11.91*
GED or High School Graduate	33.76	32.60	33.31	36.47
Some College	21.65	21.61	21.32	22.31
4-Year college or Bachelor's Degree	15.00	14.70	15.19	15.16
Master's or Doctorate or Professional Degree	14.23	15.44	13.12	14.14
<i>Poverty Level (%)</i>				
Poor	7.28	7.03	8.04	6.40
Near Poor	6.25	5.59	7.52	5.14
Low Income	17.21	16.93	17.96	16.35
Middle Income	29.30	29.71	29.38	28.47
High Income	39.96	40.74	37.09	43.62

Table 5.2 Continued

Need Factors				
Types of Cancer (%)				
Skin Cancer (Nonmelanoma or Unknown)	33.17	34.23	32.19	33.09
Skin Cancer (Melanoma)	7.11	7.71	6.85	6.57
Breast Cancer	16.05	15.25	17.44	14.99
Prostate Cancer	16.59	17.03	15.91	17.07
Colon Cancer	6.59	5.42	7.49*	6.95
Other Cancer ^c	28.16	28.81	27.48	28.26
Perceived Health Status (%)				
Poor Health	4.30	4.02	5.47	2.75
Fair	17.37	17.99	18.96	13.61*
Good	34.56	34.97	34.95	33.20
Very Good	32.90	34.01	29.54*	36.90
Excellent	10.86	9.01	11.09	13.54*
Physical Health Score (SE)	40.65(18.27)	40.47 (15.49)	39.37 (17.08)*	43.16 (14.39)*
Mental Health Score (SE)	52.2(13.97)	52.20 (14.30)	51.53 (12.15)	53.34 (11.08)*
Comorbidity (%)				
Diabetes	22.10	20.80	23.84*	21.22
Hypertension	66.74	64.61	68.57*	67.09
Heart Conditions	39.26	38.18	41.39	37.35
Cerebrovascular Disease	7.20	7.60	8.01	5.12*
COPD or Asthma	31.40	29.90	33.16	30.85
Arthritis or Joint Disorders	55.26	55.13	56.76	52.87
Mental Disorders	24.19	24.22	25.32	22.20
ADLs (%)	9.41	10.09	10.47	6.46*
IADLs (%)	16.98	16.63	20.43*	11.60*

a. The figures represent the national population of older cancer survivors.

b. Other race includes American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, and multiple races.

c. d. Other cancer includes bladder cancer, blood cancer, cervix cancer, lung cancer, lymph cancer, muscle cancer, uterus cancer, bone cancer, brain cancer, gallbladder cancer, kidney cancer, liver cancer and other types of cancer.

*Significantly different with “No USC” at P value < 0.05 in T-test or Chi-square test.

Effects of PCMH on Healthcare Utilization

To explore the effects of a PCMH on healthcare utilization among older cancer survivors, multivariate regressions were conducted for each of the dependent variables, controlling for all potential confounders described previously. ZIP regressions were performed for ED visits, inpatient hospitalizations and outpatient visits; and NBRM were performed for office-based visits. The adjusted associations (i.e. incident rate ratios (IRR) and predicted probabilities of being a non-user) of the partial PCMH and the PCMH with healthcare utilization are presented in Table 5.3, using “No USC” as the reference group. Older cancer survivors with a PCMH were more likely to have ED visits. Having a partial PCMH or a PCMH was associated with greater likelihood of having outpatient visits. Older cancer survivors with a partial PCMH made 9% more office-based visits (IRR = 1.09; 95% confidence interval (CI) = 1.02-1.16; P value < 0.05) than those without a USC. No statistically significant difference was found regarding the partial PCMH or the PCMH for days of inpatient hospitalizations among older cancer survivors.

Table 5.3. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
No USC (reference)	1.00	1.00	1.00	1.00
Partial PCMH	1.10 (0.80-1.52)	1.09 (0.84-1.41)	0.87 (0.68-1.10)	1.09 (1.02-1.16)**
PCMH	0.80 (0.51-1.26)	1.14 (0.88-1.46)	0.97 (0.76-1.25)	1.04 (0.96-1.12)
Predicted Probabilities of Being a Non-User (95% CI)				
No USC (reference)	0.50 (0.48-0.52)	0.81 (0.80-0.82)	0.60 (0.59-0.61)	N/A
Partial PCMH	0.52 (0.50-0.53)	0.80 (0.79-0.81)	0.55 (0.54-0.56)**	N/A
PCMH	0.40 (0.38-0.42)**	0.81 (0.80-0.82)	0.52 (0.51-0.53)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits. Full regression models are summarized in Appendix 1 to Appendix 4.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Effects of PCMH Features on Healthcare Utilization

Table 5.4 describes the weighted percentages of older cancer survivors by reported PCMH features. Among the older cancer survivors, 62.24% of them had a USC. The most common PCMH feature was that the USC played a critical role in total care, with 61.20% of people reporting this feature. The least common PCMH feature was that the USC was accessible, with only 30.12% of people reporting this feature. To figure out which of the PCMH features had the strongest influence on healthcare utilization, two sets of regression models were performed.

Table 5.4. Weighted Percentages of Older Cancer Survivors with a USC Reporting That Their USC Has Specific PCMH Features (N=5,507)^a, MEPS 2008-2013

Features	% Responding Affirmatively
Having a USC	62.24%
Having a USC That Played a Critical Role in Total Care	61.20%
Having a USC That Was Accessible	30.12%
Having a USC That Was Patient-centered	53.30%
Having a USC That Was Comprehensive	52.16%
Having a USC That Was Compassionate	59.55%

a. The figures represent the national population of older cancer survivors.

Table 5.5 summarizes the adjusted associations of the first set of regressions, where the six PCMH domains (i.e. having a USC, the critical role of USC, accessibility, patient-centered care, comprehensive care, compassionate care) were included in one regression model as independent variables for each of the dependent variables; and the regressions controlled for other covariates. This set of regressions explored the effects of a single PCMH feature while accounted for the effects of other PCMH domains. For ED utilization, accessibility was significantly associated with fewer ED visits (IRR = 0.78; 95% CI = 0.60-1.02; P value < 0.1); and compassionate care was significantly associated with 55% fewer ED visits (IRR = 0.45; 95% CI = 0.33-0.61; P value < 0.05). Four of the six PCMH domains were associated with higher likelihood of having ED visits, including

having a USC, the critical role of USC in total care, accessibility, and compassionate care; and comprehensive care was associated with lower likelihood of having ED visits. For inpatient utilization, comprehensive care was associated with 26% more days of inpatient hospitalization among older cancer survivors (IRR = 1.26; 95% CI = 0.96-1.65; P value < 0.1). PCMH domains that were associated with significantly higher likelihood of having zero inpatient days included the critical role of USC in total care, accessible care, patient-centered care and compassionate care. For outpatient utilization, comprehensive care and compassionate care increased outpatient visits by 37% (IRR = 1.37; 95% CI = 1.09-1.72; P value < 0.05) and 110% (IRR = 2.1; 95% CI = 1.15-3.83; P value < 0.05), respectively. Having a USC, the critical role of USC in total care and compassionate care significantly increased the likelihood of having outpatient visits when other PCMH domains and confounders were controlled. For office-based visits, having a USC was associated with 6% more office-based visits (IRR = 1.06; 95% CI = 0.99-1.12; P value < 0.1) when other PCMH domains and covariates were accounted for.

Table 5.5. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with PCMH Domains, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Having a USC				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.73-1.23)	1.14 (0.94-1.40)	0.93 (0.76-1.14)	1.06 (0.99-1.12)*
The Critical Role of USC in Total Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.15 (0.74-1.79)	0.73 (0.41-1.31)	1.08 (0.71-1.64)	1.09 (0.93-1.28)
Accessibility				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.78 (0.60-1.02)*	1.04 (0.87-1.24)	0.88 (0.73-1.06)	1.03 (0.96-1.11)
Patient-centered Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.11 (0.84-1.46)	1.08 (0.80-1.44)	0.85 (0.67-1.08)	1.05 (0.95-1.16)
Comprehensive Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.19 (0.88-1.61)	1.26 (0.96-1.65)*	1.37 (1.09-1.72)**	0.95 (0.89-1.03)
Compassionate Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.45 (0.33-0.61)**	0.81 (0.55-1.20)	2.10 (1.15-3.83)**	1.1 (0.95-1.28)

Table 5.5. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC				
No (reference)	0.44 (0.42-0.46)	0.81 (0.80-0.82)	0.60 (0.59-0.61)	N/A
Yes	0.40 (0.39-0.42)**	0.80 (0.80-0.81)	0.54 (0.53-0.55)**	N/A
The Critical Role of USC in Total Care				
No (reference)	0.46 (0.42-0.49)	0.79 (0.77-0.81)	0.62 (0.60-0.64)	N/A
Yes	0.41 (0.40-0.43)**	0.81 (0.80-0.81)*	0.56 (0.55-0.57)**	N/A
Accessibility				
No (reference)	0.44 (0.43-0.46)	0.79 (0.78-0.80)	0.56 (0.55-0.57)	N/A
Yes	0.39 (0.37-0.40)**	0.82 (0.81-0.83)**	0.56 (0.55-0.57)	N/A
Patient-centered Care				
No (reference)	0.41 (0.39-0.44)	0.79 (0.78-0.81)	0.57 (0.56-0.58)	N/A
Yes	0.42 (0.40-0.43)	0.81 (0.80-0.81)*	0.56 (0.55-0.57)	N/A
Comprehensive Care				
No (reference)	0.37 (0.35-0.40)	0.80 (0.79-0.81)	0.56 (0.54-0.57)	N/A
Yes	0.42 (0.41-0.44)**	0.81 (0.8-0.81)	0.56 (0.56-0.57)	N/A
Compassionate Care				
No (reference)	0.57 (0.53-0.62)	0.75 (0.73-0.78)	0.51 (0.48-0.53)	N/A
Yes	0.41 (0.39-0.42)**	0.81 (0.80-0.81)**	0.56 (0.56-0.57)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.6 to Table 5.11 summarize the regression results of the second set of regressions, where six separated regression models were conducted for each of the dependent variable, with “having a USC” or “having a USC with one of the PCMH features” as the independent variable, controlling for the covariates. This set of regressions explored the effects of having a USC with one of the PCMH features, regardless of the status of the other PCMH features.

For ED visits, results showed that having a USC that was accessible was significantly associated with 29% fewer ED visits among older cancer survivors (IRR = 0.71; 95% CI = 0.52-0.95; P value < 0.05). Having a USC that played a critical role in total care, having a USC that was accessible, having a USC that was comprehensive, and having a USC that was compassionate were significantly associated with higher likelihood of using ED.

For inpatient days, having a USC that was comprehensive was associated with 21% more days of inpatient hospitalization (IRR = 1.21; 95% CI = 0.98-1.48; P value < 0.1) among older cancer survivors. Older cancer survivors who had a USC that was accessible or had a USC that was patient-centered were more likely to have zero inpatient days, whereas older cancer survivors who had a USC that was comprehensive were more likely to have inpatient hospitalizations.

For outpatient visits, the likelihood of having outpatient visits increased significantly by having a USC, or having a USC that played a critical role in total care, or having a USC that was accessible, or having a USC that was patient-centered, or having a USC that was comprehensive, or having a USC that was compassionate.

Office-based visits increased by 7% if older cancer survivors had a USC (IRR = 1.07; 95% CI = 1.01-1.13; P value < 0.05), by 6% if older cancer survivors had a USC that played a critical role in total care (IRR = 1.06; 95% CI = 1.00-1.12; P value < 0.1), and by 6% (IRR = 1.06; 95% CI = 1.00-1.13; P value < 0.05) if older cancer survivors had a USC that was compassionate, controlling for the covariates.

Table 5.6. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.00 (0.74-1.36)	1.11 (0.88-1.39)	0.90 (0.73-1.11)	1.07 (1.01-1.13)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC				
No (reference)	0.50 (0.48-0.51)	0.81 (0.80-0.82)	0.60 (0.59-0.61)	N/A
Yes	0.48 (0.47-0.50)	0.80 (0.80-0.81)	0.54 (0.53-0.55)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.7. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC That Played a Critical Role in Total Care, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC That Played a Critical Role in Total Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.98 (0.71-1.36)	1.14 (0.92-1.40)	0.89 (0.72-1.09)	1.06 (1.00-1.12)*
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC That Played a Critical Role in Total Care				
No (reference)	0.50 (0.48-0.52)	0.80 (0.80-0.81)	0.60 (0.59-0.61)	N/A
Yes	0.48 (0.47-0.49)*	0.81 (0.80-0.81)	0.54 (0.53-0.55)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.8. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC Was Accessible, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC Was Accessible				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.71 (0.52-0.95)**	1.11 (0.90-1.37)	0.95 (0.77-1.18)	1.02 (0.95-1.09)
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC Was Accessible				
No (reference)	0.51 (0.50-0.52)	0.80 (0.79-0.81)	0.58 (0.57-0.59)	N/A
Yes	0.36 (0.34-0.38)**	0.82 (0.81-0.82)**	0.53 (0.52-0.54)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.9. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC Was Patient-Centered, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC Was Patient-Centered				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.73-1.24)	1.15 (0.94-1.42)	0.96 (0.80-1.16)	1.04 (0.97-1.11)
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC Was Patient-Centered				
No (reference)	0.48 (0.47-0.50)	0.80 (0.79-0.81)	0.59 (0.58-0.60)	N/A
Yes	0.49 (0.47-0.50)	0.81 (0.80-0.82)**	0.54 (0.53-0.55)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.10. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC Was Comprehensive, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC Was Comprehensive				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.70-1.28)	1.21 (0.98-1.48)*	1.05 (0.89-1.24)	1.02 (0.97-1.08)
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC Was Comprehensive				
No (reference)	0.50 (0.49-0.52)	0.81 (0.80-0.82)	0.59 (0.58-0.60)	N/A
Yes	0.48 (0.46-0.49)**	0.80 (0.79-0.81)*	0.54 (0.53-0.55)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.11. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Having a USC Was Compassionate, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC Was Compassionate				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.84 (0.60-1.17)	1.04 (0.83-1.31)	1.03 (0.86-1.23)	1.06 (1.00-1.13)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC Was Compassionate				
No (reference)	0.52 (0.51-0.54)	0.8 (0.79-0.81)	0.59 (0.58-0.60)	N/A
Yes	0.45 (0.44-0.47)**	0.81 (0.80-0.81)	0.54 (0.54-0.55)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Characteristics of Older Cancer Survivors and Healthcare Utilization

The characteristics of older cancer survivors were associated with healthcare utilization in different ways. For ED utilization (Appendix 1), being Hispanic and having higher mental health score were significantly associated with a reduced visit rate; and having heart disease or COPD/asthma was significantly associated with an increased visit rate. For inpatient hospitalization (Appendix 2), individuals who were separated with their spouses had fewer inpatient days than those who were married; compared to individuals whose education levels were less than high school, those with master's/doctorate/professional degrees had significantly more inpatient days; being low income was associated with more inpatient days, compared to being poor; those who perceived their health to be good or very good or excellent had significantly fewer inpatient days than those who perceived their health to be poor; limitations in ADLs or IADLs were associated with more inpatient days; and skin cancer survivors or prostate cancer survivors had fewer days of inpatient hospitalization; having both Medicare and private insurance was significantly associated with an increased likelihood of using inpatient hospitalization compared to having Medicare only.

For outpatient visits (Appendix 3), most of the individual characteristics had a strong association with utilization. Among the predisposing factors, being older, female, other race, and separated or never married was significantly associated with fewer outpatient visits, relative to being aged 65 to 74, male, White and married; and being divorced was associated with more outpatient visits, compared to being married. Among the enabling factors, having a bachelor's or higher degree was associated with more outpatient visits, compared with having a degree of less than high school; and being near

poor was associated with fewer outpatient visits, compared with being poor. Need factors that associated with a reduced rate of outpatient visits included better perceived health status, higher physical health score and being a prostate cancer survivor; and factors associated with an increased rate of outpatient visits included having IADLs limitations and being a breast cancer survivor. Having both Medicare and private insurance was significantly associated with an increased likelihood of having outpatient visits relative to having Medicare.

Similarly, most of the individual characteristics were associated with the rate of office-based visits dramatically (Appendix 4). Predisposing factors associated with lower office-based visit rates were living in the South, being Black or other race, being Hispanic, being divorced or separated, and having a larger household size, relative to living in the North, being White, being non-Hispanic, being married, and having a smaller household size. Insurance types, education level and poverty level were all important enabling factors for office-based visits. For example, having both Medicare and private insurance, having higher education level, and having middle income or high income were associated with more office-based visits relative to having Medicare only, having education level of less than high school and being poor; and being uninsured was associated with fewer office-based visits, compared to having Medicare. Need factors related to increased office-based visits included being a survivor of skin cancer or breast cancer or other types of cancer, and having hypertension or heart disease or COPD/asthma or joint disorders or mental disorders. Need factors associated with reduced office-based visits included having an excellent perceived health status, having higher physical health score, or needing help in IADLs.

Panel Study

To validate the influence of the PCMH on healthcare utilization, fixed effects models were applied to each of the dependent variables in the panel dataset. Since the “Partial PCMH” category could involve different PCMH domains over the two years of a panel survey, it was difficult to make reliable comparisons based on such category. The panel analysis compared the change of PCMH status based on the aggregated PCMH measure, which summarized all of the six PCMH domains.

Characteristics of Older Cancer Survivors

Characteristics of older cancer survivors (N=1,991) by receipt of care consistent with a PCMH during the two years of a panel survey in MEPS Panels 13-17 is summarized in Table 5.12. Among older cancer survivors, only 10.28% had a PCMH in both years of a panel; about two thirds (62.98%) of survivors did not have a PCMH in either year; 12.30% of survivors had a PCMH in the first year and did not have a PCMH in the second year; and 14.44% of survivors did not have a PCMH in the first year but had one in the second year. For the predisposing factors, compared with older cancer survivors who did not have a PCMH in either year, those who had a PCMH in both years were more likely to be married, and less likely to be aged 85 or older, widowed or separated. The most important enabling resources that were associated with having a PCMH in both years included having both Medicare and private insurance, and having at least education level of GED or high school. Among the need factors, older cancer survivors with a PCMH in both years had similar proportions of the diagnoses of cancer with those who had no USC in either year. Older cancer survivors with a PCMH in both years were less likely to perceive their health status to be poor or fair, and were more

likely to perceive their health status to be very good. A lower proportion of older cancer survivors with a PCMH in both years had heart conditions or cerebrovascular disease. In addition, older cancer survivors with a PCMH in both years had significantly higher physical health score and mental health score, and fewer of them needed help in ADLs and IADLs than those without a USC, compared to those without a PCMH in either year.

Table 5.12. Characteristics of Older Cancer Survivors (N=1,991), Total and by Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey, MEPS Panels 13-17

Covariates	Weighted Percentages and Weighted Means ^a				
	Total	Without a PCMH in Year 1 and Year 2 (62.98%)	With a PCMH in Year 1 and without a PCMH in Year 2 (12.30%)	Without a PCMH in Year 1 and with a PCMH in Year 2 (14.44%)	With a PCMH in Year 1 and Year 2 (10.28%)
External Environment					
<i>Geographic Region (%)</i>					
Northeast	17.64	15.34	23.38*	20.48	20.85
Midwest	23.25	22.99	24.14	20.43	27.71
South	37.92	38.06	37.63	40.28	34.12
West	21.19	23.60	14.85*	18.81	17.32
Predisposing Characteristics					
<i>Age (%)</i>					
65-74	50.14	48.75	51.56	49.69	57.62
75-84	36.79	37.32	33.78	39.54	33.31
85 and Older	13.07	13.93	14.66	10.77	9.07*
<i>Gender (%)</i>					
Female	50.86	52.01	52.01	49.11	44.90
Male	49.14	47.99	47.99	50.89	55.10
<i>Race (%)</i>					
White	93.89	92.81	96.49*	96.14*	94.20
Black	4.48	5.56	2.35*	2.52*	3.23
Other ^b	1.63	1.63	1.16	1.34	2.57
<i>Ethnicity (%)</i>					
Hispanic	3.09	3.12	2.81	2.78	3.73
Non-Hispanic	96.91	96.88	97.19	97.22	96.27

Table 5.12. Continued

<i>Marital Status (%)</i>					
Married	56.52	54.76	53.41	57.43	69.69*
Widowed	27.42	27.89	30.76	29.35	17.85*
Divorced	11.09	11.41	12.13	10.37	8.94
Separated	1.06	1.39	1.41	0.00*	0.15*
Never Married	3.91	4.56	2.29	2.85	3.37
<i>Household Size (SE)</i>	1.80 (1.07)	1.78 (0.88)	1.81 (0.78)	1.79 (0.67)	1.91 (0.55)*
Enabling Resources					
<i>Insurance (%)</i>					
Medicare Only	34.87	36.17	33.94	33.59	29.82
Medicare and Private Insurance	56.99	54.83	60.29	58.58	64.04*
Medicare and Other Public Insurance	7.28	8.42	5.62	5.06	5.43
Uninsured	0.86	0.58	0.16	2.77*	0.71
<i>Education Level (%)</i>					
Less Than High School	14.65	16.94	12.13*	8.95*	11.65*
GED or High School Graduate	34.55	33.05	41.51*	32.73	37.96
Some College	20.99	19.52	20.35	28.43*	20.31
4-Year college or Bachelor's Degree	15.70	15.80	15.58	17.95	12.11
Master's or Doctorate or Professional Degree	14.10	14.68	10.42	11.95	17.97
<i>Poverty Level (%)</i>					
Poor	9.20	9.96	9.70	6.93	7.12
Near Poor	5.33	5.51	4.13	6.84	3.53
Low Income	17.31	17.59	17.98	14.95	18.11
Middle Income	28.06	28.68	28.64	26.57	25.69
High Income	40.11	38.27	39.56	44.72	45.56

Table 5.12. Continued

Need Factors					
Types of Cancer (%)					
Skin Cancer (Nonmelanoma or Unknown)	31.97	32.54	32.53	27.24	34.48
Skin Cancer (Melanoma)	7.16	8.05	3.99*	7.45	5.13
Breast Cancer	16.78	17.23	14.00	17.70	16.09
Prostate Cancer	17.15	16.74	17.49	18.37	17.54
Colon Cancer	6.83	6.83	7.34	5.80	7.69
Other Cancer ^c	28.08	26.88	32.83	28.63	28.95
Perceived Health Status (%)					
Poor Health	2.55	3.04	3.14	1.52	0.31*
Fair	13.32	15.57	13.55	6.34*	9.06*
Good	32.75	34.18	32.18	30.38	27.95
Very Good	37.50	34.86	35.62	43.90*	46.91*
Excellent	13.88	12.34	15.51	17.86*	15.77
Physical Health Score (SE)	40.80 (14.72)	39.62 (13.23)	40.90 (6.37)*	42.81 (9.44)*	45.02 (9.89)*
Mental Health Score (SE)	52.50 (9.22)	52.11 (9.74)	52.65 (7.29)	52.92 (5.77)	54.14 (5.54)*
Comorbidity (%)					
Diabetes	22.67	23.44	22.34	18.80	23.79
Hypertension	70.64	72.44	69.68	65.67*	67.73
Heart Conditions	43.66	44.15	40.76	50.81	34.11*
Cerebrovascular Disease	9.19	10.41	9.48	6.21*	5.57*
COPD or Asthma	37.82	36.66	39.75	42.72	35.67
Arthritis or Joint Disorders	64.29	64.89	62.82	65.00	61.40
Mental Disorders	26.43	27.14	27.66	23.96	24.09
ADLs (%)	10.47	11.63	10.39	9.02	5.50*
IADLs (%)	18.37	20.13	19.52	16.27	9.24*

a. The figures represent the national population of older cancer survivors.

b. Other race includes American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, and multiple races.

c. Other cancer includes bladder cancer, blood cancer, cervix cancer, lung cancer, lymph cancer, muscle cancer, uterus cancer, bone cancer, brain cancer, gallbladder cancer, kidney cancer, liver cancer and other types of cancer.

*Significantly different with “Without a PCMH in Year 1 and Year 2” at P value < 0.05 in T-test or Chi-square test.

Effects of PCMH and PCMH Features on Healthcare Utilization

Three sets of regressions were conducted for each of the outcome measures: 1) using the aggregated PCMH measure as the independent variable (Table 5.13); 2) using six PCMH domains as six independent variables in one regression model (Table 5.14); and 3) using “having a USC” or “having a USC with one of the PCMH features” as an independent variable and analyzing six separated regression models (Table 5.15 to Table 20). The results showed that the aggregated PCMH measure was associated with none of the outcome measures at 10% level of significance (Table 5.13). When the six features of the PCMH were included in one model (Table 5.14), older cancer survivors with comprehensive care had 0.073 more ED visits on average (P value < 0.1) compared to those without comprehensive care, controlling for other PCMH features and confounders; having comprehensive care and having compassionate care were associated with 0.295 (P value < 0.1) and 0.907 (P value < 0.1) more outpatient visits, respectively, when other PCMH features and confounders were accounted for; in addition, having accessible care were associated with 0.859 fewer office-based visits (P value < 0.1). When the characteristics of the USC were used separately as the independent variable for the outcome measures (Table 5.15 to Table 20), most of the characteristics did not show significant association with healthcare utilization, except that having a USC that was comprehensive was associated with 0.428 more outpatient visits (P value < 0.1).

Table 5.13. Fixed Effects of Receipt of Care Consistent with a PCMH on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
PCMH	-0.038 (0.036)	0.102 (0.295)	0.109 (0.210)	-0.052 (0.700)

a. Full regression models are summarized in Appendix 5 to Appendix 8.

*P value < 0.1.

**P value < 0.05.

Table 5.14. Fixed Effects of PCMH Domains on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC	0.032 (0.041)	-0.106 (0.305)	0.197 (0.332)	0.957 (0.912)
The Critical Role of USC in Total Care	-0.082 (0.074)	-0.152 (0.482)	0.144 (0.292)	1.628 (1.123)
Accessibility	-0.039 (0.031)	-0.097 (0.241)	-0.053 (0.146)	-0.859 (0.510)*
Patient-centered Care	0.027 (0.053)	0.164 (0.311)	0.257 (0.265)	0.372 (0.725)
Comprehensive Care	0.073 (0.042)*	0.422 (0.262)	0.295 (0.173)*	0.741 (0.668)
Compassionate Care	-0.202 (0.135)	-0.480 (0.705)	0.907 (0.538)*	-1.788 (1.163)

*P value < 0.1.

**P value < 0.05.

Table 5.15. Fixed Effects of Having a USC on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC	0.019 (0.038)	-0.104 (0.291)	0.279 (0.305)	1.313 (0.843)

*P value < 0.1.

**P value < 0.05.

Table 5.16. Fixed Effects of Having a USC That Played a Critical Role on Total Care on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Played a Critical Role in Total Care	0.008 (0.039)	-0.090 (0.298)	0.313 (0.294)	1.107 (0.817)

*P value < 0.1.

**P value < 0.05.

Table 5.17. Fixed Effects of Having a USC That Was Accessible on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Accessible	-0.016 (0.034)	-0.050 (0.300)	0.016 (0.187)	-0.392 (0.651)

*P value < 0.1.

**P value < 0.05.

Table 5.18. Fixed Effects of Having a USC That Was Patient-Centered on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Patient-Centered	-0.006 (0.040)	-0.081 (0.290)	0.275 (0.197)	0.736 (0.765)

*P value < 0.1.

**P value < 0.05.

Table 5.19. Fixed Effects of Having a USC That Was Comprehensive on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Comprehensive	0.029 (0.033)	0.088 (0.247)	0.428 (0.254)*	0.973 (0.696)

*P value < 0.1.

**P value < 0.05.

Table 5.20. Fixed Effects of Having a USC That Was Compassionate on Healthcare Utilization among Older Cancer Survivors, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Compassionate	-0.024 (0.043)	-0.211 (0.302)	0.356 (0.278)	0.654 (0.813)

*P value < 0.1.

**P value < 0.05.

Characteristics of Older Cancer Survivors and Healthcare Utilization

In the fixed effects models, the characteristics of older cancer survivors influenced their healthcare utilization. For ED utilization (Appendix 5), the characteristics associated with an increased number of visits included being divorced, being near poor, having middle income or high income, needing help in ADLs, and having COPD/asthma, compared to being married, being poor, having no ADL limitations and having no COPD/asthma. The characteristics associated with a reduced number of visits included living in the West, having better perceived health status, having higher physical health score, and having higher mental health score, compared to living in the North, having poor perceived health status, having lower physical health score and having lower mental health score. For inpatient hospitalization (Appendix 6), having middle income or high income, needing help in ADLs, and having mental disorders were associated with more inpatient days, compared to being poor, needing no help in ADLs and having no mental disorders; having better perceived health status and higher mental health score were associated with fewer inpatient days. Living in the South, having better perceived health status, and a having higher physical health score were associated with fewer outpatient visits, compared to living in the North, having poor perceived health status and having a lower physical health score; and needing help in ADLs was associated with more outpatient visit (Appendix 7). The characteristics associated with fewer office-based visits included having higher physical health score or mental health score, and needing help in IADLs. Having COPD/asthma or joint disorder were associated with more office-based visits (Appendix 8).

Change of PCMH Status and Healthcare Utilization

To further explore the effects of PCMH status on healthcare utilization, a cross-sectional dataset was constructed from the panel dataset, using the second-year healthcare utilization as the dependent variable for each person, and the status of PCMH of the two years of a panel as the independent variable. ZIP regressions were conducted for ED visits, inpatient hospitalization and outpatient visits; and NBRM was conducted for office-based visits. The regression results are summarized in Table 5.21. However, in this set of regressions, none of the independent variables showed significant association with the dependent variables in terms of the number of ED visits, days of inpatient hospitalizations, outpatient visits and office-based visits. For ED visits, compared with older cancer survivors who had no PCMH in either year, those who had a PCMH in one of the two years in a panel study were more likely to have ED visits, whereas those who had a PCMH in both years were more likely to have no ED visits. For inpatient utilization, those who had a PCMH in year 1 but had no PCMH in year 2 were more likely to have inpatient days, those who had a PCMH in year 2 but had no PCMH in year 1 were less likely to have inpatient days, compared with older cancer survivors who had no PCMH in either year. For outpatient visits, having a PCMH in both years was significantly associated with higher likelihood of having outpatient visits, compared to having no PCMH in either year.

Table 5.21. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Cancer Survivors Associated with Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey, MEPS Panels 13-17 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Without a PCMH in Year 1 and Year 2 (reference)	1.00	1.00	1.00	1.00
With a PCMH in Year 1 and without a PCMH in Year 2	0.95 (0.67-1.36)	1.08 (0.76-1.54)	0.95 (0.67-1.34)	1.15 (0.97-1.35)
Without a PCMH in Year 1 and with a PCMH in Year 2	0.70 (0.27-1.84)	0.81 (0.53-1.24)	1.08 (0.77-1.51)	1.01 (0.89-1.16)
With a PCMH in Year 1 and Year 2	0.89 (0.44-1.82)	1.14 (0.66-1.96)	0.91 (0.61-1.36)	1.09 (0.92-1.28)
	Predicted Probabilities of Being a Non-User (95% CI)			
Without a PCMH in Year 1 and Year 2 (reference)	0.28 (0.26-0.31)	0.81 (0.80-0.82)	0.57 (0.56-0.58)	N/A
With a PCMH in Year 1 and without a PCMH in Year 2	0.24 (0.19-0.29)*	0.77 (0.75-0.79)**	0.56 (0.53-0.59)	N/A
Without a PCMH in Year 1 and with a PCMH in Year 2	0.11 (0.08-0.14)**	0.84 (0.82-0.86)**	0.57 (0.54-0.59)	N/A
With a PCMH in Year 1 and Year 2	0.39 (0.32-0.46)**	0.82 (0.79-0.84)	0.48 (0.45-0.51)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Aim 3: The PCMH, Healthcare Expenditures and Older cancer survivors

The third aim of this study is to examine the relationship between the receipt of care from a PCMH and healthcare expenditures. The cross-sectional dataset constructed in Aim 2 was used to study the annual ED expenditures, inpatient expenditures, outpatient expenditures, office-based visit expenditures, total expenditures; and the characteristics of older cancer survivors by receipt of care consistent with a PCMH were described previously in Table 5.2. For the Medicare expenditures, a cross-sectional dataset that included older cancer survivors with Medicare was constructed based on insurance types; by combining the previous 6-year data, the sample size was 5,461, representing 11,602,061 of the U.S. population. For the panel study, the same panel dataset constructed in Aim 2 was used to analyze all the expenditure variables in this study; and the characteristics of older cancer survivors by receipt of care consistent with a PCMH were described previously in Table 5.12.

Cross-Sectional Study

Effects of PCMH and PCMH Features on Healthcare Expenditures

Generalized linear regression models with a gamma distribution and a log-link function were applied to all the expenditure variables in the cross-sectional datasets. Three sets of regressions were conducted for each of the dependent variables: 1) using the variable that categorized the source of care into “No USC”, “Partial PCMH”, and “PCMH” as the independent variable (Table 5.22); 2) using six PCMH domains as six independent variables in one regression model (Table 5.23); and 3) using “having a USC” or “having a USC with one of the PCMH features” as an independent variable and analyzing six separated regression models (Table 5.24 to Table 5.29). The results showed

that the categorical source of care variable was not significantly associated with the outcome measures at 10% level of significance (Table 5.22).

When the six PCMH domains were included in one model (Table 5.23), different effects of individual domains were observed for each expenditure variable, controlling for the covariates. For the average ED expenditures, having a USC was associated with 23.81% less expenditures (difference of -\$88.19; P value < 0.05) and having compassionate care was associated with 31.75% less expenditures (difference of -\$129.90; P value < 0.05); however, having a USC that played a critical role in total care and having comprehensive care were associated with 87.76% (difference of \$138.00; P value < 0.05) and 38.40% (difference of \$83.93; P value < 0.05) more expenditures, respectively. The mean of inpatient expenditures increased by 48.14% if the older cancer survivor had patient-centered care (difference of \$1,717.12; P value < 0.05) and by 34.85% if the older cancer survivor had comprehensive care (difference of \$1,315.33; P value < 0.05). Accessible care was associated with 20.07% (difference of -\$244.66; P value < 0.05) less outpatient expenditures, and compassionate care was associated with 56.36% (difference of \$406.86; P value < 0.1) more outpatient expenditures. The mean of total expenditures increased by 12.86% if the older cancer survivor had patient-centered care (difference of \$1,503.05; P value < 0.05). The mean of Medicare expenditures reduced by 21.89% if the older cancer survivor had a USC that played a critical role in total care (difference of -\$2,252.87; P value < 0.1), but increased by 14.34% if the older cancer survivor had patient-centered care (difference of \$1,052.49; P value < 0.1). None of the six domains showed a significant association with office-based visit expenditures.

When the features of the USC were used separately as the independent variable for the outcome measures (Table 5.24 to Table 5.29), most of them did not show a significant association with healthcare expenditures, except that having a USC that was compassionate was associated with 20.94% less of the mean of ED expenditures (difference of -\$66.04; P value < 0.1).

Table 5.22. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
No USC (Reference)	311.15 (37.98)	4276.16 (441.05)	1055.49 (100.63)	3322.38 (158.36)	12549.31 (409.09)	7782.22 (356.36)
Partial PCMH	251.54 (20.13)	4671.88 (498.68)	1119.52 (97.57)	3395.62 (137.66)	13063.68 (430.61)	8246.37 (378.40)
Difference	-59.61 (40.68)	395.72 (616.34)	64.03 (129.57)	73.23 (180.17)	514.37 (559.23)	464.15 (482.20)
PCMH	259.86 (34.52)	5065.69 (767.48)	1208.84 (136.44)	3148.79 (137.98)	12984.84 (638.31)	8659.49 (570.75)
Difference	-51.29 (45.95)	789.53 (850.65)	153.35 (153.1)	-173.59 (187.54)	435.53 (737.3)	877.27 (658.42)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures. Full regression models are summarized in Appendix 9 to Appendix 14.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.23. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with PCMH Domains, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures
Having a USC				
No (reference)	336.98 (44.42)	4597.18 (502.09)	1033.19 (96.33)	3333 (160.23)
Yes	256.79 (19.04)	5014.45 (488.44)	1152.69 (93.79)	3298.61 (108.45)
Difference	-80.19 (43.72)*	417.26 (615.89)	119.50 (121.44)	-34.39 (167.00)
The Critical Role of USC in Total Care				
No (reference)	157.37 (32.64)	6424.87 (1871.28)	1260.53 (272.60)	3293.72 (419.40)
Yes	295.37 (24.05)	4762.43 (382.42)	1095.50 (74.68)	3312.81 (101.82)
Difference	138.00 (40.53)**	-1662.44 (1845.45)	-165.03 (276.31)	19.09 (416.68)
Accessibility				
No (reference)	296.51 (27.33)	4971.14 (467.99)	1218.61 (98.31)	3289.73 (138.50)
Yes	273.22 (28.09)	4686.61 (530.37)	973.95 (78.48)	3336.98 (124.26)
Difference	-23.29 (32.50)	-284.53 (617.26)	-244.66 (103.72)**	47.25 (167.23)
Patient-centered Care				
No (reference)	253.83 (36.19)	3567.72 (477.34)	1087.49 (155.49)	3121.86 (204.18)
Yes	294.56 (26.04)	5284.84 (506.44)	1110.12 (75.86)	3356.26 (117.53)
Difference	40.74 (43.15)	1717.12 (682.20)**	22.62 (157.89)	234.4 (235.7)
Comprehensive Care				
No (reference)	218.19 (30.08)	3778.21 (530.76)	981.79 (108.29)	3355.09 (203.17)
Yes	302.12 (25.50)	5093.54 (436.52)	1131.58 (80.39)	3302.72 (101.92)
Difference	83.93 (35.80)**	1315.33 (609.94)**	149.79 (116.60)	-52.37 (191.40)
Compassionate Care				
No (reference)	409.12 (76.66)	10414.43 (3806.22)	721.68 (185.13)	3302.58 (373.31)
Yes	279.22 (22.40)	4567.23 (366.54)	1128.54 (77.61)	3312.19 (103.39)
Difference	-129.90 (74.67)*	-5847.21 (3799.35)*	406.86 (199.48)**	9.61 (373.99)

Table 5.23. Continued

	Total Expenditures	Medicare Expenditures
Having a USC		
No (reference)	12522.03 (420.14)	7711.07 (363.91)
Yes	13060.47 (387.07)	8449.20 (339.29)
Difference	538.44 (545.92)	738.13 (473.24)
The Critical Role of USC in Total Care		
No (reference)	14603.22 (1365.92)	10288.48 (1304.83)
Yes	12745.75 (307.21)	8035.61 (261.68)
Difference	-1857.47 (1404.45)	-2252.87 (1318.01)*
Accessibility		
No (reference)	13051.82 (381.45)	8191.89 (340.97)
Yes	12606.29 (429.40)	8131.16 (368.72)
Difference	-445.53 (545.55)	-60.74 (479.50)
Patient-centered Care		
No (reference)	11665.12 (581.41)	7339.95 (450.03)
Yes	13168.17 (338.64)	8392.44 (300.32)
Difference	1503.05 (659.43)**	1052.49 (518.87)**
Comprehensive Care		
No (reference)	12425.22 (528.93)	7605.24 (467.48)
Yes	12948.28 (323.08)	8290.82 (288.86)
Difference	523.05 (561.23)	685.58 (515.60)
Compassionate Care		
No (reference)	14186.64 (1674.33)	9327.35 (1572.52)
Yes	12776.49 (312.73)	8095.64 (271.14)
Difference	-1410.15 (1738.78)	-1231.71 (1624.40)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.24. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC						
No (reference)	310.94 (37.89)	4275.93 (441.25)	1054.19 (100.40)	3322.83 (158.58)	12550.35 (409.49)	7772.22 (355.78)
Yes	254.37 (18.60)	4820.35 (450.08)	1150.47 (93.44)	3306.38 (106.33)	13036 (384.83)	8389.46 (331.91)
Difference	-56.57 (38.50)	544.42 (578.83)	96.28 (123.00)	-16.44 (160.56)	485.66 (528.77)	617.24 (455.77)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.25. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC That Played a Critical Role in Total Care, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Played a Critical Role in Total Care						
No (reference)	306.83 (36.52)	4549.14 (483.53)	1067.16 (100.31)	3389.15 (161.09)	12775.53 (434.99)	7965.02 (375.68)
Yes	255.42 (18.99)	4643.50 (436.04)	1142.48 (93.65)	3262.58 (102.93)	12901.15 (383.16)	8279.72 (329.35)
Difference	-51.41 (37.43)	94.36 (616.03)	75.32 (123.31)	-126.57 (161.61)	125.62 (554.78)	314.7 (472.96)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.26. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC That Was Accessible, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Accessible						
No (reference)	284.39 (22.53)	4580.84 (376.50)	1105.77 (79.43)	3322.06 (120.05)	12890.20 (329.34)	8066.66 (290.84)
Yes	249.99 (28.48)	4677.17 (610.07)	1127.01 (109.25)	3289.73 (134.28)	12755.23 (532.03)	8404.66 (473.04)
Difference	-34.41 (32.36)	96.33 (662.19)	21.24 (106.26)	-32.33 (154.70)	-134.97 (576.80)	338.00 (519.83)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.27. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC That Was Patient-Centered, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Patient-Centered						
No (reference)	299.60 (31.14)	4406.77 (405.34)	1045.39 (89.19)	3354.88 (142.02)	12691.06 (389.50)	7951.89 (326.69)
Yes	252.15 (20.27)	4805.62 (496.11)	1178.50 (99.86)	3274.32 (112.40)	12999.89 (414.37)	8347.00 (354.42)
Difference	-47.44 (33.72)	398.85 (589.92)	133.11 (114.99)	-80.57 (151.82)	308.84 (537.35)	395.11 (441.22)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.28. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC That Was Comprehensive, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Comprehensive						
No (reference)	284.34 (28.63)	4126.12 (401.03)	1046.16 (88.38)	3396.04 (147.6)	12627.99 (368.41)	7819.03 (321.49)
Yes	264.23 (21.37)	5107.20 (513.56)	1177.03 (103.85)	3235.52 (106.32)	13058.30 (427.6)	8473.53 (376.32)
Difference	-20.11 (31.61)	981.08 (609.02)	130.87 (120.57)	-160.52 (154.24)	430.31 (531.52)	654.51 (472.86)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 5.29. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Having a USC That Was Compassionate, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Comprehensive						
No (reference)	314.95 (36.17)	4580.46 (474.73)	1023.26 (93.79)	3318.42 (154.25)	12719.16 (416.63)	7916.24 (358.89)
Yes	248.91 (18.76)	4628.07 (439.75)	1178.81 (97.17)	3308.68 (108.85)	12944.48 (402.47)	8325.95 (341.95)
Difference	-66.04 (37.34)*	47.62 (605.17)	155.55 (119.75)	-9.74 (160.67)	225.32 (563.22)	409.71 (472.28)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Characteristics of Older Cancer Survivors and Healthcare Expenditures

The characteristics of older cancer survivors had significant associations with healthcare expenditures. For ED expenditures (Appendix 9), living in the South, being near poor or having low income, having very good or excellent perceived health status, and having higher physical health score or mental health score were associated with reduced expenditures, compared to living in the North, being poor, having poor perceived health status, and having lower physical health score or mental health score. Being aged 75 to 84 (compared to being aged 65 to 74), being Black (compared to being White), being a survivor of skin cancer (nonmelanoma or unknown) or prostate cancer or other types of cancer, and having heart disease or cerebrovascular disease or COPD/asthma were associated with significantly more ED expenditures. For inpatient expenditures (Appendix 10), factors associated with reduced inpatient expenditures included being separated, being uninsured, having excellent perceived health status, having higher physical health score or mental health score, and having diabetes, relative to being married, having Medicare, having poor perceived health status, having lower physical health score or mental health score; and factors associated with increased inpatient expenditures included needing help in ADLs or IADLs, being a survivor of prostate cancer or colon cancer or other types of cancer, and having hypertension or heart disease. For outpatient expenditures (Appendix 11), living in the West, being older, being female, being Hispanic, being separated, having better perceived health status, having higher physical health score, and being a prostate cancer survivor, were among the most influential factors that were associated with decreased expenditures, relative to living in the North, being aged 65 to 74, being male, being non-Hispanic, being married, having

poor perceived health status, having lower physical health score, and having no prostate cancer; and having Medicare and private insurance, and having heart disease, were associated with increased outpatient expenditures, compared to having Medicare, and having no heart disease.

Most of the individual characteristics had a strong association with office-based visit expenditures (Appendix 12). Among the predisposing characteristics, living in the Midwest, being 85 and older, being female, being separated or never married, and having a larger household size were significantly associated with lower office-based visit expenditures, relative to living in the North, being aged 65 to 74, being male, being married, and having a smaller household size. Having Medicare and private insurance, being better educated, and having higher household income were all important enabling factors that were associated with increased expenditures, relative to having Medicare, having education level of less than high school, and being poor. Among the need factors, having better perceived health status and higher physical health score were associated with lower office-based visit expenditures, whereas being a survivor of skin cancer (nonmelanoma or unknown) or breast cancer or other types of cancer, and having heart disease or COPD/asthma or joint disorders or mental disorders were associated with higher expenditures.

Factors that were associated with significantly lower total expenditures included (Appendix 13): living the South (compared to living in the North), being 85 or older (compared to being aged 65 to 74), being female, being separated or never married (compared to being married), having a larger household size, being uninsured (compared to having Medicare), having better perceived health status, and having higher physical

health score or mental health score. Having Medicare and private insurance (compared to having Medicare), having higher education level, having higher income, needing help in ADLs and IADLs, and being a survivor of colon cancer or other types of cancer were associated with significantly more total expenditures. Most of the comorbidities were associated with higher total expenditures, except for diabetes and cerebrovascular disease, which showed no significant association.

For Medicare expenditures (Appendix 14), living in the South, being female, being separated, having better perceived health status, and having higher physical health score were associated with significantly lower expenditures, relative to living in the North, being male, being married, having poor perceived health status, and having lower physical health score. Having a master's/doctorate/professional degree (compared to having education level of less than high school), having ADL limitations, being a survivor of breast cancer or colon cancer or other types of cancer, and having heart disease or COPD/asthma or joint disorders or mental disorders were associated with significantly higher expenditures.

Panel Study

Effects of PCMH and PCMH Features on Healthcare Expenditures

The panel dataset constructed in Aim 2 was used to validate the effects of PCMH on healthcare expenditures. Three sets of fixed effects models were applied to each of the expenditures measures: 1) using the aggregated PCMH measure as the independent variable (Table 5.30); 2) using six PCMH domains as six independent variables in one regression model (Table 5.31); and 3) using “having a USC” or “having a USC with one

of the PCMH features” as an independent variable and analyzing six separated regression models (Table 5.32 to Table 5.37).

As shown in Table 5.30, the aggregated PCMH measure was significantly associated with none of the expenditure measures. When the six features of the PCMH were included in one model (Table 5.31), having comprehensive care and having compassionate care were associated with \$462.34 (P value < 0.05) and \$734.09 (P value < 0.1) more outpatient expenditures among older cancer survivors, controlling for other PCMH features and confounders. Having compassionate care was associated with \$1,110.36 (P value < 0.05) lower office-based visit expenditures, when other PCMH features and covariates were controlled. Having accessible care was significantly associated with lower annual healthcare expenditures, since total expenditures were reduced by \$1,694.42 (P value < 0.1) and Medicare expenditures were reduced by \$2,046.58 (P value < 0.05) among older cancer survivors, when other PCMH features and covariates were accounted for. When the characteristics of the USC was used separately as the independent variable for the outcome measures (Table 5.32 to Table 5.37), most of them did not show significant association with healthcare expenditures, except having a USC that was comprehensive was associated with \$423.19 (P value < 0.1) more outpatient expenditures, and having a USC that was accessible was associated with \$1,567.87 (P value < 0.1) less Medicare expenditures.

Table 5.30. Fixed Effects of Receipt of Care Consistent with a PCMH on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
PCMH	-43.13 (55.10)	794.77 (866.02)	146.84 (168.29)	-419.13 (461.51)	260.15 (1049.49)	-221.18 (880.59)

*P value < 0.1.

**P value < 0.05.

Table 5.31. Fixed Effects of PCMH Domains on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC	-44.03 (70.44)	362.81 (746.85)	220.66 (332.36)	-554.31 (716.65)	-223.06 (1130.29)	-775.07 (1004.31)
The Critical Role of USC in Total Care	8.16 (69.17)	-194.72 (1720.02)	187.55 (325.66)	1249.07 (1479.48)	1632.85 (2289.77)	2009.46 (2233.32)
Accessibility	1.54 (48.67)	-301.53 (850.67)	-277.39 (181.87)	-552.64 (436.35)	-1694.42* (1014.38)	-2046.58** (881.36)
Patient-centered Care	18.61 (57.10)	-262.74 (856.22)	-14.58 (205.53)	-94.45 (479.70)	-105.75 (1096.51)	487.55 (990.02)
Comprehensive Care	80.84 (73.24)	471.46 (1020.36)	462.34** (200.00)	209.39 (385.02)	1484.41 (1154.33)	1138.17 (1083.17)
Compassionate Care	-123.92 (173.90)	1285.82 (2359.33)	734.09* (376.39)	-1110.36** (487.36)	1241.37 (2592.66)	-484.22 (2195.46)

*P value < 0.1.

**P value < 0.05.

Table 5.32. Fixed Effects of Having a USC on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC	-37.02 (64.56)	276.71 (864.63)	254.41 (301.15)	-349.22 (505.98)	29.23 (1075.53)	-383.41 (969.91)

*P value < 0.1.

**P value < 0.05.

Table 5.33. Fixed Effects of Having a USC That Played a Critical Role on Total Care on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Played a Critical Role in Total Care	-30.92 (64.16)	-7.58 (878.20)	259.80 (287.33)	-272.32 (342.77)	-47.73 (1028.17)	-399.19 (905.79)

*P value < 0.1.

**P value < 0.05.

Table 5.34. Fixed Effects of Having a USC That Was Accessible on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Accessible	1.12 (47.74)	-158.00 (935.06)	90.92 (175.30)	-617.82 (474.60)	-1353.35 (1128.79)	-1576.87* (954.51)

*P value < 0.1.

**P value < 0.05.

Table 5.35. Fixed Effects of Having a USC That Was Patient-Centered on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Patient-Centered	-53.48 (60.10)	-257.58 (801.13)	81.86 (190.63)	-534.60 (457.19)	-959.71 (977.74)	-968.21 (894.59)

*P value < 0.1.

**P value < 0.05.

Table 5.36. Fixed Effects of Having a USC That Was Comprehensive on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Comprehensive	-32.92 (59.54)	251.29 (783.01)	423.19 (248.34)*	-347.97 (428.22)	578.28 (986.77)	-24.91 (886.96)

*P value < 0.1.

**P value < 0.05.

Table 5.37. Fixed Effects of Having a USC That Was Compassionate on Healthcare Expenditures among Older Cancer Survivors, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Compassionate	-72.94 (63.40)	71.81 (925.24)	334.75 (274.29)	-502.03 (469.14)	-92.64 (1134.743)	-513.98 (1008.93)

*P value < 0.1.

**P value < 0.05.

Characteristics of Older Cancer Survivors and Healthcare Expenditures

In the fixed effects models, the characteristics of older cancer survivors impacted their healthcare expenditures. For ED expenditures (Appendix 15), being divorced or separated (compared to being married), needing help in ADLs and having COPD/asthma were associated with significantly higher expenditures; and perceived health status to be very good was associated with lower expenditures. For inpatient expenditures (Appendix 16), having better perceived health status, and having higher physical health score or mental health score were associated with significantly lower inpatient expenditures, whereas needing help in ADLs and having heart disease were associated with higher inpatient expenditures. For outpatient expenditures (Appendix 17), factors associated with higher outpatient expenditures included having Medicare and other public insurance and having ADL limitations, relative to having Medicare and having no ADL limitations; and factors associated with lower outpatient expenditures included being near poor (compared to being poor), having higher physical health score, and having hypertension. For office-based visits expenditures (Appendix 18), having Medicare and private insurance was associated with significantly higher office-based visit expenditures compared to having Medicare, while having higher mental health score was associated with reduced office-based visit expenditures. For total expenditures (Appendix 19), older cancer survivors who were divorced, having better perceived health status, and having higher physical health score or mental health score, had significantly lower total healthcare expenditures, compared to those who were married, having poor perceived health status and having lower physical health score or mental health score; and needing help in ADLs and having mental disorders were associated with higher total healthcare

expenditures. For Medicare expenditures (Appendix 20), factors associated with higher expenditures included being separated (compared to being married), needing help in ADLs and having mental disorders; and factors associated with lower expenditures included having better perceived health status, and having higher physical health score or mental health score.

Change of PCMH Status and Healthcare Expenditures

In addition, the influence of the change in PCMH status on healthcare expenditures was explored, using the cross-sectional dataset constructed from the panel dataset, as described in Aim 2. The dependent variables were the second-year healthcare expenditures, and the independent variable was the status of PCMH of the two years in a panel survey. Generalized linear regression models with a gamma distribution and a log-link function were performed for each of the expenditure variables, controlling for the covariates. The results are summarized in Table 5.38. In this set of regressions, older cancer survivors who had a PCMH in the first year but had no PCMH in the second year, had 24.86% more total expenditures (difference of \$2985.26; P value < 0.05) than those who did not have a PCMH in either year, controlling for the covariates.

Table 5.38. Adjusted Average Healthcare Expenditures (\$) among Older Cancer Survivors Associated with Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey, MEPS Panels 13-17 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Without a PCMH in Year 1 and Year 2 (Reference)	321.88 (53.28)	5595.59 (1071.40)	1027.74 (133.06)	3059.92 (136.29)	12020.08 (464.53)	7843.78 (421.61)
With a PCMH in Year 1 and without a PCMH in Year 2	288.25 (54.60)	9128.82 (2769.19)	844.27 (177.84)	3923.45 (502.35)	15005.34 (1597.77)	10043.20 (1424.96)
Difference	-33.63 (59.91)	3533.23 (2644.99)	-183.47 (205.75)	863.54 (525.95)	2985.26* (1637.65)	2199.42 (1457.63)
Without a PCMH in Year 1 and with a PCMH in Year 2	254.79 (68.93)	4873.87 (1611.23)	1228.73 (276.12)	3304.32 (375.48)	12345.83 (1178.53)	7926.49 (985.69)
Difference	-67.09 (83.91)	-721.72 (1702.44)	200.99 (275.72)	244.40 (383.73)	325.75 (1182.40)	82.71 (999.58)
With a PCMH in Year 1 and Year 2	203.42 (65.69)	5219.74 (1729.64)	1351.49 (327.08)	2972.14 (267.93)	11627.29 (1082.97)	8206.49 (1049.39)
Difference	-118.46 (76.89)	-375.86 (1598.30)	323.76 (330.52)	-87.78 (298.85)	-392.79 (1066.64)	362.70 (1057.19)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Summary

This chapter described the results for Aim 1, Aim 2 and Aim 3 accordingly. The prevalence of a PCMH among older cancer survivors was summarized. Results of the ZIP regressions and NBRM for healthcare utilization and results of the generalized linear models for healthcare expenditures were presented. In addition, fixed effects of the PCMH on healthcare outcomes were explored. Moreover, this chapter discussed the associations between individual characteristics of older cancer survivors and healthcare outcomes based on the conceptual framework in Chapter III.

Results showed that the prevalence of the PCMH among older cancer survivors increased in recent years. Among older cancer survivors, having a PCMH was significantly associated with higher likelihood of having ED visits and outpatient visits. Healthcare utilization and healthcare expenditures were influenced significantly by the features of the PCMH.

For healthcare utilization among older cancer survivors, the analyses in the cross-sectional study showed that accessibility was the most important PCMH domain that was associated with significantly fewer ED visits; comprehensive care was associated with significantly more days of inpatient hospitalization; comprehensive care and compassionate care were associated with significantly more outpatient visits; and having a USC was significantly associated with more office-based visits. The findings of the panel study confirmed that among older cancer survivors, comprehensive care and compassionate care were associated with significantly more outpatient visits.

For healthcare expenditures among older cancer survivors, the analyses in the cross-sectional study showed that controlling for other PCMH domains and covariates, having

a USC or compassionate care was significantly associated with less ED expenditures, whereas the critical role of USC in total care and comprehensive care were significantly associated with more ED expenditures; for inpatient expenditures, patient-centered care and comprehensive care were significantly associated with more expenditures; accessibility was significantly associated with less outpatient expenditures, whereas compassionated care was significantly associated with more outpatient expenditures; patient-centered care was significantly associated with less total expenditures; for Medicare expenditures, having a USC that played a critical role in total care was significantly associated with less expenditures, whereas patient-centered care was significantly associated with more expenditures. The findings of the panel study showed that comprehensive care and compassionate care were significantly associated with more outpatient expenditures; compassionated care was associated with less office-based expenditures; and accessibility was the most important PCMH domain that was significantly associated with less total expenditures and less Medicare expenditures among older cancer survivors.

Chapter VI. Sensitivity Analysis

Older cancer survivors usually have complicated conditions (e.g. functional and cognitive impairment, comorbidities) that make health care more difficult and expensive (Nekhlyudov et al., 2014). To validate the effects of the PCMH in a larger sample, sensitivity analysis was conducted among the whole older population in MEPS 2008-2013 and MEPS Panels 13-17, using the same set of statistical methods performed for older cancer survivor sample, as described in Chapter IV. The results are presented in this chapter.

The Prevalence of the PCMH among Older Adults

To estimate the prevalence of having a PCMH among all U.S. older adults, the percentage of older adults were calculated and weighted using person-level weight, variance for primary survey unit and variance for strata, to provide an unbiased estimation that adjusted for complex survey design and oversampling. Older adults with a person weight greater than zero were included in the estimation, indicating they were members of the civilian, noninstitutionalized population for that year. In MEPS 2008-2013, the number of older adults was 23,248, and 22,639 (97.38%) of the older adults had a person weight greater than zero, representing 41,274,865 individuals of the U.S. population.

Table 6.1 shows the number of older adults, the number of older adults having a PCMH, the number of older adults having a partial PCMH, the prevalence of the PCMH, and the prevalence of the partial PCMH. The U.S. older adult population increased steadily each year. From 2008 to 2013, the number of older adults in the U.S. increased

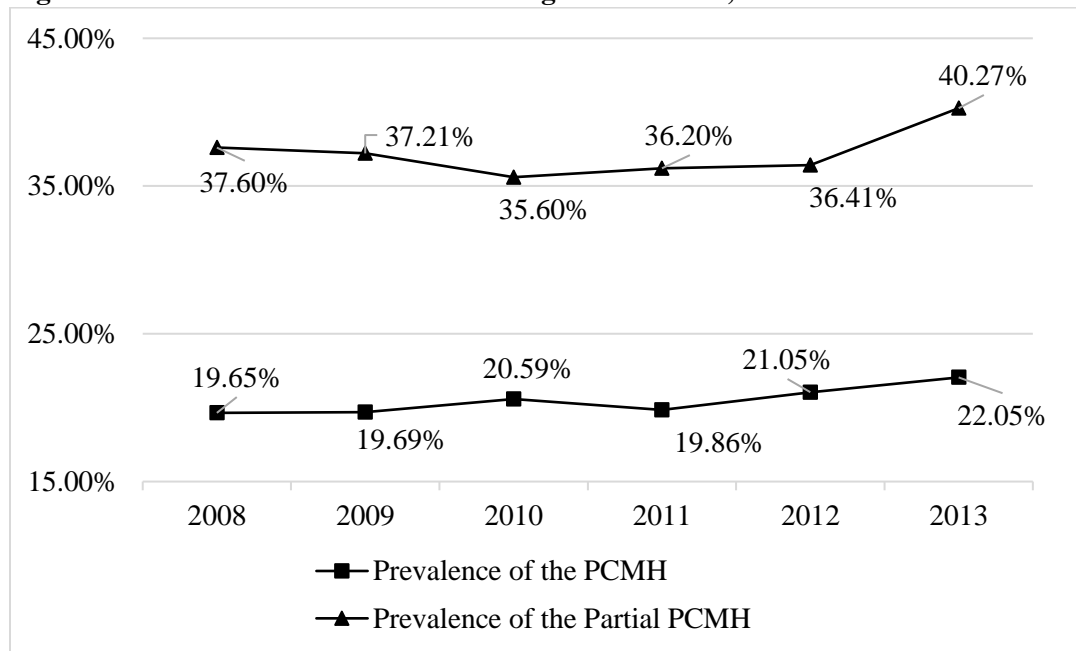
by 15.20%, from 38,183,912 to 45,026,788. Among the older adult sample in MEPS 2008-2013, 4,200 (18.55%) of the individuals had a PCMH, representing 8,472,209 of the U.S. population. The weighted percentage of the PCMH was 20.53% on average during the studied six years. The prevalence of the PCMH among older adults was 19.65%, 19.69%, 20.59%, 19.86%, 21.05%, 22.05% from 2008 to 2013, respectively. About 36% of the sample had a partial PCMH, representing 15,376,269 of the U.S. population. The prevalence of the partial PCMH among older adults was 37.60%, 37.21%, 35.60%, 36.20%, 36.41% and 40.27% from 2008 to 2013, respectively. The percentage of older adults without a USC stayed stable around 43% from 2008 to 2012, and reached the lowest at 37.68% in 2013.

Table 6.1. Prevalence of the PCMH among Older Adults, MEPS 2008-2013

Year	Number of Individuals		Number of Individuals with a PCMH		Prevalence of the PCMH		Number of Individuals with a Partial PCMH		Prevalence of the Partial PCMH	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
2008	3,296	38,183,912	595	7,503,285	18.05%	19.65%	1,228	14,358,127	37.26%	37.60%
2009	3,754	38,790,334	680	7,635,906	18.11%	19.69%	1,366	14,434,487	36.39%	37.21%
2010	3,598	39,811,334	689	8,198,628	19.15%	20.59%	1,241	14,172,717	34.49%	35.60%
2011	3,932	42,026,449	709	8,344,649	18.03%	19.86%	1,386	15,211,792	35.25%	36.20%
2012	4,183	43,810,376	781	9,222,331	18.67%	21.05%	1,453	15,949,229	34.74%	36.41%
2013	3,876	45,026,788	746	9,928,457	19.25%	22.05%	1,506	18,131,259	38.85%	40.27%
Total	22,639	41,274,865	4,200	8,472,209	18.55%	20.53%	8,180	15,376,269	36.13%	37.25%

Figure 6.1 shows the trend of the prevalence of the PCMH and the prevalence of the partial PCMH among older adults. The prevalence of the PCMH increased with some fluctuation in recent years. Starting from the lowest at 19.65% in 2008, the prevalence of the PCMH reached the highest at 22.05% in 2013 among older adults. Starting from 37.60% in 2008, the prevalence of the partial PCMH among older adults decreased to the lowest at 35.60% in 2010, then increased steadily and reached the highest at 40.27% in 2013.

Figure 6.1. Prevalence of the PCMH among Older Adults, MEPS 2008-2013



Compared with older cancer survivors (as shown previously in Table 5.1 and Figure 5.1), lower proportions of all older adults had a PCMH or a partial PCMH. Similar patterns were found for older cancer survivors and all older adults, in terms of the trend of the prevalence of the PCMH and the trend of the prevalence of the partial PCMH.

Healthcare Utilization among All Older Adults as a Function of PCMH

To further explore the effects of the PCMH, the studied applied the multivariate analysis to all individuals aged 65 and older in MEPS 2008-2013 and Panels 13-17, who had positive person weights and no missing data on the variables of interests. The sample sized of the cross-sectional dataset was 20,123, representing 37,459,285 of the U.S. population, among which the weighted percentage of older cancer survivors was 31.24%. The sample size of the panel dataset was 7,494, representing 33,708,141 of the U.S. population. In the regression models, instead of controlling for different types of cancer, a dummy variable was included, indicating whether the older adult was a cancer survivor.

Cross-sectional Study

Characteristics of Older Adults

The characteristics of older adults by receipt of care consistent with a PCMH in MEPS 2008-2013 are presented in Table 6.2. Among older adults, 40.73% of them did not have a USC, 38.38% of them had a USC with some but not all of the PCMH features (i.e. a partial PCMH), and 20.89% of them had a PCMH.

Table 6.2. Characteristics of Older Adults (N=20,123), by Receipt of Care Consistent with a PCMH in MEPS 2008-2013

Covariates	Weighted Percentages and Weighted Means ^a			
	Total	No USC (40.73%)	Partial PCMH (38.38%)	PCMH (20.89%)
External Environment				
<i>Geographic Region (%)</i>				
Northeast	19.00	15.24	20.13*	24.25*
Midwest	22.66	24.15	20.55	23.62
South	37.21	35.09	39.79*	36.62
West	21.14	25.53	19.54*	15.51*
Predisposing Characteristics				
<i>Age (%)</i>				
65-74	55.09	57.97	51.61*	55.86
75-84	32.67	30.33	34.68*	33.53*
85 and Older	12.25	11.70	13.71*	10.60
<i>Gender (%)</i>				
Female	56.34	53.71	59.18*	56.23*
Male	43.66	46.29	40.82*	43.77*
<i>Race (%)</i>				
White	86.73	85.60	86.59	89.16*
Black	8.30	9.07	8.41	6.60*
Other ^b	4.97	5.32	5.00	4.25
<i>Ethnicity (%)</i>				
Hispanic	6.96	8.51	6.36*	5.05*
Non-Hispanic	93.94	91.49	93.64*	94.95*
<i>Marital Status (%)</i>				
Married	54.72	54.25	52.67	59.43*
Widowed	28.09	26.48	30.72*	26.39
Divorced	11.99	13.61	11.23*	10.22*
Separated	1.18	1.27	1.32	0.75*
Never Married	4.02	4.39	4.06	3.21*
<i>Household Size (SE)</i>	1.96 (2.38)	2.03 (2.29)	1.89 (1.55)*	1.95 (1.56)*

Table 6.2. Continued

Enabling Resources				
<i>Insurance (%)</i>				
Medicare Only	36.30	37.13	36.78	33.80*
Medicare and Private Insurance	52.75	51.02	51.85	57.78*
Medicare and Other Public Insurance	9.81	10.24	10.59	7.53*
Uninsured	1.15	1.62	0.78*	0.89*
<i>Education Level (%)</i>				
Less Than High School	19.56	20.52	20.16	16.58*
GED or High School Graduate	33.46	32.93	33.88	33.71
Some College	21.69	21.75	21.13	22.61
4-Year college or Bachelor's Degree	13.58	13.80	13.15	13.95
Master's or Doctorate or Professional Degree	11.71	11.00	11.67	13.15*
<i>Poverty Level (%)</i>				
Poor	8.81	9.03	9.44	7.23*
Near Poor	6.50	6.38	7.02	5.77
Low Income	17.63	17.96	18.32	15.69*
Middle Income	29.74	29.09	30.56	29.48
High Income	37.33	37.53	34.67*	41.83*

Table 6.2. Continued

Need Factors				
<i>Cancer Diagnosis (%)</i>	31.24	28.96	32.10*	34.10*
<i>Perceived Health Status (%)</i>				
Poor Health	3.31	3.06	4.36*	1.84*
Fair	15.96	16.30	17.70	12.12*
Good	33.73	33.79	34.74	31.72
Very Good	34.78	35.06	32.55*	38.32*
Excellent	12.23	11.79	10.64	15.99*
<i>Physical Health Score (SE)</i>	41.67 (20.68)	41.93 (17.27)	40.28 (19.81)*	43.71 (17.33)*
<i>Mental Health Score (SE)</i>	52.33 (17.48)	52.19 (14.92)	51.64 (17.82)*	53.87 (11.51)*
<i>Comorbidity (%)</i>				
Diabetes	23.88	22.52	25.35*	23.82
Hypertension	66.66	63.92	68.96*	67.79*
Heart Conditions	34.23	31.96	36.96*	33.64
Cerebrovascular Disease	6.85	6.38	7.80*	6.02
COPD or Asthma	29.00	26.86	31.49*	28.61
Arthritis or Joint Disorders	53.68	51.97	56.76*	51.36
Mental Disorders	22.94	22.00	25.47*	20.15
<i>ADLs (%)</i>	9.01	8.95	10.61*	6.20*
<i>IADLs (%)</i>	16.00	16.00	18.58*	11.27*

a. The figures represent the national population of older adults.

b. Other race includes American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, and multiple races.

c. Other cancer includes bladder cancer, blood cancer, cervix cancer, lung cancer, lymph cancer, muscle cancer, uterus cancer, bone cancer, brain cancer, gallbladder cancer, kidney cancer, liver cancer and other types of cancer.

*Significantly different with “No USC” at P value < 0.05 in T-test or Chi-square test.

Effects of PCMH on Healthcare Utilization

The adjusted associations of the partial PCMH and the PCMH with healthcare utilization are presented in Table 6.3, using “No USC” as the reference group. The results showed that older adults with a partial PCMH were more likely to have ED visits. Having a partial PCMH was associated with higher likelihood of having days of inpatient hospitalization, whereas having a PCMH was associated with lower likelihood of having days of inpatient hospitalization. Having a partial PCMH or a PCMH increased the likelihood of having outpatient visits. Having a partial PCMH was associated with 8% more office-based visits (IRR = 1.08; 95% CI = 1.03-1.13; P value < 0.05), and having a PCMH was associated with 8% more office-based visits (IRR = 1.08; 95% CI = 1.03-1.14; P value < 0.05).

Table 6.3. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
No USC (reference)	1.00	1.00	1.00	1.00
Partial PCMH	0.97 (0.83-1.15)	1.07 (0.92-1.25)	0.94 (0.75-1.18)	1.08 (1.03-1.13)**
PCMH	0.91 (0.73-1.14)	1.04 (0.89-1.22)	0.98 (0.84-1.16)	1.08 (1.03-1.14)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.88-1.22)	1.02 (0.90-1.16)	1.24 (1.05-1.47)	1.29 (1.23-1.36)**
	Predicted Probabilities of Being a Non-User (95% CI)			
No USC (reference)	0.60 (0.59-0.61)	0.84 (0.84-0.84)	0.69 (0.68-0.69)	N/A
Partial PCMH	0.56 (0.56-0.57)**	0.83 (0.82-0.83)**	0.61 (0.61-0.62)**	N/A
PCMH	0.59 (0.59-0.60)	0.85 (0.84-0.85)**	0.61 (0.60-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Effects of PCMH Features on Healthcare Utilization

Table 6.4 summarizes the weighted percentages of older adults by reported PCMH features. Among the older adults, 59.27% of them had a USC. The most common PCMH feature was that the USC played a critical role in total care, with 58.46% of people reporting this feature. The least common PCMH feature was that the USC was accessible, with only 28.14% of people reporting this feature.

Table 6.4. Weighted Percentages of Older Adults with a USC Reporting That Their USC Has Specific PCMH Features (N=20,123)^a

Features	% Responding Affirmatively
Having a USC	59.27%
Having a USC That Played a Critical Role in Total Care	58.46%
Having a USC That Was Accessible	28.14%
Having a USC That Was Patient-centered	49.52%
Having a USC That Was Comprehensive	49.60%
Having a USC That Was Compassionate	56.78%

a. The figures represent the national population of older adults.

Table 6.5 presents the adjusted associations for the six PCMH domains, which were included in one regression model for each of the healthcare utilization variables. For ED visits, having a USC and the critical of USC in total care were associated with higher likelihood of having ED visits, whereas accessibility, patient-centered care, comprehensive care and compassionate care were associated with lower likelihood of having ED visits. For inpatient utilization, having a USC that played a critical role in total care was associated with 25% fewer days of inpatient hospitalizations (IRR = 0.75; 95% CI = 0.54-1.05; P value < 0.1). Having a USC and the critical of USC in total care increased the likelihood of having days of inpatient hospitalization, whereas accessibility, patient-centered care, comprehensive care and compassionate care decreased the likelihood having inpatient hospitalization. For outpatient visits, the PCMH domains that were associated with an increased likelihood of being a healthcare user included having a

USC, the critical role of USC in total care, accessibility and patient-centered care; and the PCMH domains that were associated with a decreased likelihood of being a healthcare user included comprehensive care and compassionated care. For office-based visits, older adults with a USC made 4% more office-based visits (IRR = 1.04; 95% CI = 1.00-1.09; P value < 0.05), compared to those without a USC, when other PCMH domains and covariates were controlled. Having a USC that played a critical role in total care was associated with 26% more office-based visits (IRR = 1.26; 95% CI = 1.13-1.41; P value < 0.05). Moreover, having patient-centered care significantly increased the office-based visits by 7% (IRR = 1.07; 95% CI = 1.01-1.13; P value < 0.05), controlling for the rest of PCMH domains and other individual characteristics.

Table 6.5. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with PCMH Domains, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Having a USC				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.80-1.12)	1.11 (0.98-1.26)	0.96 (0.8-1.15)	1.04 (1.00-1.09)**
The Critical Role of USC in Total Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.04 (0.77-1.39)	0.75 (0.54-1.05)*	0.93 (0.59-1.47)	1.26 (1.13-1.41)**
Accessibility				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.94 (0.80-1.10)	0.98 (0.88-1.10)	0.88 (0.76-1.03)	1.02 (0.97-1.07)
Patient-centered Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.08 (0.87-1.35)	0.97 (0.82-1.15)	1.08 (0.82-1.42)	1.07 (1.01-1.13)**
Comprehensive Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.12 (0.91-1.37)	1.08 (0.92-1.26)	1.12 (0.89-1.42)	0.98 (0.94-1.03)
Compassionate Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.83 (0.61-1.12)	1.08 (0.86-1.38)	1.42 (0.92-2.17)	1.06 (0.97-1.17)
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.87-1.21)	1.02 (0.90-1.15)	1.24 (1.05-1.47)**	1.29 (1.23-1.36)**

Table 6.5. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC				
No (reference)	0.60 (0.59-0.60)	0.84 (0.84-0.84)	0.68 (0.68-0.69)	N/A
Yes	0.57 (0.57-0.58)**	0.83 (0.83-0.84)**	0.61 (0.60-0.62)**	N/A
The Critical Role of USC in Total Care				
No (reference)	0.59 (0.58-0.60)	0.86 (0.86-0.87)	0.76 (0.75-0.77)	N/A
Yes	0.58 (0.58-0.59)*	0.83 (0.83-0.84)**	0.63 (0.63-0.64)**	N/A
Accessibility				
No (reference)	0.57 (0.56-0.57)	0.83 (0.82-0.83)	0.65 (0.64-0.65)	N/A
Yes	0.60 (0.59-0.60)**	0.85 (0.84-0.85)**	0.64 (0.63-0.64)**	N/A
Patient-centered Care				
No (reference)	0.56 (0.55-0.57)	0.83 (0.82-0.83)	0.67 (0.67-0.68)	N/A
Yes	0.59 (0.58-0.59)**	0.84 (0.84-0.84)**	0.63 (0.63-0.64)**	N/A
Comprehensive Care				
No (reference)	0.51 (0.50-0.52)	0.82 (0.81-0.83)	0.63 (0.62-0.63)	N/A
Yes	0.60 (0.59-0.60)**	0.84 (0.84-0.84)**	0.64 (0.64-0.65)**	N/A
Compassionate Care				
No (reference)	0.55 (0.54-0.57)	0.79 (0.78-0.80)	0.59 (0.58-0.61)	N/A
Yes	0.58 (0.58-0.59)**	0.84 (0.84-0.84)**	0.64 (0.64-0.65)**	N/A
Cancer Diagnosis				
No (reference)	0.59 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.66-0.68)	N/A
Yes	0.55 (0.54-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.58)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.6 to Table 6.11 summarizes the adjusted associations of models where “having a USC” or “having a USC with one of the PCMH features” were used as the independent variable separately for each of the dependent variables, controlling for the covariates. For ED utilization, having a USC, having a USC that played a critical role in total care, having a USC that was accessible and having a USC that was compassionate were associated with higher likelihood of having ED visits, whereas having a USC that was patient-centered was associated with lower likelihood of having ED visits. For inpatient utilization, having a USC that was comprehensive was associated with 12% more days of hospitalization (IRR = 1.12; 95% CI = 0.99-1.27; P value < 0.1). Having a USC and having a USC that played a critical role in total care increased the likelihood of having days of inpatient hospitalizations, whereas having a USC that was accessible and having a USC that was patient-centered decreased the likelihood of having days of inpatient hospitalizations. For outpatient visits, having a USC or having a USC with any one of the PCMH features significantly increased the likelihood of having outpatient visits. Increased office-based visits were found for older adults with a USC and when the USC had one of the PCMH features, that is, the number of office-based visits increased by 8% among older adults who had a USC (IRR = 1.08; 95% CI = 1.04-1.13; P value < 0.05), by 8% among older adults who had a USC that played a critical role in total care (IRR = 1.08; 95% CI = 1.03-1.12; P value < 0.05), by 6% among older adults who had a USC that was accessible (IRR = 1.06; 95% CI = 1.01-1.11; P value < 0.05), by 7% among older adults who had a USC that was patient-centered (IRR = 1.07; 95% CI = 1.03-1.11; P value < 0.05), by 5% among older adults who had a USC that was comprehensive (IRR = 1.05; 95% CI = 1.01-1.09; P value < 0.05), and by 8% among

older adults who had USC that was compassionate (IRR = 1.08; 95% CI = 1.04-1.13; P value < 0.05).

Statistics in the cross-sectional dataset (Table 6.3, Table 6.5 to Table 6.11) showed that older cancer survivors had approximately 25% more outpatient visits (P value < 0.05) and about 30% more office-based visits (P value < 0.05) than those who did not have cancer, and they were more likely to have ED visits (P value < 0.05) inpatient hospitalizations (P value < 0.05) and outpatient visits (P value < 0.05), when the covariates were accounted for.

Table 6.6. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Having a USC				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.96 (0.82-1.12)	1.06 (0.93-1.22)	0.95 (0.8-1.14)	1.08 (1.04-1.13)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.88-1.21)	1.02 (0.9-1.16)	1.24 (1.05-1.48)**	1.29 (1.23-1.36)**
	Predicted Probabilities of Being a Non-User (95% CI)			
Having a USC				
No (reference)	0.60 (0.59-0.61)	0.84 (0.84-0.84)	0.69 (0.68-0.69)	N/A
Yes	0.57 (0.57-0.58)**	0.83 (0.83-0.84)**	0.61 (0.61-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.7. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC That Played a Critical Role in Total Care, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC That Played a Critical Role in Total Care				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.81-1.11)	1.07 (0.94-1.22)	0.94 (0.79-1.12)	1.08 (1.03-1.12)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.88-1.21)	1.02 (0.9-1.16)	1.24 (1.05-1.48)**	1.29 (1.23-1.36)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC That Played a Critical Role in Total Care				
No (reference)	0.60 (0.60-0.61)	0.84 (0.84-0.84)	0.68 (0.68-0.69)	N/A
Yes	0.57 (0.57-0.58)**	0.84 (0.83-0.84)*	0.61 (0.61-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.8. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC That Was Accessible, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC That Was Accessible				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.86 (0.72-1.04)	1.01 (0.89-1.16)	0.94 (0.81-1.10)	1.06 (1.01-1.11)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.04 (0.88-1.22)	1.03 (0.90-1.17)	1.25 (1.05-1.48)**	1.29 (1.23-1.36)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC That Was Accessible				
No (reference)	0.59 (0.58-0.59)	0.83 (0.83-0.84)	0.65 (0.65-0.66)	N/A
Yes	0.57 (0.56-0.57)**	0.85 (0.84-0.85)**	0.61 (0.60-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.59 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.55 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.9. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC That Was Patient-Centered, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Having a USC That Was Patient-Centered				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.01 (0.86-1.19)	1.04 (0.91-1.19)	1.05 (0.92-1.21)	1.07 (1.03-1.11)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.87-1.21)	1.02 (0.9-1.16)	1.24 (1.04-1.48)**	1.29 (1.23-1.36)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC That Was Patient-Centered				
No (reference)	0.58 (0.57-0.58)	0.83 (0.83-0.84)	0.67 (0.66-0.68)	N/A
Yes	0.59 (0.59-0.60)**	0.84 (0.84-0.85)**	0.61 (0.61-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.10. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC That Was Comprehensive, MEPS 2008-2013 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Having a USC That Was Comprehensive				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.97 (0.83-1.14)	1.12 (0.99-1.27)*	0.99 (0.86-1.13)	1.05 (1.01-1.09)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.87-1.22)	1.02 (0.9-1.16)	1.25 (1.05-1.48)**	1.30 (1.23-1.36)**
	Predicted Probabilities of Being a Non-User (95% CI)			
Having a USC That Was Comprehensive				
No (reference)	0.59 (0.58-0.59)	0.84 (0.83-0.84)	0.67 (0.66-0.67)	N/A
Yes	0.58 (0.58-0.59)	0.84 (0.83-0.84)	0.62 (0.61-0.62)**	N/A
Cancer Diagnosis				
No (reference)	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.11. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Having a USC That Was Compassionate, MEPS 2008-2013^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	IRR (95% CI)			
Having a USC That Was Compassionate				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.95 (0.81-1.11)	1.05 (0.92-1.20)	1.03 (0.89-1.19)	1.08 (1.04-1.13)**
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	1.03 (0.88-1.21)	1.02 (0.90-1.16)	1.24 (1.05-1.48)**	1.29 (1.23-1.36)**
Predicted Probabilities of Being a Non-User (95% CI)				
Having a USC That Was Compassionate				
No (reference)	0.59 (0.59-0.60)	0.83 (0.83-0.84)	0.68 (0.67-0.68)	N/A
Yes	0.58 (0.57-0.58)**	0.84 (0.83-0.84)	0.61 (0.61-0.62)**	N/A
Cancer Diagnosis				
No	0.60 (0.59-0.60)	0.85 (0.85-0.85)	0.67 (0.67-0.68)	N/A
Yes	0.56 (0.55-0.56)**	0.81 (0.80-0.81)**	0.58 (0.57-0.59)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Panel Study

Characteristics of Older Adults

Characteristics of older adults (N=7,494) by receipt of care consistent with a PCMH during the two years of a panel survey in MEPS Panels 13-17 is summarized in Table 6.12. Among older adults, approximately 10% of them had a PCMH in both years of a panel; about two thirds (66.62%) of older adults did not have a PCMH in either year; 11.13% of older adults had a PCMH in the first year and did not have a PCMH in the second year; and 12.27% of older adults did not have a PCMH in the first year but had one in the second year.

Table 6.12. Characteristics of Older Adults (N=7,494), by Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey in MEPS Panels 13-17

Covariates	Weighted Percentages and Weighted Means ^a				
	Total	Without a PCMH in Year 1 and Year 2 (66.62%)	With a PCMH in Year 1 and without a PCMH in Year 2 (11.13%)	Without a PCMH in Year 1 and with a PCMH in Year 2 (12.27%)	With a PCMH in Year 1 and Year 2 (9.98%)
External Environment					
<i>Geographic Region (%)</i>					
Northeast	19.07	17.36	23.15*	20.00	24.79*
Midwest	22.98	22.63	25.46	22.15	23.60
South	36.78	36.48	36.44	39.15	36.28
West	21.16	23.53	14.94*	18.69	15.33*
Predisposing Characteristics					
<i>Age (%)</i>					
65-74	56.24	56.52	54.18	53.66	59.80
75-84	32.83	32.35	31.92	36.94*	32.00
85 and Older	10.93	11.12	13.90	9.39	8.19
<i>Gender (%)</i>					
Female	56.46	56.42	59.44	56.36	53.50
Male	43.54	43.58	40.56	43.64	46.50
<i>Race (%)</i>					
White	87.05	85.95	89.77*	88.8*	89.13
Black	8.04	8.92	6.18*	6.36*	6.33
Other ^b	4.92	5.13	4.05	4.84	4.54
<i>Ethnicity (%)</i>					
Hispanic	6.92	7.92	5.70	4.91*	4.11*
Non-Hispanic	93.08	92.08	94.30	95.09	95.89

Table 6.12. Continued

<i>Marital Status (%)</i>					
Married	55.46	53.88	55.64	57.10	63.77*
Widowed	28.03	28.23	29.85	29.64	22.73*
Divorced	11.22	11.98	10.27	9.22*	9.61
Separated	1.25	1.48	0.92	0.77	0.65*
Never Married	4.05	4.43	3.32	3.27	3.24
<i>Household Size (SE)</i>	1.89 (1.46)	1.89 (1.40)	1.83 (0.90)	1.93 (1.07)	1.9 (0.98)
Enabling Resources					
<i>Insurance (%)</i>					
Medicare Only	37.15	38.02	36.25	37.52	31.91*
Medicare and Private Insurance	52.21	50.28	53.86	53.36	61.82*
Medicare and Other Public Insurance	9.56	10.53	9.09	7.94*	5.57*
Uninsured	1.08	1.16	0.80	1.18	0.70
<i>Education Level (%)</i>					
Less Than High School	18.82	20.25	18.10	15.03*	14.72*
GED or High School Graduate	34.34	34.01	36.25	36.14	32.18
Some College	21.12	20.35	21.38	24.34*	22.07
4-Year college or Bachelor's Degree	13.99	14.11	13.23	12.98	15.28
Master's or Doctorate or Professional Degree	11.73	11.28	11.04	11.50	15.75*
<i>Poverty Level (%)</i>					
Poor	11.26	11.79	12.62	9.61	8.28
Near Poor	5.95	6.34	5.26	5.27	4.92
Low Income	16.32	16.60	16.81	14.20	16.52
Middle Income	29.43	29.91	28.18	30.07	26.79
High Income	37.04	35.35	37.14	40.85*	43.50*

Table 6.12. Continued

Need Factors					
<i>Cancer Diagnosis (%)</i>	30.15	28.50	33.30*	35.49*	31.06
<i>Perceived Health Status (%)</i>					
Poor Health	1.83	2.25	1.76	0.90*	0.23*
Fair	12.34	14.21	10.49*	8.61*	6.57*
Good	31.16	32.33	30.26	30.78	24.78*
Very Good	38.73	37.21	38.57	43.04*	43.75*
Excellent	15.94	14.00	18.92*	16.68	24.68*
<i>Physical Health Score (SE)</i>	41.78(14.94)	40.94(14.18)	42.47(11.44)*	42.77(11.82)*	45.42(11.73)*
<i>Mental Health Score (SE)</i>	52.57(12.11)	51.96(11.82)	53.19(9.77)*	53.39(8.74)*	54.87(7.29)*
<i>Comorbidity (%)</i>					
Diabetes	24.79	25.03	23.60	25.07	24.19
Hypertension	71.15	70.98	73.28	71.36	69.59
Heart Conditions	38.22	38.06	37.97	42.42	34.40
Cerebrovascular Disease	8.37	8.99	8.39	7.62	5.21*
COPD or Asthma	35.12	35.03	35.58	37.48	32.33
Arthritis or Joint Disorders	62.93	63.81	61.12	64.67	56.92*
Mental Disorders	25.86	26.99	25.44	25.01	19.81*
<i>ADLs (%)</i>	10.65	11.92	10.81	8.20*	5.00*
<i>IADLs (%)</i>	17.66	19.70	16.70	13.62*	10.09*

a. The figures represent the national population of older adults.

b. Other race includes American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, and multiple races.

*Significantly different with “Without a PCMH in Year 1 and Year 2” at P value < 0.05 in T-test or Chi-square test.

Effects of PCMH and PCMH Features on Healthcare Utilization

Table 6.13 to Table 6.20 present the regression coefficients of the fixed effects models conducted among older adults regarding the effects of PCMH on healthcare utilization. For inpatient utilization, having a USC that was accessible was associated with 0.273 fewer inpatient days (P value < 0.1). Older adults who had patient-centered care made 0.285 more outpatient visits (P value < 0.05) when other PCMH features and covariates were accounted for. For office-based visits, when the six PCMH domains were included in one model, having a USC was associated with 0.709 more office-based visits (P value < 0.1), having a USC that played a critical role in total care was associated with 1.232 more office-based visits (P value < 0.05), whereas having accessible care was associated with 0.458 fewer office-based visits among older adults (P value < 0.1). When the PCMH features of a USC were analyzed separately, older adults who had a USC made 0.942 more office-based visits (P value < 0.05) compared to those who did not had a USC; having a USC that played a critical role in total care increased the number of office-based visits by 1.013 (P value < 0.05); having a USC that was patient-centered was associated with 0.670 more office-based visits (P value < 0.05); and having a USC that was compassionate was associated with 0.724 more office-based visits (P value < 0.05). No significant effects of PCMH features were found for ED visits.

Table 6.13. Fixed Effects of Receipt of Care Consistent with a PCMH on Healthcare Utilization among Older Adults, MEPS Panels 13-17

a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
PCMH	-0.031 (0.020)	-0.168 (0.154)	0.157 (0.107)	-0.324 (0.348)

a. Full regression models are summarized in Appendix 5 to Appendix 8.

*P value < 0.1.

**P value < 0.05.

Table 6.14. Fixed Effects of PCMH Domains on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC	0.032 (0.024)	0.095 (0.237)	0.245 (0.189)	0.709 (0.404)*
The Critical Role of USC in Total Care	-0.022 (0.039)	-0.229 (0.413)	-0.362 (0.255)	1.232 (0.570)**
Accessibility	-0.023 (0.017)	-0.067 (0.132)	0.044 (0.076)	-0.458 (0.267)*
Patient-centered Care	-0.001 (0.024)	-0.059 (0.198)	0.285 (0.131)**	0.064 (0.332)
Comprehensive Care	0.012 (0.023)	0.166 (0.202)	-0.115 (0.145)	-0.186 (0.323)
Compassionate Care	-0.062 (0.053)	0.075 (0.587)	0.066 (0.197)	-0.353 (0.614)

*P value < 0.1.

**P value < 0.05.

Table 6.15. Fixed Effects of Having a USC on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC	0.027 (0.023)	0.045 (0.243)	0.216 (0.169)	0.942 (0.380)**

*P value < 0.1.

**P value < 0.05.

Table 6.16. Fixed Effects of Having a USC That Played a Critical Role on Total Care on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Played a Critical Role in Total Care	0.024 (0.022)	0.031 (0.238)	0.203 (0.164)	1.013 (0.370)**

*P value < 0.1.

**P value < 0.05.

Table 6.17. Fixed Effects of Having a USC That Was Accessible on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Accessible	-0.021 (0.020)	-0.273 (0.154)*	0.124 (0.094)	0.027 (0.313)

*P value < 0.1.

**P value < 0.05.

Table 6.18. Fixed Effects of Having a USC That Was Patient-Centered on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Patient-Centered	0.001 (0.020)	-0.090 (0.175)	0.215 (0.133)	0.670 (0.325)**

*P value < 0.1.

**P value < 0.05.

Table 6.19. Fixed Effects of Having a USC That Was Comprehensive on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Comprehensive	0.013 (0.019)	0.043 (0.183)	0.084 (0.135)	0.219 (0.325)

*P value < 0.1.

**P value < 0.05.

Table 6.20. Fixed Effects of Having a USC That Was Compassionate on Healthcare Utilization among Older Adults, MEPS Panels 13-17

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Having a USC That Was Compassionate	0.003 (0.023)	0.126 (0.242)	0.226 (0.152)	0.724 (0.350)**

*P value < 0.1.

**P value < 0.05.

Change of PCMH Status and Healthcare Utilization

The adjusted associations regarding the relationship between the change in PCMH status and healthcare utilization among older adults are summarized in Table 6.21. For ED utilization, having a PCMH in year 1 but having no PCMH in year 2 was associated with lower likelihood of having ED visits, whereas having no PCMH in year 1 but having a PCMH in year 2, and having a PCMH in both years of a panel study were associated with higher likelihood of having ED visits, compared to having no PCMH in either year. In contrast, for inpatient utilization, older adults having a PCMH in year 1 but having no PCMH in year 2 were more likely to have inpatient days, whereas those having no PCMH in year 1 but having a PCMH in year 2, and those having a PCMH in both years of a panel study were less likely to have inpatient days, compared to those having no PCMH in either year. For outpatient utilization, compared to older adults who did not have a PCMH in both years of a panel study, those who had a PCMH year 1 but had no PCMH year 2 made 17% fewer outpatient visits (IRR = 0.83; 95% CI = 0.67-1.03; P value < 0.1); and older adults who had PCMH in one of the two years or both years of a panel study were more likely to make outpatient visits. For office-based visits, having a PCMH in the first year but no PCMH in the second year was associated with 15% more visits (IRR = 1.15; 95% CI = 1.04-1.26; P value < 0.05); and having a PCMH in both years of a panel study was associated with 10% more visits (IRR = 1.10; 95% CI = 1.16-1.34; P value < 0.1) among older adults.

Table 6.21. Incidence Rate Ratios and Predicted Probabilities of Healthcare Utilization among Older Adults Associated with Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey, MEPS Panels 13-17 ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
IRR (95% CI)				
Without a PCMH in Year 1 and Year 2 (reference)	1.00	1.00	1.00	1.00
With a PCMH in Year 1 and without a PCMH in Year 2	1.24 (0.90-1.71)	1.19 (0.89-1.59)	0.83 (0.67-1.03)*	1.15 (1.04-1.26)**
Without a PCMH in Year 1 and with a PCMH in Year 2	0.80 (0.55-1.17)	1.03 (0.78-1.37)	1.04 (0.79-1.37)	1.07 (0.99-1.16)
With a PCMH in Year 1 and Year 2	0.66 (0.36-1.22)	1.15 (0.78-1.67)	1.06 (0.74-1.52)	1.10 (0.99-1.21)*
Cancer Diagnosis				
No (reference)	1.00	1.00	1.00	1.00
Yes	0.80 (0.61-1.03)*	0.85 (0.68-1.07)	1.06 (0.87-1.28)	1.25 (1.16-1.34)**
Predicted Probabilities of Being a Non-User				
Without a PCMH in Year 1 and Year 2 (reference)	0.53 (0.52-0.54)	0.83 (0.83-0.84)	0.63 (0.63-0.64)	N/A
With a PCMH in Year 1 and without a PCMH in Year 2	0.58 (0.56-0.60)**	0.82 (0.81-0.83)**	0.61 (0.59-0.62)**	N/A
Without a PCMH in Year 1 and with a PCMH in Year 2	0.49 (0.47-0.51)**	0.85 (0.84-0.86)**	0.59 (0.58-0.61)**	N/A
With a PCMH in Year 1 and Year 2	0.47 (0.45-0.49)**	0.84 (0.83-0.85)**	0.56 (0.54-0.58)**	N/A
Cancer Diagnosis				
No (reference)	0.56 (0.55-0.57)	0.84 (0.84-0.85)	0.64 (0.64-0.65)	N/A
Yes	0.45 (0.43-0.46)**	0.81 (0.81-0.82)**	0.57 (0.56-0.58)**	N/A

a. Zero-inflated Poisson regressions were conducted for ED visits, inpatient days, and outpatient visits; and negative binomial regressions were conducted for office-based visits.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Healthcare Expenditures among All Older Adults as a Function of PCMH

To examine the effects of the PCMH on healthcare expenditures in a larger sample, the cross-sectional dataset which included all the older adults who had positive person weights and no missing data on the variables of interests in MEPS 2008-2013 was used to study the annual ED expenditures, inpatient expenditures, outpatient expenditures, office-based visit expenditures, total expenditures; and the characteristics of older adults by receipt of care consistent with a PCMH were described previously in Table 6.2. For the Medicare expenditures, a cross-sectional dataset that included older adults with Medicare was constructed based on insurance types; by combining the previous 6-year data, the sample size was 19,827, representing 37,029,497 of the U.S. population. For the panel study, the panel dataset which included all the older adults was used to analyze all the expenditure variables; and the characteristics of older adults by receipt of care consistent with a PCMH were described previously in Table 6.12. Regression results of the key independent variables are summarized in Table 6.22 to Table 6.38.

Cross-Sectional Study

Effects of PCMH and PCMH Features on Healthcare Expenditures

Table 6.22 presents the adjusted average healthcare expenditures associated with the partial PCMH and the PCMH. On averages, older adults who had a PCMH had 17.12% more outpatient expenditures (difference of \$109.49; P value < 0.1) when the covariates were controlled. Among older adults who had a partial PCMH, the mean of office-based visit expenditures increased by 6.82% (difference of \$156.79; P value < 0.1) and the mean of Medicare expenditures increased by 7.04% (difference of \$444.93; P value <

0.1). In this set of regressions, no significant association was found for ED expenditures, inpatient expenditures and total expenditures at a 10% level of significance.

When the six domains of the PCMH were included in one regression model for each of the dependent variables (Table 6.23), significant effects showed on several aspects. For ED expenditures, older adults with a USC had 14.70% lower expenditures (difference of -\$43.60; P value < 0.1) than those without a USC, controlling for other PCMH features and covariates. Having patient-centered care was associated with 27.63% more outpatient expenditures on average (difference of \$156.16; P value < 0.05). For office-based expenditures, having a USC that played a critical role in total care increased the mean expenditures by 23.61% (difference of \$462.60; P value < 0.05), and having patient-centered care increased the mean expenditures by 10.63% (difference of \$234.20; P value < 0.05). The mean of total expenditures increased by 11.40% among older adults who had a USC playing a critical role in total care (difference of \$1067.81; P value < 0.05), when other features of the PCMH and covariates were accounted for. Inpatient expenditures and Medicare expenditures were not significantly impacted by the PCMH domains.

Table 6.24 to Table 6.29 summarizes the adjusted average healthcare expenditures of regression models where “having a USC” or “having a USC with one of the PCMH features” were used as the independent variable for each of the expenditures variables, controlling for the covariates. The average of ED expenditures reduced by 15.04% among older adults who had a USC (difference of -\$44.44; P value < 0.1), by 14.53% among older adults who had a USC playing critical role in total care (difference of -\$42.74; P value < 0.1), by 15.25% among older adults who had a USC that was accessible

(difference of -\$42.56; P value < 0.1), by 13.93% among older adults who had a USC that was patient-centered (difference of -\$39.99; P value < 0.1), and by 18.70% among older adults who had a USC that was compassionate (difference of -\$56.31; P value < 0.05). The mean of outpatient expenditures increased significantly when older adults had a USC or the USC had one of the PCMH features, for example, having a USC was associated with a 13.20% increase (difference of \$84.24; P value < 0.1), having a USC that played a critical role in total care was associated with a 12.52% increase (difference of \$80.57; P value < 0.1), having a USC that was patient-centered was associated with a 22.26% increase (difference of \$138.27; P value < 0.05), and having a USC that was compassionate was associated with a 17.35% increase (difference of \$109.02; P value < 0.05). For office-based visits expenditures, it increased by 5.76% among older adults who had a USC (difference of \$132.77; P value < 0.1), and by 6.93% among older adults who had a USC that was compassionate (difference of \$158.12; P value < 0.05). Medicare expenditures increased by 7.36% on average among older adults who had a USC (difference of \$463.20; P value < 0.1), by 6.61% among older adults who had a USC playing a critical role in total care (difference of \$415.79; P value < 0.1), and by 7.04% among older adults who had a USC that was comprehensive (difference of \$446.56; P value < 0.1). The effects of having a USC or a USC with a PCMH feature were not significant for inpatient expenditures and total expenditures.

The multivariate regressions in the cross-sectional study showed that older cancer survivors had significantly more healthcare expenditures than those who did not have cancer (Table 6.22 to Table 6.29). Older cancer survivors had approximately 26% more inpatient expenditures (P value < 0.05), 97% more outpatient expenditures (P value <

0.05), 58% more office-based expenditure (P value < 0.05), 30% more total expenditures (P value < 0.05) and 37% more Medicare expenditures (P value < 0.05), compared to older adults who had no cancer, controlling for the covariates. No significant difference was found for ED expenditures.

Table 6.22. Adjusted Average Healthcare Expenditures among Older Adults Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
No USC (Reference)	295.54 (23.13)	3601.36 (228.15)	638.33 (38.87)	2301.72 (69.95)	10146.82 (212.7)	6283.3 (179.35)
Partial PCMH	253.16 (17.11)	3594.47 (194.48)	709.24 (43.52)	2458.51 (70.99)	10440.1 (209.05)	6728.23 (187.05)
Difference	-42.39 (25.98)	-6.89 (272.06)	70.91 (53.14)	156.79 (86.70)*	293.28 (295.51)	444.93 (256.47)*
PCMH	247.27 (26.13)	3590.14 (355.60)	747.82 (54.71)	2389.4 (82.68)	10483.53 (307.84)	6780.45 (270.59)
Difference	-48.28 (32.32)	-11.22 (383.27)	109.49 (57.06)*	87.68 (97.33)	336.71 (359.74)	497.15 (316.75)
Cancer Diagnosis						
No	273.05 (15.75)	3282.48 (172.47)	517.85 (23.93)	1985.59 (51.30)	9366.48 (166.09)	5832.79 (148.82)
Yes	260.74 (18.60)	4153.69 (252.62)	1016.38 (61.38)	3137.07 (93.30)	12154.65 (264.48)	7962.65 (230.56)
Difference	-12.32 (19.14)	871.21 (271.43)**	498.53 (58.13)**	1151.48 (96.86)**	2788.18 (302.58)**	2129.86 (272.23)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.23. Adjusted Average Healthcare Expenditures among Older Adults Associated with PCMH Domains, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures
Having a USC				
No (reference)	296.11 (23.35)	3641.07 (227.07)	659.48 (40.24)	2348.75 (72.99)
Yes	252.51 (14.68)	3584.41 (194.17)	710.67 (36.02)	2405.59 (59.78)
Difference	-43.60 (25.25)*	-56.66 (265.77)	51.18 (46.25)	56.84 (80.86)
The Critical Role of USC in Total Care				
No (reference)	288.87 (49.81)	3161.83 (564.46)	617.04 (85.37)	1949.84 (148.7)
Yes	268.30 (14.84)	3643.18 (163.73)	695.24 (30.75)	2412.44 (53.95)
Difference	-20.57 (53.32)	481.35 (568.74)	78.20 (85.41)	462.60 (155.16)**
Accessibility				
No (reference)	278.10 (17.16)	3597.98 (193.42)	698.00 (38.93)	2416.42 (71.37)
Yes	258.24 (18.37)	3620.76 (272.12)	682.77 (37.76)	2345.30 (60.52)
Difference	-19.86 (22.22)	22.79 (327.02)	-15.23 (47.48)	-71.12 (83.65)
Patient-centered Care				
No (reference)	266.33 (27.53)	3987.90 (335.07)	565.44 (48.08)	2196.44 (81.76)
Yes	271.01 (14.67)	3495.87 (177.03)	721.60 (32.61)	2430.64 (59.59)
Difference	4.68 (29.00)	-492.03 (366.59)	156.16 (50.20)**	234.20 (95.85)**
Comprehensive Care				
No (reference)	271.25 (28.34)	3269.64 (283.89)	719.16 (54.37)	2411.96 (91.42)
Yes	269.49 (14.68)	3689.95 (180.50)	685.06 (33.17)	2377.81 (55.01)
Difference	-1.76 (29.53)	420.30 (314.55)	-34.10 (59.63)	-34.15 (93.37)
Compassionate Care				
No (reference)	343.57 (71.59)	3555.79 (628.07)	576.44 (87.82)	2257.91 (152.8)
Yes	264.58 (14.69)	3611.23 (168.04)	696.97 (31.59)	2390.65 (52.70)
Difference	-79.00 (75.33)	55.44 (650.95)	120.53 (93.67)	132.74 (152.52)
Cancer Diagnosis				
No (reference)	273.68 (15.27)	3282.99 (174.46)	517.30 (23.91)	1982.77 (50.83)
Yes	262.40 (18.60)	4184.00 (258.38)	1020.49 (60.79)	3143.45 (95.43)
Difference	-11.28 (18.68)	901.01 (275.45)**	503.19 (57.72)**	1160.69 (99.11)**

Table 6.23. Continued

	Total Expenditures	Medicare Expenditures
Having a USC		
No	10263.38 (208.12)	6326.82 (176.98)
Yes	10382.91 (192.60)	6717.59 (171.29)
Difference	119.53 (274.38)	390.77 (240.71)
The Critical Role of USC in Total Care		
No	9338.90 (470.54)	6149.65 (453.32)
Yes	10406.71 (149.75)	6595.95 (132.24)
Difference	1067.81 (475.57)**	446.30 (468.42)
Accessibility		
No	10422.53 (192.76)	6571.02 (163.24)
Yes	10222.80 (215.33)	6560.57 (182.95)
Difference	-199.74 (282.13)	-10.45 (232.53)
Patient-centered Care		
No	9939.65 (287.72)	6475.92 (272.69)
Yes	10445.79 (160.60)	6592.47 (134.51)
Difference	506.14 (312.28)	116.55 (287.04)
Comprehensive Care		
No	10258.50 (256.16)	6424.20 (216.02)
Yes	10354.26 (162.31)	6599.86 (141.60)
Difference	95.76 (281.93)	175.67 (238.44)
Compassionate Care		
No	10131.85 (584.52)	6527.68 (559.27)
Yes	10349.51 (157.51)	6569.38 (136.46)
Difference	217.66 (627.39)	41.70 (593.19)
Cancer Diagnosis		
No	9366.75 (164.77)	5832.57 (147.56)
Yes	12162.32 (265.56)	7968.74 (231.24)
Difference	2795.57 (303.66)**	2136.17 (271.34)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.24. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC						
No (reference)	295.77 (23.19)	3601.48 (227.42)	638.23 (38.86)	2302.01 (70.03)	10146.1 (212.37)	6282.1 (179.15)
Yes	251.33 (14.55)	3593.04 (188.04)	722.47 (36.96)	2434.78 (60.96)	10454.59 (194.83)	6745.29 (172.11)
Difference	-44.44 (24.30)*	-8.44 (259.17)	84.24 (45.45)*	132.77 (79.05)*	308.49 (280.56)	463.20 (243.62)*
Cancer Diagnosis						
No (reference)	273.18 (15.72)	3282.47 (172.65)	517.55 (23.94)	1985.35 (51.26)	9366.55 (166.14)	5832.7 (148.82)
Yes	260.60 (18.54)	4153.47 (254.4)	1017.38 (61.54)	3136.31 (93.44)	12155.69 (265.64)	7964.37 (231.37)
Difference	-12.58 (18.93)	871.00 (270.52)**	499.82 (58.29)**	1150.96 (97.06)**	2789.14 (303.40)**	2131.66 (272.75)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.25. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC That Played a Critical Role in Total Care, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Played a Critical Role in Total Care						
No (reference)	294.27 (22.82)	3643.74 (236.21)	641.2 (38.52)	2324.27 (70.63)	10199.17 (215.58)	6315.34 (182.65)
Yes	251.53 (14.74)	3563.5 (184.59)	721.77 (36.59)	2422.14 (60.79)	10424.09 (194.33)	6731.13 (172.8)
Difference	-42.74 (24.15)*	-80.24 (265.84)	80.57 (44.16)*	97.86 (79.66)	224.92 (282.99)	415.79 (247.91)*
Cancer Diagnosis						
No (reference)	273.16 (15.71)	3281.39 (172.23)	517.36 (23.89)	1984.89 (51.26)	9364.86 (165.85)	5830.43 (148.53)
Yes	260.4 (18.55)	4155 (254.69)	1018.06 (61.57)	3138.01 (93.47)	12159.82 (266.3)	7970.1 (232.06)
Difference	-12.76 (18.93)	873.61 (269.56)**	500.7 (58.32)**	1153.12 (97.15)**	2794.96 (303.63)**	2139.68 (272.79)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.26. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC That Was Accessible, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Accessible						
No (reference)	279.00 (16.36)	3605.39 (172.13)	672.20 (32.67)	2365.13 (58.12)	10312.10 (163.04)	6500.74 (139.87)
Yes	236.44 (20.87)	3567.08 (325.57)	731.91 (47.40)	2430.24 (74.82)	10396.52 (277.73)	6754.75 (243.36)
Difference	-42.56 (25.08)*	-38.31 (348.14)	59.71 (48.76)	65.10 (80.97)	84.42 (303.07)	254.01 (262.07)
Cancer Diagnosis						
No (reference)	272.11 (15.47)	3282.08 (172.91)	516.53 (23.83)	1985.22 (51.32)	9363.49 (165.31)	5829.86 (147.97)
Yes	261.54 (18.79)	4154.63 (252.56)	1017.61 (61.44)	3136.98 (93.18)	12161.54 (265.90)	7965.47 (231.84)
Difference	-10.58 (19.36)	872.55 (268.56)**	501.08 (58.43)**	1151.76 (96.91)**	2798.04 (302.29)**	2135.61 (271.47)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.27. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC That Was Patient-Centered, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Patient-Centered						
No (reference)	287.11 (20.30)	3751.75 (212.65)	621.01 (33.41)	2315.28 (64.87)	10244.57 (194.09)	6437.68 (167.55)
Yes	247.12 (14.67)	3431.72 (201.77)	759.27 (41.77)	2447.67 (69.79)	10423.89 (210.38)	6694.86 (180.97)
Difference	-39.99 (22.66)*	-320.03 (261.18)	138.27 (43.74)**	132.39 (86.15)	179.32 (275.19)	257.18 (235.53)
Cancer Diagnosis						
No (reference)	271.59 (15.37)	3272.39 (171.96)	519.35 (24.14)	1984.76 (51.09)	9365.82 (165.88)	5831.44 (148.25)
Yes	259.81 (18.23)	4174.24 (257.63)	1017.48 (61.81)	3135.80 (93.45)	12157.69 (266.59)	7967.31 (232.85)
Difference	-11.78 (18.94)	901.85 (271.88)**	498.13 (58.20)**	1151.04 (96.98)**	2791.87 (304.10)**	2135.87 (273.46)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.28. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC That Was Comprehensive, MEPS 2008-2013 ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Comprehensive						
No (reference)	284.89 (20.59)	3488.30 (207.73)	674.24 (35.81)	2321.82 (64.38)	10172.03 (190.60)	6341.91 (161.12)
Yes	250.27 (15.14)	3719.69 (220.74)	700.66 (38.34)	2441.93 (68.73)	10493.75 (220.69)	6788.47 (192.58)
Difference	-34.61 (23.47)	231.39 (283.68)	26.42 (42.92)	120.11 (83.77)	321.72 (287.11)	446.56 (245.88)*
Cancer Diagnosis						
No (reference)	271.86 (15.38)	3293.69 (174.56)	516.00 (23.84)	1984.09 (51.07)	9365.04 (165.74)	5831.93 (148.37)
Yes	259.9 (18.43)	4147.36 (253.82)	1016.22 (61.35)	3137.67 (93.37)	12155.95 (265.76)	7965.55 (231.28)
Difference	-11.96 (19.00)	853.67 (273.21)**	500.22 (58.28)**	1153.59 (96.96)**	2790.91 (303.66)**	2133.62 (272.63)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Table 6.29. Adjusted Average Healthcare Expenditures among Older Adults Associated with Having a USC That Was Compassionate, MEPS 2008-2013^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Compassionate						
No (reference)	301.76 (21.79)	3655.50 (226.78)	627.28 (36.67)	2291.23 (67.81)	10165.22 (206.39)	6338.53 (175.42)
Yes	245.45 (14.77)	3548.99 (195.78)	736.29 (38.73)	2449.35 (63.58)	10458.38 (206.51)	6732.62 (180.95)
Difference	-56.31 (22.84)**	-106.51 (272.15)	109.02 (45.06)**	158.12 (80.49)**	293.16 (290.56)	394.09 (251.08)
Cancer Diagnosis						
No (reference)	274.02 (15.80)	3280.8 (172.34)	518.46 (24.05)	1985.14 (51.19)	9365.15 (165.79)	5830.21 (148.36)
Yes	261.52 (18.64)	4155.6 (254.09)	1017.14 (61.52)	3136.13 (93.44)	12157.17 (265.61)	7966.49 (231.86)
Difference	-12.5 (19.00)	874.81 (268.90)**	498.68 (58.21)**	1150.99 (96.93)**	2792.02 (303.07)**	2136.28 (272.89)**

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Panel Study

Effects of PCMH and PCMH Features on Healthcare Expenditures

Table 6.30 to Table 6.37 present the regression coefficients of the fixed effects models conducted among older adults regarding the effects of PCMH on healthcare expenditures. For inpatient expenditures, patient-centered care was associated with \$887.68 less expenditures (P value < 0.05), controlling for other PCMH features and confounders; and having a USC that was accessible was associated with \$662.44 less expenditures (P value < 0.1). When the six domains were included in one model, having a USC was associated with \$270.99 more outpatient expenditures (P value < 0.05). When having a USC and a USC with a PCMH feature was used as independent variable in separate models, outpatient expenditures increased significantly among older adults who had a USC showing such PCMH features: the highest increase on outpatient expenditures (\$290.19, P value < 0.05) was found among older adults who had a USC that was compassionate, and the lowest increase on outpatient expenditures (\$168.90, P value < 0.1) was found among older adults who had a USC that was comprehensive.

Accessibility of care was the most important PCMH features which was associated with reduced total expenditures and Medicare expenditures. When the six PCMH domains were included in one model, accessible care was associated with \$745.21 less total expenditures (P value < 0.1) and \$734.74 less Medicare expenditures (P value < 0.05), controlling for the covariates. Total expenditures and Medicare expenditures decreased by \$899.34 (P value < 0.1) and \$1,006.43 (P value < 0.05), respectively, among older adults who had a USC that was accessible. No significant effects of the PCMH features

were found regarding ED expenditures and office-based expenditures in the fixed-effects models.

Table 6.30. Fixed Effects of Receipt of Care Consistent with a PCMH on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
PCMH	-14.35 (33.97)	-167.13 (393.67)	140.19 (89.69)	-4.94 (185.29)	-210.16 (472.64)	-496.54 (394.58)

*P value < 0.1.

**P value < 0.05.

Table 6.31. Fixed Effects of PCMH Domains on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC	-2.32 (43.44)	525.19 (492.28)	270.99** (130.52)	20.02 (299.76)	780.36 (601.42)	334.55 (524.97)
The Critical Role of USC in Total Care	-33.85 (74.36)	-396.09 (896.76)	-5.35 (157.18)	500.87 (488.30)	10.91 (1086.65)	213.68 (1007.22)
Accessibility	27.75 (31.56)	356.17 (354.94)	10.57 (78.22)	-185.79 (153.84)	-745.21* (423.66)	-734.74** (360.53)
Patient-centered Care	-2.51 (41.90)	-887.68** (434.29)	102.54 (85.10)	48.27 (164.66)	-825.50 (505.68)	-557.98 (451.74)
Comprehensive Care	19.00 (51.01)	243.88 (453.07)	6.80 (84.62)	-39.53 (170.03)	292.78 (534.22)	185.68 (467.86)
Compassionate Care	-88.24 (91.87)	1135.66 (1207.91)	138.63 (179.35)	-113.29 (225.03)	1439.42 (1278.44)	1134.23 (1183.69)

*P value < 0.1.

**P value < 0.05.

Table 6.32. Fixed Effects of Having a USC on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC	-8.98 (39.60)	323.91 (490.80)	286.92 (125.65)**	119.35 (243.03)	664.04 (565.22)	292.62 (494.67)

*P value < 0.1.

**P value < 0.05.

Table 6.33. Fixed Effects of Having a USC That Played a Critical Role on Total Care on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Played a Critical Role in Total Care	-7.27 (38.56)	201.30 (482.83)	271.82 (121.34)**	170.60 (206.77)	591.22 (544.02)	273.26 (470.24)

*P value < 0.1.

**P value < 0.05.

Table 6.34. Fixed Effects of Having a USC That Was Accessible on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Accessible	4.69 (33.66)	-662.44* (398.52)	174.03** (86.68)	-48.45 (168.23)	-899.34* (471.05)	-1006.43** (402.75)

*P value < 0.1.

**P value < 0.05.

Table 6.35. Fixed Effects of Having a USC That Was Patient-Centered on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Patient-Centered	-41.00 (34.76)	-480.92 (364.87)	200.79 (89.31)**	71.28 (201.91)	-369.05 (444.09)	-416.43 (387.08)

*P value < 0.1.

**P value < 0.05.

Table 6.36. Fixed Effects of Having a USC That Was Comprehensive on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Comprehensive	-12.58 (37.30)	193.80 (362.25)	168.90 (100.87)*	54.55 (197.41)	495.69 (434.76)	112.31 (375.39)

*P value < 0.1.

**P value < 0.05.

Table 6.37. Fixed Effects of Having a USC That Was Compassionate on Healthcare Expenditures among Older Adults, MEPS Panels 13-17

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Having a USC That Was Compassionate	-22.49 (38.36)	-17.27 (473.33)	290.19 (118.54)**	112.81 (223.84)	438.80 (550.02)	138.39 (489.20)

*P value < 0.1.

**P value < 0.05.

Change of PCMH Status and Healthcare Expenditures

The adjusted average healthcare expenditures associated with the change of PCMH status among older adults are presented in Table 6.38. Compared to those who did not have a PCMH in both years, older adults who had a PCMH in year 1 but no PCMH in year 2 spent 43.76% more on inpatient expenditures (difference of \$1557.41; P value < 0.1), 13.31% more on total expenditures (difference of \$1363.64; P value < 0.1), and 19.36% more on Medicare expenditures (difference of \$1284.58; P value < 0.1), controlling for the covariates. Older adults who had a PCMH in the second year but no PCMH in the first year had 31.12% more outpatient expenditures (difference of \$212.83; P value < 0.1). Having a PCMH in both years was associated with 43.45% less ED expenditures (difference of -\$127.73; P value < 0.05) and 31.92% more outpatient expenditures (difference of \$212.83; P value < 0.1).

Table 6.38. Adjusted Average Healthcare Expenditures among Older Adults Associated with Receipt of Care Consistent with a PCMH During the Two Years of a Panel Survey, MEPS Panels 13-17^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Without a PCMH in Year 1 and Year 2 (Reference)	294.14 (24.19)	3555.18 (246.95)	666.73 (41.81)	2384.15 (95.39)	10282.23 (261.05)	6651.79 (240.70)
With a PCMH in Year 1 and without a PCMH in Year 2	249.85 (34.52)	5112.59 (887.85)	655.72 (108.59)	2625.75 (213.11)	11645.87 (783.66)	7936.37 (713.41)
Difference	-44.29 (38.77)	1557.41* (936.32)	-11.02 (116.73)	241.60 (206.58)	1363.64* (824.04)	1284.58* (764.90)
Without a PCMH in Year 1 and with a PCMH in Year 2	249.46 (45.20)	2828.00 (524.87)	874.05 (129.19)	2538.04 (193.58)	10299.53 (580.60)	6624.67 (486.21)
Difference	-44.68 (47.27)	-727.18 (558.07)	207.31 (127.57)	153.88 (199.23)	17.30 (600.13)	-27.12 (501.59)
With a PCMH in Year 1 and Year 2	166.41 (30.29)	4495.84 (971.72)	879.57 (117.01)	2509.80 (172.53)	10945.40 (787.93)	7770.83 (806.36)
Difference	-127.73** (36.67)	940.66 (932.78)	212.83* (118.65)	125.64 (203.93)	663.17 (797.66)	1119.04 (805.16)
Cancer Diagnosis						
No (reference)	270.66 (21.91)	3600.84 (273.21)	600.57 (38.30)	2144.80 (85.17)	9923.66 (259.01)	6471.55 (240.54)
Yes	285.51 (31.43)	3905.84 (371.18)	930.78 (86.63)	3033.14 (140.48)	11607.33 (418.28)	7678.71 (370.15)
Difference	14.85 (31.73)	305.00 (415.95)	330.21** (90.75)	888.33** (143.76)	1683.67** (460.64)	1207.17** (412.91)

a. Generalized linear models were performed for ED expenditures, inpatient expenditures, outpatient expenditures, office-based expenditures, total expenditures, and Medicare expenditures.

*Significantly different with the reference group at P value < 0.1.

**Significantly different with the reference group at P value < 0.05.

Summary

This chapter summarized the results of sensitivity analysis conducted among all older adults in MEPS 2008-2013 and MEPS Panels 13-17, which used the same set of statistical methods performed for older cancer survivor sample in this study. The prevalence of a PCMH among older adults was discussed. The adjusted associations for the key independent variables were presented for each of the healthcare outcomes for both the cross-sectional dataset and the panel dataset.

Results showed that compared with older cancer survivors, lower proportions of older adults had a PCMH. Similar patterns were found for older cancer survivors and all older adults, in terms of the trend of the prevalence of the PCMH: the prevalence of the PCMH increased in recent years with some fluctuation in recent years.

Among older adults, having a PCMH was significantly associated with more office-based visits, lower likelihood of having inpatient hospitalizations, higher likelihood of having outpatient visits, and more outpatient expenditures. Healthcare utilization and healthcare expenditures were influenced significantly by the features of the PCMH.

For healthcare utilization among older adults, the analyses cross-sectional study showed that the critical role of USC in total care was associated with significantly fewer days of inpatient hospitalization, when other PCMH domains and covariates were controlled; having a USC that was comprehensive was associated with significantly more days of inpatient hospitalizations; having a USC or having a USC with one of the PCMH features was associated with significantly more office-based visits. The findings of the panel study confirmed that older adults with a USC had significantly more office-based visits.

For healthcare expenditures among older adults, the analyses in the cross-sectional study showed that controlling for other PCMH domains and covariates, having a USC was significantly associated with less ED expenditures; patient-centered care was significantly associated with more outpatient expenditures; the critical role of USC in total care and patient-centered care were significantly associated with more office-based visits expenditures; and the critical role of USC in total care was significantly associated with more total expenditures. For ED expenditures, having a USC that played a critical role in total care, having a USC that was accessible, having a USC that was patient-centered and having a USC that was compassionate were significantly associated with lower ED expenditures. For outpatient expenditures, significantly higher expenditures were found among older adults who had a USC, or had a USC that played a critical role in total care, or had a USC that was patient-centered, or had a USC that was compassionate. Having a USC and having a USC that was compassionate were significantly associated with more office-based visits expenditures. Increased Medicare expenditures were found among older adults who had a USC, or had a USC that played a critical role in total care, or had a USC that was comprehensive. The findings of the panel study showed that having a USC was significantly associated with more outpatient expenditures; and accessibility was significantly associated with less total expenditures and less Medicare expenditures among older adults.

Chapter VII. Discussion

The purpose of this study was to assess the associations between receipt of care consistent with a PCMH and the healthcare outcomes among older cancer survivors. Specifically, this study explored the prevalence of the PCMH among older cancer survivors in recent years, and examined the effects of the PCMH on ED utilization, days of inpatient hospitalization, outpatient visits, office-based visits, ED expenditures, inpatient expenditures, outpatient expenditures, office-based visits expenditures, total expenditures and Medicare expenditures. The measure of PCMH was constructed based on survey items in MEPS. The six domains of the PCMH included: having a USC, the critical role that the USC played in total care, accessibility, patient-centered care, comprehensive care, and compassionate care. In addition to studying the aggregated PCMH measure, the effects of each PCMH domain on healthcare utilization and expenditures were examined.

This chapter will summarize the findings of the study, discuss the findings in the context of the previous research, review the strengths and limitations of the study, discuss policy implications and make recommendations for future research.

Summary of the Findings

Healthcare organized according to the Joint Principles of the PCMH is expected to reduce barriers in access, enhance the quality of health services, and improve healthcare outcomes for older cancer survivors in a cost-effective manner (AAFP et al., 2007; DePuccio & Hoff, 2014; Hudson et al., 2012; Nekhlyudov et al., 2014; Sprandio, 2010). This study conducted multivariate analyses regarding healthcare utilization and

expenditures among older cancer survivors using data from MEPS 2008-2013 and Panels 13-17. Factors included in the analysis were categorized according to the Andersen's Behavioral Model of Health Services Use (Andersen, 1995). The key independent variable – the PCMH – was included as an important enabling factor. To reduce bias, all the analysis accounted for the complex survey design of MEPS. The findings of this study extend the understanding of the effectiveness of the PCMH in older cancer survivor by analyzing the PCMH and its components. The major findings of this study are summarized as below.

The Prevalence of the PCMH

The measure of the PCMH was constructed based on 27 survey items of MEPS. On average, approximately 22.60% of older cancer survivors received care consistent with a PCMH from 2008 to 2013. With some fluctuation, the prevalence of the PCMH increased in recent years as hypothesized for Aim 1. Starting from 21.26% in 2008, the prevalence of the PCMH was the lowest (20.23%) in 2009, and reached the highest (25.07%) in 2013.

Compared with older cancer survivors, lower proportions of older adults had a PCMH: about 20.53% on average from 2008 to 2013. Similar patterns were found for older cancer survivors and all older adults, in terms of the trend of the prevalence of the PCMH.

The PCMH and Healthcare Utilization

Aim 2 in this study was to examine the relationship between the receipt of care from a PCMH and healthcare utilization for older cancer survivors. The weighted percentage of older cancer survivors who had a PCMH was 22.80%. In the cross-sectional study,

analysis showed that the aggregated PCMH measure was significantly associated with a higher likelihood of having ED visits (P value < 0.05) and outpatient visits (P value < 0.05) for older cancer survivors. However, the aggregated PCMH measure was not significantly associated with days of inpatient hospitalization or office-based visits. Controlling for other PCMH features and the individual characteristics, the most important PCMH features that were associated with reduced ED visits were accessibility and compassionate care; comprehensive care was significantly associated with increased days of inpatient hospitalization; both comprehensive care and compassionate care were significantly associated with increased outpatient visits; and having a USC was associated with significantly more office-based visits among older cancer survivors. When having a USC with one of the PCMH features was used as the independent variable in the regression models, having a USC that was accessible was significantly associated with 29% fewer ED visits (P value < 0.05); an increased likelihood of having outpatient visits was found with having a USC with PCMH features; office-based visits increased by 7% if older cancer survivors had a USC (P value < 0.05), by 6% if older cancer survivors had a USC playing a critical role in total care (P value < 0.1), and by 6% if older cancer survivors had a USC that was compassionate (P value < 0.05); however, having a USC that was comprehensive were associated with 21% more days of inpatient hospitalization (P value < 0.1).

In the panel study, the results showed that the aggregated PCMH measure was not significantly associated with any of the outcome measures at a 10% level of significance. When the six features of the PCMH were included in one model, older cancer survivors with comprehensive care had 0.073 more ED visits on average (P value < 0.1); having

comprehensive care and having compassionate care were associated with 0.295 (P value < 0.1) and 0.907 (P value < 0.1) more outpatient visits, respectively; in addition, having accessible care were associated with 0.859 fewer office-based visits (P value < 0.1). Having a USC that was comprehensive was associated with 0.428 more outpatient visits (P value < 0.1).

To further explore the effects of the PCMH, a parallel study was conducted using the sample of all older adults. The weighted percentage of older adults who had a PCMH was 20.89%. In the cross-sectional analysis, older adults with a PCMH made 8% more office-based visits than those without a USC (P value < 0.1); however, no significant association with the PCMH was found for ED visits, inpatient hospitalization or outpatient visits. When the six PCMH domains were included in one regression model, having a USC, the critical role of USC in total care and patient-centered care were associated with significantly more office-based visits; the critical role of USC in total care was associated with 25% fewer days of inpatient hospitalizations (P value < 0.1). When having a USC with one of the PCMH features was used as the independent variable in the regression models, for inpatient utilization, having a USC that was comprehensive was associated with 12% more days of hospitalization (P value < 0.1); having a USC or having a USC with any one of the PCMH features significantly increased the likelihood of having outpatient visits; increased office-based visits were found for older adults with a USC and when the USC had one of the PCMH features. Similarly, in the panel study, most of the PCMH features were associated with increased office-based visits; having patient-centered care was associated with 0.285 more outpatient visits (P value < 0.05), controlling for other PCMH features and covariates;

and having a PCMH that was accessible was associated with 0.273 fewer days of inpatient hospitalization among older adults. The associations between the PCMH features and ED visits were less evident.

Table 7.1 and Table 7.2 summarize the results of the regressions that include the most significant associations (P value < 0.05) between receipt of care consistent with a PCMH and healthcare utilization among older cancer survivors and older adults. The most consistent findings included having a USC or having a USC with PCMH features was associated with higher likelihood of having outpatient visits, and having a USC or having a USC with PCMH features was associated with more office-based visits.

Table 7.1. Significant Associations (P value < 0.05) between Receipt of Care Consistent with a PCMH and Healthcare Utilization among Older Cancer Survivors ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Cross-sectional Study (IRR) ^b	Partial PCMH			+
	PCMH			
	Having a USC			
	The Critical Role of USC in Total Care			
	Accessibility			
	Patient-Centered Care			
	Comprehensive Care			
	Compassionate Care			
	-		+	
Having a USC				+
Having a USC That Was Accessible				
	-			
Having a USC That Was Compassionate				+

a. “+” indicates an increased IRR or predicted probability, and “-” indicates a decreased IRR or predicted probability, which was significant at a 5% level of significance in the regressions conducted in this study.

b. IRRs were obtained from zero-inflated Poisson regressions or negative binomial regressions using data from MEPS 2008-2013.

Table 7.1. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits	
Cross-sectional Study (Predicted Probabilities of Being a Non-User) ^c	Partial PCMH		-	N/A	
	PCMH	-		N/A	
	Having a USC	-		N/A	
	The Critical Role of USC in Total Care	-		N/A	
	Accessibility	-	+		N/A
	Patient-Centered Care				N/A
	Comprehensive Care	+			N/A
	Compassionate Care	-	+	-	N/A
	Having a USC			-	N/A
	Having a USC That Played a Critical Role in Total Care			-	N/A
	Having a USC That Was Accessible	-	+	-	N/A
	Having a USC That Was Patient-Centered		+	-	
	Having a USC That Was Comprehensive	-		-	N/A
Having a USC That Was Compassionate	-		-	N/A	
Panel Study (Predicted Probabilities of Being a Non-User) ^d		ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	With a PCMH in Year 1 and without a PCMH in Year 2		-		N/A
	Without a PCMH in Year 1 and with a PCMH in Year 2	-	+		N/A
With a PCMH in Year 1 and Year 2	+		-	N/A	

c. Predicted probabilities of being a non-user were obtained from zero-inflated Poisson regressions using data from MEPS 2008-2013.

d. Predicted probabilities of being a non-user were obtained from zero-inflated Poisson regressions using data from MEPS Panels 13-17.

Table 7.2. Significant Associations (P value < 0.05) between Receipt of Care Consistent with a PCMH and Healthcare Utilization among Older Adults ^a

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Cross-sectional Study (IRR) ^b	Partial PCMH			+
	PCMH			+
	Having a USC			+
	The Critical Role of USC in Total Care Accessibility			+
	Patient-Centered Care			+
	Comprehensive Care			
	Compassionate Care			
	Having a USC			+
	Having a USC That Played a Critical Role in Total Care			+
	Having a USC That Was Accessible			+
	Having a USC That Was Patient-Centered			+
Having a USC That Was Comprehensive			+	
Having a USC That Was Compassionate			+	

a. “+” indicates an increased IRR or predicted probability or number of healthcare utilization, and “-” indicates a decreased IRR or predicted probability or number of healthcare utilization, which was significant at a 5% level of significance in the regressions conducted in this study.

b. IRRs were obtained from zero-inflated Poisson regressions or negative binomial regressions using data from MEPS 2008-2013.

Table 7.2. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits	
Cross-sectional Study (Predicted Probabilities of Being a Non-User) ^c	Partial PCMH	-	-	-	N/A
	PCMH		+	-	N/A
	Having a USC	-	-	-	N/A
	The Critical Role of USC in Total Care		-	-	N/A
	Accessibility	+	+	-	N/A
	Patient-Centered Care	+	+	-	N/A
	Comprehensive Care	+	+	+	N/A
	Compassionate Care	+	+	+	N/A
	Having a USC	-	-	-	N/A
	Having a USC That Played a Critical Role in Total Care	-		-	N/A
	Having a USC That Was Accessible	-	+	-	N/A
	Having a USC That Was Patient-Centered	+	+	-	N/A
	Having a USC That Was Comprehensive			-	N/A
Having a USC That Was Compassionate	-		-	N/A	

c. Predicted probabilities of being a non-user were obtained from zero-inflated Poisson regressions using data from MEPS 2008-2013.

Table 7.2. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits	
Panel Study (Fixed Effects on Healthcare Utilization) ^d	Having a USC				
	The Critical Role of USC in Total Care Accessibility			+	
	Patient-Centered Care				
	Comprehensive Care			+	
	Compassionate Care				
	Having a USC				+
	Having a USC That Played a Critical Role in Total Care				+
	Having a USC That Was Patient-Centered				+
Having a USC That Was Compassionate				+	

d. Fixed effects were obtained from fixed effects models using data from MEPS Panels 13-17.

Table 7.2. Continued

	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
Panel Study (IRR)^e	With a PCMH in Year 1 and without a PCMH in Year 2			
	Without a PCMH in Year 1 and with a PCMH in Year 2			
	With a PCMH in Year 1 and Year 2			
Panel Study (Predicted Probabilities of Being a Non-User)^f	ED Visits	Inpatient Days	Outpatient Visits	Office-based Visits
	With a PCMH in Year 1 and without a PCMH in Year 2			
	Without a PCMH in Year 1 and with a PCMH in Year 2			
With a PCMH in Year 1 and Year 2				

e. IRRs were obtained from zero-inflated Poisson regressions or negative binomial regressions using data from MEPS Panels 13-17.

f. Predicated probabilities of being a non-user were obtained from zero-inflated Poisson regressions using data from MEPS Panels 13-17.

The PCMH and Healthcare Expenditures

The third aim of this study is to examine the relationship between the receipt of care from a PCMH and healthcare expenditures for older cancer survivors. In the cross-sectional study, analyses showed that the aggregated PCMH measure was not significantly associated with any of the expenditures variables. When the six PCMH domains were included in one model controlling for the covariates, the effects of PCMH features on expenditures varied: for the average ED expenditures, having a USC and having compassionate care were associated with less expenditures, however, having a USC that played a critical role in total care and having comprehensive care were associated with more expenditures; the mean of inpatient expenditures increased if the older cancer survivor had patient-centered care or comprehensive care, whereas it reduced if the older cancer survivor had compassionate care. Accessible care was associated with less outpatient expenditures, and compassionate care was associated with more outpatient expenditures; the mean of total expenditures increased if the older cancer survivor had patient-centered care; and the mean of Medicare expenditures reduced if the older cancer survivor had a USC that played a critical role in total care, but increased if the older cancer survivor had patient-centered care. When the features of the USC were used separately as the independent variable for the outcome measures, having a USC that was compassionate was associated with less ED expenditures.

In the panel study, the aggregated PCMH measure still showed no significant association with any of the expenditures variables. When the six features of the PCMH were included in one model, the most important feature that was associated with lower annual expenditures was accessibility: total expenditures were reduced by \$1,694.42 (P value < 0.1) and Medicare expenditures were reduced by \$2,046.58 (P value < 0.05)

among older cancer survivors when other PCMH features and covariates were accounted for. In addition, having comprehensive care and having compassionate care were associated with more outpatient expenditures among older cancer survivors, controlling for other PCMH features and confounders; and having compassionate care was associated with \$1,110.36 lower office-based visits expenditures. Having a USC that was comprehensive was associated with \$423.19 (P value < 0.1) more outpatient expenditures, and having a USC that was accessible was associated with \$1,567.87 (P value < 0.1) less Medicare expenditures.

For the sample that included all older adults, in the cross-sectional study, the aggregated PCMH measure showed no significant effects on healthcare expenditures. When the six domains of the PCMH were accounted for in one regression model, having a USC was associated with significantly less ED expenditures; having patient-centered care was associated with more outpatient visit expenditures; having a USC that played a critical role in total care and having patient-centered care were associated with increased office-based visits expenditures; and having a USC that played a critical role in total care were associated with increased total expenditures. When “having a USC” or “having a USC with one of the PCMH features” were used as the independent variable for each of the expenditures variables, the average of ED expenditures reduced significantly in most cases, and the mean of outpatient expenditures and the mean of office-based visits expenditures increased significantly. Medicare expenditures increased by 7.36% on average among older adults who had a USC (P value < 0.1), by 6.61% among older adults who had a USC playing a critical role in total care (P value < 0.1), and by 7.04% among older adults who had a USC that was comprehensive (P value < 0.1). In the panel

study, having a USC was significantly associated with increased outpatient expenditures; and having a USC that was accessible significantly reduced the total expenditures and Medicare expenditures by \$899.34 (P value < 0.1) and by \$1,006.43 (P value < 0.05), respectively.

Table 7.3 and Table 7.4 summarize the results of the regressions that include the most significant associations (P value < 0.05) between receipt of care consistent with a PCMH and healthcare expenditures among older cancer survivors and older adults. The most consistent findings included that the most important PCMH feature that was associated with lower Medicare expenditures was accessibility, when other PCMH features and covariates were controlled. For older adults, having a USC or having a USC with PCMH features significantly increased outpatient expenditures.

Table 7.3. Significant Associations (P value < 0.05) between Receipt of Care Consistent with a PCMH and Healthcare Expenditures among Older Cancer Survivors ^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Cross-sectional Study (Adjusted Average Healthcare Expenditures) ^b	Having a USC					
	The Critical Role of Accessibility	+		-		
	Patient-Centered Care		+		+	+
	Comprehensive Care	+	+			
Panel Study (Fixed Effects on Healthcare Expenditures) ^c	Having a USC					
	The Critical Role of Accessibility					-
	Patient-Centered Care					
	Comprehensive Care			+		
				-		

a. “+” indicates an increased healthcare expenditure, and “-” indicates a decreased healthcare expenditure, which was significant at a 5% level of significance in the regressions conducted in this study.

b. Adjusted average healthcare expenditures were obtained from generalized linear regression models using data from MEPS 2008-2013.

c. Fixed effects were obtained from fixed effects models using data from MEPS Panels 13-17.

Table 7.4. Significant Associations (P value < 0.05) between Receipt of Care Consistent with a PCMH and Healthcare Expenditures among Older Adults^a

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Cross-sectional Study (Adjusted Average Healthcare Expenditures)^b	Having a USC					
	The Critical Role of USC in Total Care Accessibility					
			+	+	+	
			+			
	-		+	+		

a. “+” indicates an increased healthcare expenditure, and “-” indicates a decreased healthcare expenditure, which was significant at a 5% level of significance in the regressions conducted in this study.

b. Adjusted average healthcare expenditures were obtained from generalized linear regression models using data from MEPS 2008-2013.

Table 7.4. Continued

	ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Panel Study (Fixed Effects on Healthcare Expenditures) ^c	Having a USC		+			
	The Critical Role of USC in Total Care Accessibility					-
	Patient-Centered Care		-			
	Comprehensive Care					
	Compassionate Care					
	Having a USC			+		
Having a USC That Played a Critical Role in Total Care			+			
Having a USC That Was Accessible			+			-
Having a USC That Was Patient-Centered			+			
Having a USC That Was Compassionate			+			

c. Fixed effects were obtained from fixed effects models using data from MEPS Panels 13-17.

Table 7.4. Continued

		ED Expenditures	Inpatient Expenditures	Outpatient Expenditures	Office-Based Visits Expenditures	Total Expenditures	Medicare Expenditures
Panel Study (Adjusted Average Healthcare Expenditures)^d	With a PCMH in Year 1 and without a PCMH in Year 2						
	Without a PCMH in Year 1 and with a PCMH in Year 2						
	With a PCMH in Year 1 and Year 2	-					

d. Adjusted average healthcare expenditures were obtained from generalized linear regression models using data from MEPS Panels 13-17.

Individual Characteristics and Healthcare Outcomes

Analysis in this study showed that compared to older adults who did not had cancer, older cancer survivors had about 25% more outpatient visits and about 30% more office-based visits, and were more likely to have inpatient hospitalization. Controlling for the covariates, older cancer survivors had approximately 26% more inpatient expenditures, 97% more outpatient expenditures, 58% more office-based expenditure, 30% more total expenditures and 37% more Medicare expenditures, compared to older adults who had no cancer, controlling for the covariates. No significant difference between older cancer survivors and older adults without cancer was found on ED utilization or ED expenditures.

Among older cancer survivors, most of the individual characteristics had significant influence on healthcare outcomes. For example, for the predisposing factors, being female was associated with fewer outpatient visits, lower outpatient expenditures, lower total expenditures and lower Medicare expenditures; being Hispanic was associated with fewer ED visits, fewer office-based visits and less outpatient expenditures; being separated was associated with fewer inpatient day, fewer outpatient visits and less healthcare expenditures, compared with being married; and having a larger household size was associated with fewer office-based visits and lower office-based visits expenditures. For the need factors, limitations in ADLs or IADLs and most of the comorbidities were associated with more healthcare utilization and expenditures, whereas better perceived health status, higher physical health score and higher mental health score were associated with less healthcare utilization and expenditures. The most important enabling factor was insurance type: compared to those only had Medicare, older cancer

survivors with both Medicare and private insurance had significantly more inpatient days, more outpatient visits, more office-based visits, higher outpatient expenditures, higher office-based visits expenditures and higher total expenditures.

Discussion of the Findings

Although the analyses in Aim 1 showed that the prevalence of the PCMH among older cancer survivors increased in recent years – it reached the highest point of 25.07% in 2013, the majority of older cancer survivors still did not have a PCMH as their USC. Among older adults, the average prevalence of the PCMH was 20.89%. Much more effort is needed to promote the PCMH among the older population.

The findings of this study showed that older cancer survivors had significantly more healthcare utilization and expenditures than older adults who did not have cancer, regarding outpatient visits, office-based visits, inpatient expenditures, outpatient expenditures, office-based visit expenditures, total expenditures and Medicare expenditures. The analyses of the cross-sectional study showed that the PCMH was associated with significantly higher likelihood of having ED visits and outpatient visits among older cancer survivors, having a USC that was accessible reduced ED visits significantly, and having a USC significantly increased office-based visits. The most important findings in the panel study included that among the PCMH domains, comprehensive care and compassionate care was significantly associated with more outpatient visits, having a USC was associated with more office based visits, and accessibility was significantly associated with less total expenditures and less Medicare

expenditures, which was consistent for older cancer survivors and older adult population in general.

The PCMH is a concept under development with various operational definitions (AAFP et al., 2007; Arend et al., 2012; NCQA, 2015). Studies using MEPS to measure the PCMH have selected different survey items and achieved mixed findings (Reibling, 2016; Stockbridge et al., 2014; Xin et al., 2015). To the extent of the author's knowledge, there was only one other study focusing on the PCMH and older adults' healthcare expenditures using data from MEPS (Stockbridge et al., 2014). Stockbridge et al. (2014) studied the PCMH features and expenditures among Medicare beneficiaries in the MEPS, using a single survey item representing one of the PCMH features; and the study found, having little to no difficulty contacting the usual source of care through telephone during business hours was associated with lower inpatient expenditures and lower total expenditures annually, having access to the usual source of care at night or weekends was associated with significantly lower outpatient, ED and other medical expenditures, however, other PCMH features (e.g. having a PCP usually asking about medications and treatments prescribed by other doctors, having a PCP asking patient to decide between treatment) only had moderate effects on expenditures. The findings of Stockbridge et al.'s (2014) study were consistent with the findings of this study in that the accessibility components of the PCMH played an important role in lower total expenditures. Being different from this study, a few studies used MEPS data to examine the relationship between the PCMH and patient experience, quality and equity, and showed that the PCMH had the potential to enhance patient experience and was significantly associated with the receipt of preventive care services (Reibling, 2016; Xin et al., 2015).

Previous research examined the relationship between the PCMH and various outcome measures among older adults, for instance, patient/staff experience, quality of care, clinical outcomes, receipt of preventive services, chronic illness management, ED visits, inpatient admission, avoidable hospitalizations and healthcare expenditures (Clarke et al., 2015; David et al., 2015; Farrell et al., 2015; Ferrante et al., 2010; Fishman et al., 2012; Flottemesch et al., 2011; Flottemesch et al., 2012; Flottemesch et al., 2012; Garwood et al., 2014; Hochman et al., 2013; Liss et al., 2013; Liss et al., 2014; Maeng et al., 2012; Nelson et al., 2014; Phillips et al., 2011; Pines et al., 2015; Randall et al., 2015; Reid et al., 2009; Stranges et al., 2015; van Hasselt et al., 2015; Xin et al., 2015; Yoon et al., 2013; Yoon et al., 2015). Although the PCMH was positively associated with better patient/staff experience and improvement in clinical quality, the findings regarding healthcare utilizations and expenditures were inconsistent. For example, Liss et al. (2013) found that older patients with a PCMH had 21% fewer ambulatory care-sensitive hospitalizations, 7% fewer inpatient admissions and 18% fewer ED and urgent care contacts compared with those who had no PCMH and Stranges et al. (2015) found the PCMH was significantly associated with reduced readmission rates and long time to readmission among individuals aged 60 and older, however, Hochman et al. (2013) observed no changes in ED or hospital utilization over a one-year study period of a PCMH intervention, Phillips et al. (2011) found no changes in ED visits, and hospitalization and readmission rates, and Reid et al. (2013) discovered that patients in the PCMH had the same inpatient admissions during the PCMH implementation and stabilization periods. For healthcare expenditures, Maeng et al. (2015) found that total costs associated with the PCMH exposure decreased by about 7.9% among elderly

Medicare beneficiaries, whereas some studies observed no significant changes in healthcare costs for older adults under the PCMH model (David et al., 2015; Fishman et al., 2012; Reid et al., 2009; Rosenthal et al., 2015; Yoon et al., 2013; Yoon et al., 2015).

This study and previous studies differed in data sources, sample, measurements, research design, statistical analysis and other aspects, making it difficult to compare and synthesize the results. Since primary care plays an important role in providing counseling, prevention services, cancer screenings, medication management and specialty referrals (Ferrer et al., 2005; Metlay et al., 2005; Ornstein et al., 2010; Schonberg et al., 2008) and the improvement in healthcare outcomes was most evident among older adults who had chronic conditions (e.g. diabetes, hypertension, CHD) (David et al., 2015; Flottemesch et al., 2012; Liss et al., 2013; Pagan & Carlson, 2013; Rosenthal et al., 2015), the PCMH may play an important role in chronic illness management.

The findings of this study extend the understanding of the effectiveness of the PCMH in older cancer survivor by analyzing the PCMH and its components, which will inform future research regarding the PCMH and long-term cancer management. Results in this study showed that the aggregated PCMH measure was associated with significantly higher likelihood of having ED visits and outpatient visits among older cancer survivors. However, since the majority of the study sample were older cancer survivors instead of older adults under active cancer treatment, the effects of the PCMH on healthcare utilizations and expenditures may be less evident for those who no longer had cancer symptoms.

Studies or surveys in aging population may face many methodological challenges. Older adults' responses to measurement tools can be affected by different kinds of

functional impairment and development, resulting in increased response variance and bias (Campbell & Alwin, 1995; Strotmeyer & Ward, 2012). Since the PCMH measure in this study was a proxy measure instead of actual enrollment, it may have reliability and validity issues leading to inaccurate study findings.

Reliability refers to the extent to which a measure is consistent (Strotmeyer & Ward, 2012). In this study, a panel dataset was constructed which involved a PCMH measurement for each older cancer survivor in each of the two years of a panel. According to the statistics, approximately 27% of older cancer survivors changed their PCMH status. Since older cancer survivors usually stay with the same PCPs to receive continuous care (Cohen, 2009; O'Toole et al., 2009), the switched PCMH status may be caused by unreliable responses from the older cancer survivors during different rounds of a survey (i.e. test/retest reliability issue). It is possible that an older cancer survivor had similar healthcare utilization and expenditures during the two years of a panel, however, his/her PCMH status differed due to recall issues regarding the same PCP he/she had. In this case, the status of the PCMH may be not significantly associated with most of the healthcare outcome measures in fixed effects models.

Validity refers to whether or not an instrument measure is able to measure what is supposed to be measured (Strotmeyer & Ward, 2012). To date, a variety of measurements of PCMH have been developed. The measurements of PCMH range from organizational self assessments by providers and the evaluation of structure and process (e.g. use of electronic health record system), to patient responses to survey questions assessing practices characteristics and healthcare experiences (e.g. accessibility, patient-centered care, comprehensiveness and coordination) (Alexander et al., 2013; Beal et al., 2009;

Burton, Devers & Berenson, 2011; Cooley, McMllister, Sherrieb & Clark, 2003; Goldman et al., 2015; NCQA, 2015; Schoen et al., 2007). The Urban Institute conducted a comprehensive comparison of ten PCMH assessment instruments which were used for PCMH recognition, designed for practices serving a general patient population and completed by a practice; and the report concluded that most of the instruments had not been tested for validity or reliability, excepted for the pediatric version of the Medical Home Index (Burton et al., 2011). 2013). It is recommended that PCMH measurement should be sufficiently comprehensive to assess both the structural transformation and the experiences of different stakeholders, in which case, process evaluation, survey instruments, patient outcomes, quality measures, qualitative interviews and participant observation should be used together (Goldman et al., 2015).

The measurement of the PCMH in this study was constructed based on survey items in MEPS, as 27 survey items were grouped into six PCMH domains and aggregated according to previously published approaches (Bethell et al., 2004; Romaine & Bell, 2010). Though the survey items in MEPS captured most of the PCMH features, the coordinated care feature could not be measured (Bethell et al., 2004; Romaine & Bell, 2010). Besides, the scoring system utilized in this study was merely a proxy reflecting what kind of care the older cancer survivors received. The measurements of healthcare experiences of older cancer survivors may be subject to considerable variations in how the PCMH domains are defined and operationalized (Alexander et al., 2013). If the aggregated measurement of PCMH is invalid, the associations between the PCMH and the healthcare outcomes may be difficult to be detected as hypothesized.

It is important to understand how PCMH functions through each of the domains. This study aggregated six PCMH domains into one measure, and in some cases, different domains may have contrary effects on healthcare outcomes, thus, it was difficult to capture the overall effects of the PCMH. For example, the results of this study showed ED expenditures decreased significantly among older cancer survivors who had a USC or compassionate care, whereas it increased by comprehensive care or the critical role of USC in total care, when other PCMH domains and covariates were controlled. For inpatient expenditures, it increased if the older cancer survivors had patient-centered care or comprehensive care, whereas it reduced if the older cancer survivor had compassionate care. It is possible that time lags exist among the functioning of each PCMH domains. For instance, Hearld and Alexander (2012) conducted path analysis and suggested that fair and respectful relationships (i.e. compassionate care) between patients and physicians may serve as precursors to other patient-centered activity (e.g. extending physician-patient communication, joint physician-patient decision making about care plans and treatment goals), which could be a key leverage point for reducing ED utilization. Different PCMH domains may not impact the healthcare outcomes equally, in which case, different PCMH domains may need appropriate weighting in healthcare outcome evaluations (Alexander et al., 2013). Thus, using an aggregated PCMH measurement to study healthcare outcomes could sometimes be problematic.

Since the aggregated PCMH measure in this study had reliability and validity issues, it is hard to determine whether the PCMH was effective or whether the effectiveness of the PCMH was not evident due to measurement deficiency among older cancer survivors regarding healthcare utilization and expenditures.

Policy Implications

A growing movement has been established to improve healthcare delivery in the United States by transforming primary care into the PCMH (Hoff, 2012; Kay & Townley, 2013; PCPCC, 2015). The PCMH is considered as a promising model to improve the quality of care and reduce costs (Arend et al., 2012; Berenson et al., 2008; Fishman et al., 2012; Jackson et al., 2013; Keehan et al., 2015; Rittenhouse et al., 2009), however, most of the daily PCMH practices have not yet been tailored specifically for the needs of older adults (DePuccio & Hoff, 2014; Fishman et al., 2012; Hoff, 2010; Phillips et al., 2011; Stranges et al., 2015). Older cancer survivors usually have complicated conditions that make their care more difficult (Nekhlyudov et al., 2014).

The findings of this study demonstrated that it is important to identify how individual PCMH features or components impact healthcare outcomes to achieve better managed cancer care among older adults. Primary care practices which did not have all PCMH features may still achieve improved healthcare outcomes. For example, since accessibility of the USC was significantly associated with reduced ED utilization, lower total expenditures and lower Medicare expenditures, a primary care practice could enhance healthcare outcomes by providing accessible services over the phone, after hours, at nights or on the weekends.

One of the major challenges faced by the implementation of the PCMH is that many of the PCMH functions are not supported by traditional payment structures (Arend et al., 2012). Financing systems need to recognize the features of the PCMH and provide additional payments for achieving quality improvement (AAFP et al., 2007). A primary

care practice is recognized as a PCMH by NCQA according to a set of standards, for example, patient access, communication, data tracking and performance reporting; and financial incentives are allowed from health insurance plans and employers (NCQA, 2015). Current payment reforms fall into five broad categories, including modified fee-for-service systems, blended payment models, shared savings, comprehensive payments and grant-based payments (Arend et al., 2012; McCarthy, Mueller & Wrenn, 2009; PCPCC, 2009; Centers for Medicare and Medicaid Services, 2011). Future payment reform could consider incentivizing medical practices that adopt part of the cost-saving PCMH features and facilitate the progression of the implementation of a full PCMH model (Stockbridge et al., 2014). New financing systems need to recognize the care management and coordination performed outside of face-to-face visits, support new communication options and use of healthcare information, allow for case-mix differences among patient population, in order to secure the benefits of the PCMH, improve healthcare outcomes and reduce costs (AAFP et al., 2007; Robert Graham Center, 2007).

A major barrier in healthcare system reform exists in Medicare payment reform: the predominant fee-for-service payment system is expensive, fragmental, technically complex, and it does not align payments with performance (Nielson et al., 2016). Medicare spending accounted for 20% of the national health expenditures and will grow continuously due to expected increases in use of medical goods and services by the elderly population (Centers for Medicare and Medicaid Services, 2014). Recently, the flawed Medicare sustainable growth rate payment formula was repealed and new incentive payment methods will be introduced which reward physician groups for providing high-value care (Clemens & Veuger, 2015). Medicare fee-for-service model

will be shifted toward value-based payment models in the near future (Clemens & Veuger, 2015; Nielson et al., 2016). The PCMH model is expected to be associated with consistent cost and utilization improvements, and can well adapt to a Medicare payment system that values the quality of care, aligns performance measures and incorporates value-based reimbursement (Nielson et al., 2016). Findings of this study inform the Medicare payment reform regarding the effects of the PCMH and its components on healthcare utilization and expenditures among older cancer survivors. It is important to figure out whether the innovative PCMH care model works under the current payment reform and how the payment systems could better support the functions of the PCMH model.

Strengths and Limitations

The study conducted secondary data analysis using the nationally representative datasets from MEPS-HC. The strengths of the study included several aspects. First, MEPS was unique in inclusion of the PCMH related survey items, which permits the investigation on the presence of the PCMH through the respondents' experiences. Second, the results of the study illustrated the effects of having a PCMH on healthcare utilization and expenditures, and the trend of PCMH prevalence in recent years among older cancer survivors was observed, which provided important evidence for current research gaps and policy reforms. Third, the study took advantages of the multistage sampling design in MEPS and the analysis accounted for clustering, stratification, and sample weights, to generate unbiased national estimates. Fourth, for potential selection issues related to the PCMH among the studied population, the study conducted data

analysis using fixed effects models to control for confounders, such as health beliefs, health behaviors and other unobservable factors, to reduce the bias.

In addition to the reliability and validity issue regarding the aggregated PCMH measure which was discussed previously, the study has several other limitations. First, the major analysis in this study was based on cross-sectional data, therefore a causal relationship between the PCMH and healthcare outcomes could not be determined. Second, MEPS data collection was based on self reports or responses from a family member, which was subject to recall bias. The healthcare experiences and receipt of healthcare could be over-reported or under-reported (Romaine & Bell, 2010). The information may not as reliable as medical records or documentation. Third, the analysis in this study was restricted to the components of the PCMH which could be measured in MEPS, and did not include information about the structural features of the primary care practices (e.g. adoption of electronic health records, use of evidence-based clinical protocols, process of care transitioning) which could potentially influence the healthcare outcomes (Stockbridge et al., 2014). Fourth, the MEPS did not include information on cancer stages, so that the variance among older cancer survivors could not be fully accounted for in the analysis. Fifth, the sample of this study involved older cancer survivors who were non-institutionalized, and the results cannot be generalized to those who were institutionalized.

Recommendations for Future Research

The findings in this study showed that several areas are in need of future research. In order to get a reliable and valid PCMH measure, researchers should spend more effort on

better defining or constructing the PCMH measure in survey database, such as MEPS. Since the PCMH may play a critical role in cancer care management and the impacts of the PCMH need to be further examined, a randomized control trial that recruit older cancer survivors into the PCMH will offer invaluable evidence. To determine whether the PCMH was effective among cancer survivors, additional empirical research should use administrative data on healthcare outcomes, instead of self-reported survey data, to enhance the reliability. In addition, future research could examine the effectiveness of PCMH among older cancer survivors who were engaged in active cancer treatment, among whom the needs of care were most complicated, and the effectiveness of a better care management program on healthcare outcomes would be more evident. Moreover, future research is needed to more precisely identify how PCMH features are related to healthcare utilization and expenditures and establish causal relationships using longitudinal designs.

One important feature of the PCMH was that it could strengthen primary care functions by improving comprehensiveness and coordination (Reibling, 2016). For older cancer survivors, experience and satisfaction with care could influence their quality of life profoundly. Besides healthcare utilization and expenditures, future research could focus on to what extent the PCMH could improve the experience and satisfaction among older cancer survivors and their families.

Since the PCMH has the potential to reduced disparities in terms of access to quality care (Beal et al., 2007), it is important for future research to examine the effectiveness of the PCMH among vulnerable populations, for example, dual-eligible older adults, racial

and ethnic minority groups, the homeless, individuals with multiple chronic conditions, and individuals with mental problems or substance abuse problems.

Another area that needs more research is the reimbursement of the PCMH and payment reform. Results in this study showed that insurance type was the most critical enabling factor for healthcare outcomes. The PCMH model could potentially well adapt to a Medicare payment system that values the quality of care, aligns performance measures and incorporates value-based reimbursement (Nielson et al., 2016). Future research can provide solutions on how to recognize the PCMH activities (e.g. non-visit-associated patient communication, care coordination, and supporting patient self-management) under Medicare or private insurance system, which will strengthen the functions of primary care.

Appendices

Appendix 1: Coefficients of ZIP for ED Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

ED Visits	Coefficient	Linearized Standard Error	t	P> t	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.097	0.162	0.600	0.552	-0.223	0.416
PCMH	-0.227	0.230	-0.980	0.326	-0.681	0.228
Year						
2008	(reference)					
2009	0.114	0.183	0.620	0.536	-0.248	0.475
2010	-0.176	0.275	-0.640	0.523	-0.718	0.367
2011	-0.061	0.208	-0.290	0.769	-0.472	0.349
2012	-0.302	0.219	-1.380	0.169	-0.733	0.130
2013	-0.160	0.181	-0.890	0.377	-0.517	0.197
Geographic Region						
Northeast	(reference)					
Midwest	-0.258	0.249	-1.040	0.301	-0.750	0.233
South	0.021	0.211	0.100	0.922	-0.395	0.437
West	-0.099	0.278	-0.360	0.722	-0.647	0.449
Age						
65-74	(reference)					
75-84	-0.036	0.135	-0.270	0.789	-0.302	0.230
85 and Older	0.104	0.216	0.480	0.630	-0.322	0.531
Gender						
Male	(reference)					
Female	-0.047	0.206	-0.230	0.820	-0.454	0.360
Race						
White	(reference)					
Black	-0.125	0.264	-0.470	0.637	-0.645	0.396
Other	0.410	0.362	1.130	0.259	-0.305	1.125
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.867	0.307	-2.820	0.005	-1.473	-0.261
Marital Status						
Married	(reference)					
Widowed	0.031	0.166	0.190	0.853	-0.296	0.358
Divorced	0.350	0.249	1.410	0.161	-0.140	0.840
Separated	0.614	0.398	1.540	0.124	-0.170	1.399
Never Married	-0.259	0.328	-0.790	0.431	-0.906	0.388
Household Size	0.084	0.058	1.450	0.150	-0.031	0.198

Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-0.096	0.227	-0.420	0.674	-0.545	0.353
Medicare and Other Public Insurance	0.091	0.298	0.310	0.760	-0.497	0.680
Uninsured	-0.361	0.456	-0.790	0.430	-1.259	0.538
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	-0.281	0.281	-1.000	0.319	-0.836	0.274
Some College	0.100	0.285	0.350	0.726	-0.462	0.662
4-Year college or Bachelor's Degree	0.113	0.293	0.390	0.701	-0.466	0.692
Master's or Doctorate or Professional Degree	0.126	0.311	0.410	0.685	-0.488	0.741
Poverty Level						
Poor						
Near Poor	-0.162	0.273	-0.590	0.553	-0.700	0.376
Low Income	-0.080	0.152	-0.530	0.599	-0.380	0.220
Middle Income	0.035	0.186	0.190	0.852	-0.333	0.402
High Income	-0.262	0.177	-1.490	0.139	-0.611	0.086
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.331	0.261	-1.270	0.207	-0.847	0.185
Good	-0.147	0.252	-0.580	0.561	-0.645	0.351
Very Good	-0.390	0.278	-1.400	0.163	-0.939	0.159
Excellent	-0.769	0.712	-1.080	0.282	-2.175	0.636
Physical Health Score	-0.011	0.007	-1.620	0.108	-0.025	0.002
Mental Health Score	-0.011	0.005	-1.990	0.048	-0.021	0.000
ADLs	0.174	0.148	1.170	0.242	-0.119	0.466
IADLs	-0.011	0.194	-0.060	0.953	-0.393	0.371
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.073	0.219	0.330	0.741	-0.360	0.505
Skin Cancer (Melanoma)	-0.100	0.269	-0.370	0.709	-0.631	0.430
Breast Cancer	0.194	0.251	0.770	0.442	-0.302	0.689
Prostate Cancer	0.299	0.384	0.780	0.437	-0.458	1.057
Colon Cancer	0.340	0.265	1.280	0.202	-0.184	0.864
Other Cancer	0.186	0.233	0.800	0.425	-0.273	0.646

Comorbidity						
Diabetes	0.026	0.130	0.200	0.841	-0.231	0.283
Hypertension	-0.059	0.201	-0.290	0.770	-0.456	0.338
Heart Conditions	0.267	0.121	2.200	0.029	0.028	0.506
Cerebrovascular Disease	0.118	0.178	0.660	0.508	-0.233	0.468
COPD or Asthma	0.273	0.099	2.770	0.006	0.079	0.468
Arthritis or Joint Disorders	-0.126	0.164	-0.770	0.441	-0.449	0.196
Mental Disorders	0.069	0.112	0.610	0.540	-0.153	0.291
Constant	0.574	0.637	0.900	0.369	-0.683	1.830

Inflate Model

PCMH Category						
No USC	(reference)					
Partial PCMH	0.142	0.376	0.380	0.706	-0.599	0.884
PCMH	-0.517	0.582	-0.890	0.376	-1.665	0.632
Year						
2008	(reference)					
2009	0.474	0.364	1.300	0.195	-0.245	1.193
2010	-0.182	0.662	-0.280	0.783	-1.487	1.123
2011	0.296	0.411	0.720	0.473	-0.516	1.107
2012	-0.683	0.579	-1.180	0.240	-1.826	0.460
2013	-0.493	0.413	-1.200	0.233	-1.307	0.320
Geographic Region						
Northeast	(reference)					
Midwest	-0.439	0.663	-0.660	0.509	-1.746	0.869
South	0.644	0.548	1.180	0.241	-0.437	1.725
West	0.064	0.682	0.090	0.925	-1.282	1.410
Age						
65-74	(reference)					
75-84	-0.392	0.294	-1.340	0.184	-0.973	0.188
85 and Older	-0.117	0.455	-0.260	0.797	-1.015	0.781
Gender						
Male	(reference)					
Female	-0.088	0.479	-0.180	0.854	-1.033	0.857
Race						
White	(reference)					
Black	-0.544	0.535	-1.020	0.311	-1.601	0.512
Other	0.808	0.577	1.400	0.164	-0.332	1.947
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-3.053	2.520	-1.210	0.227	-8.025	1.920
Marital Status						
Married	(reference)					
Widowed	-0.347	0.384	-0.910	0.367	-1.105	0.410
Divorced	0.375	0.452	0.830	0.408	-0.518	1.268

Separated	0.674	0.828	0.810	0.417	-0.960	2.308
Never Married	-0.889	0.928	-0.960	0.339	-2.720	0.941
Household Size	0.045	0.131	0.340	0.732	-0.214	0.304
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-0.210	0.492	-0.430	0.670	-1.180	0.761
Medicare and Other Public Insurance	0.362	0.636	0.570	0.570	-0.893	1.617
Uninsured	0.051	0.723	0.070	0.944	-1.377	1.478
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	-0.430	0.799	-0.540	0.591	-2.005	1.146
Some College	0.224	0.685	0.330	0.744	-1.128	1.576
4-Year college or Bachelor's Degree	0.621	0.587	1.060	0.292	-0.538	1.780
Master's or Doctorate or Professional Degree	0.312	0.645	0.480	0.629	-0.961	1.585
Poverty Level						
Poor	(reference)					
Near Poor	-0.060	0.606	-0.100	0.922	-1.255	1.135
Low Income	-0.120	0.340	-0.350	0.723	-0.791	0.550
Middle Income	-0.184	0.417	-0.440	0.660	-1.006	0.639
High Income	-0.308	0.382	-0.800	0.422	-1.062	0.447
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.286	0.683	-0.420	0.676	-1.634	1.061
Good	0.016	0.529	0.030	0.976	-1.028	1.060
Very Good	0.298	0.647	0.460	0.646	-0.979	1.575
Excellent	-0.679	1.586	-0.430	0.669	-3.808	2.450
Physical Health Score	0.010	0.016	0.620	0.539	-0.022	0.042
Mental Health Score	0.007	0.012	0.580	0.561	-0.017	0.031
ADLs	-0.217	0.343	-0.630	0.528	-0.893	0.460
IADLs	0.066	0.396	0.170	0.868	-0.715	0.847
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	-0.552	0.496	-1.110	0.267	-1.530	0.426
Skin Cancer (Melanoma)	-0.548	0.650	-0.840	0.400	-1.830	0.733
Breast Cancer	0.128	0.565	0.230	0.821	-0.986	1.243

Prostate Cancer	-0.039	0.817	-0.050	0.962	-1.651	1.574
Colon Cancer	0.795	0.548	1.450	0.149	-0.286	1.876
Other Cancer	-0.160	0.523	-0.310	0.761	-1.192	0.872
Comorbidity						
Diabetes	-0.233	0.284	-0.820	0.413	-0.795	0.328
Hypertension	-0.389	0.415	-0.940	0.350	-1.209	0.430
Heart Conditions	-0.561	0.237	-2.360	0.019	-1.030	-0.093
Cerebrovascular Disease	-0.328	0.439	-0.750	0.456	-1.195	0.539
COPD or Asthma	-0.114	0.255	-0.450	0.656	-0.618	0.390
Arthritis or Joint Disorders	-0.292	0.353	-0.830	0.409	-0.990	0.405
Mental Disorders	-0.444	0.239	-1.860	0.065	-0.916	0.028
Constant	0.797	1.532	0.520	0.603	-2.226	3.821

Appendix 2: Coefficients of ZIP for Inpatient Days among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Inpatient Days	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.089	0.130	0.680	0.497	-0.168	0.346
PCMH	0.129	0.128	1.010	0.312	-0.122	0.381
Year						
2008	(reference)					
2009	0.066	0.181	0.370	0.714	-0.290	0.422
2010	-0.039	0.140	-0.280	0.783	-0.316	0.238
2011	0.153	0.169	0.900	0.367	-0.181	0.486
2012	-0.053	0.135	-0.390	0.696	-0.318	0.213
2013	-0.320	0.161	-1.990	0.048	-0.637	-0.003
Geographic Region						
Northeast	(reference)					
Midwest	-0.158	0.135	-1.170	0.245	-0.424	0.109
South	-0.021	0.140	-0.150	0.879	-0.297	0.254
West	-0.001	0.169	-0.010	0.995	-0.334	0.332
Age						
65-74	(reference)					
75-84	-0.271	0.155	-1.750	0.082	-0.575	0.034
85 and Older	-0.336	0.207	-1.620	0.106	-0.744	0.072
Gender						
Male	(reference)					
Female	-0.226	0.182	-1.240	0.215	-0.584	0.132
Race						
White	(reference)					
Black	-0.219	0.162	-1.350	0.178	-0.539	0.101
Other	0.006	0.183	0.030	0.974	-0.355	0.367
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.008	0.243	-0.030	0.974	-0.487	0.471
Marital Status						
Married	(reference)					
Widowed	0.267	0.189	1.420	0.159	-0.105	0.639
Divorced	0.119	0.151	0.780	0.434	-0.180	0.417
Separated	-0.629	0.375	-1.680	0.095	-1.368	0.111
Never Married	-0.231	0.230	-1.000	0.316	-0.684	0.223
Household Size						
	0.022	0.051	0.440	0.662	-0.079	0.124
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	-0.124	0.121	-1.020	0.308	-0.363	0.115
Medicare and Other Public Insurance	-0.082	0.161	-0.510	0.614	-0.400	0.237
Uninsured	0.724	0.432	1.670	0.096	-0.129	1.576
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.143	0.159	0.900	0.368	-0.170	0.457
Some College	0.107	0.118	0.910	0.363	-0.125	0.340
4-Year college or Bachelor's Degree	-0.030	0.176	-0.170	0.863	-0.377	0.316
Master's or Doctorate or Professional Degree	0.553	0.222	2.490	0.014	0.114	0.991
Poverty Level						
Poor	(reference)					
Near Poor	0.134	0.205	0.660	0.513	-0.270	0.538
Low Income	0.302	0.161	1.870	0.063	-0.016	0.619
Middle Income	0.211	0.150	1.410	0.159	-0.084	0.506
High Income	-0.123	0.166	-0.740	0.462	-0.451	0.206
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.137	0.202	-0.680	0.499	-0.536	0.262
Good	-0.341	0.188	-1.810	0.072	-0.713	0.031
Very Good	-0.572	0.228	-2.510	0.013	-1.022	-0.123
Excellent	-0.513	0.324	-1.580	0.115	-1.152	0.127
Physical Health Score	-0.004	0.006	-0.610	0.541	-0.015	0.008
Mental Health Score	0.002	0.005	0.430	0.671	-0.007	0.011
ADLs	0.351	0.141	2.490	0.014	0.073	0.630
IADLs	0.400	0.119	3.370	0.001	0.166	0.634
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	-0.409	0.135	-3.030	0.003	-0.676	-0.142
Skin Cancer (Melanoma)	-0.355	0.210	-1.690	0.093	-0.768	0.059
Breast Cancer	-0.209	0.168	-1.240	0.216	-0.540	0.123
Prostate Cancer	-0.313	0.156	-2.000	0.047	-0.621	-0.004
Colon Cancer	0.067	0.175	0.380	0.704	-0.279	0.412
Other Cancer	-0.185	0.144	-1.290	0.198	-0.469	0.098
Comorbidity						
Diabetes	-0.141	0.118	-1.200	0.233	-0.373	0.091

Hypertension	0.112	0.105	1.060	0.290	-0.096	0.319
Heart Conditions	0.082	0.092	0.890	0.374	-0.099	0.262
Cerebrovascular Disease	0.038	0.166	0.230	0.819	-0.290	0.366
COPD or Asthma	0.072	0.097	0.740	0.462	-0.120	0.264
Arthritis or Joint Disorders	0.057	0.104	0.550	0.584	-0.148	0.261
Mental Disorders	-0.069	0.110	-0.630	0.532	-0.285	0.148
Constant	2.217	0.455	4.870	0.000	1.319	3.115

Inflate Model

PCMH Category						
No USC	(reference)					
Partial PCMH	-0.012	0.111	-0.110	0.916	-0.231	0.208
PCMH	-0.173	0.143	-1.210	0.228	-0.455	0.109
Year						
2008	(reference)					
2009	0.026	0.150	0.180	0.860	-0.269	0.322
2010	0.152	0.154	0.980	0.326	-0.153	0.456
2011	0.240	0.164	1.470	0.145	-0.083	0.564
2012	0.249	0.173	1.440	0.151	-0.091	0.589
2013	0.094	0.166	0.570	0.571	-0.233	0.421
Geographic Region						
Northeast	(reference)					
Midwest	-0.092	0.171	-0.540	0.590	-0.429	0.245
South	0.029	0.156	0.190	0.852	-0.278	0.337
West	0.226	0.178	1.270	0.206	-0.126	0.578
Age						
65-74	(reference)					
75-84	-0.017	0.105	-0.170	0.869	-0.224	0.190
85 and Older	0.058	0.151	0.380	0.702	-0.240	0.356
Gender						
Male	(reference)					
Female	0.180	0.109	1.650	0.100	-0.035	0.394
Race						
White	(reference)					
Black	0.037	0.153	0.240	0.809	-0.265	0.339
Other	-0.005	0.229	-0.020	0.983	-0.457	0.447
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.050	0.204	-0.250	0.805	-0.453	0.352
Marital Status						
Married	(reference)					
Widowed	-0.071	0.115	-0.620	0.536	-0.298	0.156
Divorced	-0.018	0.144	-0.130	0.898	-0.302	0.266
Separated	0.644	0.453	1.420	0.157	-0.250	1.537
Never Married	-0.191	0.277	-0.690	0.493	-0.738	0.356

Household Size	-0.042	0.048	-0.860	0.391	-0.137	0.054
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-0.184	0.098	-1.870	0.063	-0.378	0.010
Medicare and Other Public Insurance	0.143	0.173	0.830	0.410	-0.198	0.484
Uninsured	0.660	0.561	1.180	0.241	-0.447	1.768
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.070	0.146	0.480	0.630	-0.217	0.358
Some College	-0.050	0.152	-0.330	0.741	-0.351	0.250
4-Year college or Bachelor's Degree	0.037	0.175	0.210	0.832	-0.308	0.383
Master's or Doctorate or Professional Degree	0.181	0.195	0.930	0.354	-0.204	0.566
Poverty Level						
Poor	(reference)					
Near Poor	0.058	0.216	0.270	0.788	-0.368	0.485
Low Income	0.040	0.181	0.220	0.824	-0.317	0.398
Middle Income	0.109	0.181	0.600	0.548	-0.249	0.466
High Income	0.148	0.181	0.820	0.414	-0.208	0.504
Perceived Health Status						
Poor Health	(reference)					
Fair	0.154	0.167	0.920	0.358	-0.176	0.484
Good	0.199	0.189	1.050	0.296	-0.175	0.572
Very Good	0.445	0.219	2.030	0.044	0.013	0.878
Excellent	0.710	0.310	2.290	0.023	0.099	1.320
Physical Health Score	0.028	0.005	5.110	0.000	0.017	0.039
Mental Health Score	0.013	0.005	2.790	0.006	0.004	0.023
ADLs	-0.257	0.149	-1.730	0.086	-0.551	0.037
IADLs	-0.275	0.130	-2.110	0.036	-0.533	-0.018
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	-0.390	0.158	-2.470	0.015	-0.702	-0.078
Skin Cancer (Melanoma)	-0.355	0.194	-1.830	0.069	-0.738	0.028
Breast Cancer	-0.363	0.183	-1.980	0.049	-0.725	-0.001
Prostate Cancer	-0.443	0.166	-2.660	0.009	-0.771	-0.114
Colon Cancer	-0.411	0.180	-2.280	0.024	-0.765	-0.056

Other Cancer	-0.780	0.152	-5.150	0.000	-1.079	-0.481
Comorbidity						
Diabetes	0.021	0.104	0.200	0.839	-0.184	0.226
Hypertension	-0.046	0.098	-0.470	0.642	-0.239	0.148
Heart Conditions	-0.636	0.099	-6.450	0.000	-0.830	-0.441
Cerebrovascular Disease	-0.389	0.162	-2.400	0.017	-0.710	-0.069
COPD or Asthma	-0.139	0.095	-1.460	0.147	-0.326	0.049
Arthritis or Joint Disorders	0.101	0.088	1.150	0.252	-0.072	0.274
Mental Disorders	0.019	0.103	0.190	0.852	-0.184	0.222
Constant	0.216	0.523	0.410	0.680	-0.816	1.248

Appendix 3: Coefficients of ZIP for Outpatient Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Outpatient Visits	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	-0.143	0.123	-1.160	0.246	-0.385	0.099
PCMH	-0.028	0.125	-0.220	0.826	-0.275	0.220
Year						
2008	(reference)					
2009	0.318	0.148	2.150	0.033	0.026	0.611
2010	0.198	0.148	1.340	0.181	-0.093	0.489
2011	0.029	0.155	0.190	0.850	-0.276	0.335
2012	-0.330	0.130	-2.550	0.012	-0.585	-0.074
2013	-0.023	0.143	-0.160	0.873	-0.305	0.260
Geographic Region						
Northeast	(reference)					
Midwest	0.096	0.154	0.620	0.535	-0.208	0.400
South	-0.131	0.164	-0.800	0.427	-0.455	0.194
West	-0.061	0.227	-0.270	0.787	-0.509	0.386
Age						
65-74	(reference)					
75-84	-0.312	0.122	-2.550	0.012	-0.553	-0.070
85 and Older	-0.525	0.170	-3.080	0.002	-0.862	-0.189
Gender						
Male	(reference)					
Female	-0.680	0.143	-4.740	0.000	-0.963	-0.397
Race						
White	(reference)					
Black	0.011	0.220	0.050	0.960	-0.423	0.445
Other	-0.488	0.268	-1.820	0.070	-1.016	0.041
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.193	0.227	-0.850	0.396	-0.642	0.255
Marital Status						
Married	(reference)					
Widowed	0.077	0.122	0.630	0.526	-0.163	0.317
Divorced	0.446	0.162	2.760	0.006	0.128	0.765
Separated	-0.692	0.283	-2.450	0.015	-1.249	-0.134
Never Married	-0.478	0.218	-2.190	0.030	-0.909	-0.047
Household Size						
	-0.067	0.067	-1.010	0.313	-0.199	0.064
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	-0.081	0.102	-0.790	0.429	-0.283	0.121
Medicare and Other Public Insurance	-0.289	0.180	-1.600	0.111	-0.644	0.067
Uninsured	-0.502	0.566	-0.890	0.376	-1.618	0.614
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.073	0.124	0.590	0.557	-0.171	0.317
Some College	0.274	0.146	1.880	0.062	-0.014	0.563
4-Year college or Bachelor's Degree	0.627	0.188	3.330	0.001	0.255	0.999
Master's or Doctorate or Professional Degree	0.310	0.173	1.790	0.075	-0.031	0.652
Poverty Level						
Poor	(reference)					
Near Poor	-0.337	0.200	-1.680	0.094	-0.732	0.058
Low Income	0.247	0.167	1.480	0.142	-0.083	0.577
Middle Income	0.065	0.165	0.390	0.697	-0.262	0.391
High Income	-0.144	0.169	-0.850	0.396	-0.478	0.190
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.122	0.171	-0.710	0.476	-0.458	0.215
Good	-0.383	0.169	-2.270	0.024	-0.716	-0.050
Very Good	-0.627	0.204	-3.070	0.002	-1.031	-0.224
Excellent	-0.844	0.271	-3.110	0.002	-1.379	-0.309
Physical Health Score	-0.019	0.006	-3.150	0.002	-0.031	-0.007
Mental Health Score	0.008	0.006	1.380	0.170	-0.003	0.019
ADLs	0.237	0.161	1.480	0.141	-0.079	0.554
IADLs	0.509	0.170	3.000	0.003	0.174	0.843
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	-0.065	0.149	-0.440	0.660	-0.359	0.228
Skin Cancer (Melanoma)	-0.308	0.203	-1.520	0.131	-0.708	0.092
Breast Cancer	0.332	0.170	1.960	0.052	-0.003	0.666
Prostate Cancer	-0.376	0.162	-2.330	0.021	-0.695	-0.057
Colon Cancer	-0.056	0.238	-0.240	0.814	-0.525	0.413
Other Cancer	-0.011	0.134	-0.090	0.932	-0.275	0.252
Comorbidity						
Diabetes	-0.126	0.103	-1.230	0.221	-0.330	0.077

Hypertension	-0.175	0.146	-1.200	0.233	-0.463	0.114
Heart Conditions	-0.106	0.093	-1.140	0.254	-0.289	0.077
Cerebrovascular Disease	-0.298	0.188	-1.580	0.115	-0.669	0.073
COPD or Asthma	-0.166	0.106	-1.560	0.120	-0.376	0.044
Arthritis or Joint Disorders	0.145	0.110	1.310	0.192	-0.073	0.363
Mental Disorders	-0.034	0.097	-0.350	0.728	-0.226	0.158
Constant	2.585	0.609	4.240	0.000	1.383	3.788

Inflate Model

PCMH Category						
No USC	(reference)					
Partial PCMH	-0.186	0.105	-1.780	0.077	-0.393	0.021
PCMH	-0.270	0.107	-2.520	0.013	-0.481	-0.058
Year						
2008	(reference)					
2009	0.034	0.132	0.250	0.800	-0.227	0.294
2010	0.075	0.148	0.510	0.612	-0.217	0.367
2011	0.036	0.148	0.240	0.810	-0.256	0.327
2012	-0.238	0.145	-1.630	0.104	-0.524	0.049
2013	-0.345	0.131	-2.630	0.009	-0.604	-0.086
Geographic Region						
Northeast	(reference)					
Midwest	-0.150	0.207	-0.720	0.471	-0.558	0.259
South	0.300	0.186	1.620	0.108	-0.066	0.667
West	0.659	0.212	3.110	0.002	0.241	1.078
Age						
65-74	(reference)					
75-84	0.084	0.104	0.810	0.417	-0.120	0.288
85 and Older	0.479	0.180	2.660	0.008	0.124	0.834
Gender						
Male	(reference)					
Female	-0.386	0.128	-3.010	0.003	-0.640	-0.133
Race						
White	(reference)					
Black	0.107	0.136	0.780	0.433	-0.161	0.374
Other	-0.298	0.248	-1.200	0.231	-0.788	0.192
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.332	0.206	1.610	0.108	-0.074	0.738
Marital Status						
Married	(reference)					
Widowed	-0.032	0.114	-0.280	0.779	-0.257	0.192
Divorced	0.284	0.132	2.160	0.032	0.025	0.544
Separated	-0.241	0.393	-0.610	0.541	-1.016	0.535
Never Married	0.011	0.270	0.040	0.968	-0.521	0.543

Household Size	0.003	0.053	0.050	0.960	-0.101	0.106
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-0.270	0.087	-3.110	0.002	-0.441	-0.099
Medicare and Other Public Insurance	-0.181	0.162	-1.120	0.265	-0.501	0.139
Uninsured	-0.580	0.611	-0.950	0.344	-1.786	0.626
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	-0.133	0.148	-0.900	0.370	-0.426	0.159
Some College	-0.131	0.149	-0.880	0.381	-0.425	0.163
4-Year college or Bachelor's Degree	-0.030	0.161	-0.190	0.851	-0.349	0.288
Master's or Doctorate or Professional Degree	-0.169	0.174	-0.970	0.334	-0.513	0.175
Poverty Level						
Poor	(reference)					
Near Poor	-0.237	0.206	-1.150	0.250	-0.643	0.168
Low Income	0.140	0.161	0.870	0.385	-0.177	0.456
Middle Income	-0.101	0.152	-0.660	0.507	-0.402	0.199
High Income	-0.090	0.160	-0.560	0.578	-0.406	0.227
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.084	0.202	-0.420	0.677	-0.482	0.314
Good	0.022	0.218	0.100	0.918	-0.407	0.452
Very Good	-0.165	0.250	-0.660	0.509	-0.658	0.327
Excellent	0.097	0.304	0.320	0.752	-0.504	0.697
Physical Health Score	0.014	0.005	2.730	0.007	0.004	0.024
Mental Health Score	0.001	0.005	0.250	0.805	-0.009	0.012
ADLs	0.392	0.179	2.180	0.030	0.038	0.745
IADLs	0.509	0.147	3.460	0.001	0.219	0.799
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.005	0.176	0.030	0.976	-0.343	0.353
Skin Cancer (Melanoma)	0.053	0.241	0.220	0.825	-0.422	0.528
Breast Cancer	0.101	0.179	0.560	0.574	-0.252	0.453
Prostate Cancer	-0.050	0.174	-0.290	0.776	-0.393	0.293
Colon Cancer	0.049	0.226	0.220	0.828	-0.397	0.495

Other Cancer	-0.090	0.147	-0.610	0.541	-0.381	0.201
Comorbidity						
Diabetes	-0.253	0.104	-2.430	0.016	-0.459	-0.047
Hypertension	0.079	0.108	0.730	0.467	-0.135	0.293
Heart Conditions	-0.443	0.091	-4.860	0.000	-0.623	-0.263
Cerebrovascular Disease	-0.128	0.187	-0.690	0.493	-0.496	0.240
COPD or Asthma	-0.435	0.090	-4.810	0.000	-0.613	-0.257
Arthritis or Joint Disorders	-0.203	0.084	-2.420	0.017	-0.369	-0.037
Mental Disorders	-0.179	0.116	-1.540	0.124	-0.408	0.050
Constant	0.457	0.546	0.840	0.404	-0.621	1.534

Appendix 4: Coefficients of NBRM for Office-based Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Office-Based Visits	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.084	0.033	2.520	0.013	0.018	0.149
PCMH	0.037	0.038	0.960	0.338	-0.039	0.112
Year						
2008	(reference)					
2009	0.063	0.039	1.610	0.108	-0.014	0.141
2010	-0.023	0.052	-0.440	0.660	-0.125	0.080
2011	-0.050	0.058	-0.860	0.390	-0.164	0.064
2012	-0.004	0.051	-0.080	0.937	-0.105	0.097
2013	0.087	0.055	1.580	0.115	-0.021	0.195
Geographic Region						
Northeast	(reference)					
Midwest	-0.063	0.064	-0.980	0.330	-0.190	0.064
South	-0.134	0.065	-2.070	0.040	-0.261	-0.006
West	-0.057	0.059	-0.960	0.338	-0.173	0.060
Age						
65-74	(reference)					
75-84	0.030	0.039	0.770	0.442	-0.047	0.108
85 and Older	-0.070	0.076	-0.920	0.358	-0.219	0.080
Gender						
Male	(reference)					
Female	-0.074	0.043	-1.700	0.091	-0.159	0.012
Race						
White	(reference)					
Black	-0.188	0.070	-2.690	0.008	-0.325	-0.050
Other	-0.158	0.091	-1.730	0.085	-0.337	0.022
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.153	0.075	-2.040	0.043	-0.300	-0.005
Marital Status						
Married	(reference)					
Widowed	-0.058	0.044	-1.300	0.196	-0.145	0.030
Divorced	-0.123	0.066	-1.860	0.065	-0.253	0.008
Separated	-0.411	0.162	-2.540	0.012	-0.730	-0.092
Never Married	-0.033	0.129	-0.260	0.797	-0.287	0.221
Household Size						
	-0.075	0.019	-4.030	0.000	-0.111	-0.038
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.072	0.038	1.890	0.060	-0.003	0.146
Medicare and Other Public Insurance	0.056	0.075	0.750	0.456	-0.091	0.203
Uninsured	-0.475	0.166	-2.870	0.005	-0.802	-0.148
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.220	0.051	4.340	0.000	0.120	0.321
Some College	0.265	0.059	4.500	0.000	0.149	0.382
4-Year college or Bachelor's Degree	0.368	0.057	6.510	0.000	0.257	0.480
Master's or Doctorate or Professional Degree	0.436	0.070	6.240	0.000	0.298	0.574
Poverty Level						
Poor	(reference)					
Near Poor	0.027	0.082	0.330	0.740	-0.134	0.188
Low Income	0.082	0.067	1.210	0.226	-0.051	0.215
Middle Income	0.177	0.055	3.200	0.002	0.068	0.287
High Income	0.157	0.057	2.730	0.007	0.043	0.270
Perceived Health Status						
Poor Health	(reference)					
Fair	0.014	0.100	0.140	0.890	-0.183	0.210
Good	-0.076	0.102	-0.750	0.457	-0.278	0.126
Very Good	-0.157	0.109	-1.440	0.150	-0.372	0.058
Excellent	-0.264	0.122	-2.160	0.032	-0.506	-0.022
Physical Health Score	-0.011	0.002	-4.970	0.000	-0.015	-0.006
Mental Health Score	0.000	0.002	0.020	0.985	-0.004	0.004
ADLs	0.035	0.069	0.510	0.610	-0.100	0.171
IADLs	-0.157	0.061	-2.560	0.011	-0.277	-0.036
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.238	0.066	3.630	0.000	0.109	0.368
Skin Cancer (Melanoma)	0.234	0.083	2.830	0.005	0.071	0.398
Breast Cancer	0.276	0.078	3.560	0.000	0.123	0.429
Prostate Cancer	0.097	0.073	1.330	0.185	-0.047	0.241
Colon Cancer	0.038	0.080	0.470	0.639	-0.121	0.196
Other Cancer	0.289	0.061	4.700	0.000	0.167	0.410
Comorbidity						
Diabetes	0.000	0.038	-0.010	0.995	-0.074	0.074

Hypertension	0.076	0.035	2.180	0.030	0.007	0.146
Heart Conditions	0.266	0.040	6.610	0.000	0.186	0.345
Cerebrovascular Disease	-0.054	0.059	-0.910	0.362	-0.169	0.062
COPD or Asthma	0.222	0.036	6.130	0.000	0.150	0.293
Arthritis or Joint Disorders	0.190	0.036	5.260	0.000	0.119	0.261
Mental Disorders	0.165	0.042	3.950	0.000	0.083	0.247
Constant	2.338	0.216	10.840	0.000	1.913	2.764

Appendix 5: Coefficients of Fixed Effects Model for ED Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

ED Visits	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	-0.038	0.036	-1.070	0.287	-0.109	0.032
Geographic Region						
Northeast	(reference)					
Midwest	0.054	0.218	0.250	0.803	-0.373	0.481
South	0.190	0.183	1.040	0.299	-0.169	0.550
West	-0.556	0.268	-2.070	0.038	-1.081	-0.030
Age						
65-74	(reference)					
75-84	0.000	(omitted)				
85 and Older	0.000	(omitted)				
Gender						
Male	(reference)					
Female	0.000	(omitted)				
Race						
White	(reference)					
Black	0.000	(omitted)				
Other	0.000	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.000	(omitted)				
Marital Status						
Married	(reference)					
Widowed	0.106	0.158	0.670	0.502	-0.204	0.416
Divorced	1.152	0.623	1.850	0.065	-0.070	2.374
Separated	0.162	0.365	0.440	0.657	-0.554	0.877
Never Married	0.000	(omitted)				
Household Size	0.000	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	0.043	0.073	0.590	0.553	-0.100	0.186
Medicare and Other Public Insurance	0.172	0.180	0.960	0.337	-0.180	0.525
Uninsured	0.090	0.183	0.490	0.622	-0.268	0.448
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.000	(omitted)				

Some College	0.000	(omitted)				
4-Year college or Bachelor's Degree	0.000	(omitted)				
Master's or Doctorate or Professional Degree	0.000	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	0.150	0.079	1.900	0.057	-0.005	0.305
Low Income	0.074	0.069	1.070	0.283	-0.061	0.210
Middle Income	0.142	0.066	2.140	0.032	0.012	0.271
High Income	0.114	0.065	1.750	0.080	-0.014	0.241
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.421	0.169	-2.490	0.013	-0.752	-0.089
Good	-0.483	0.190	-2.550	0.011	-0.854	-0.111
Very Good	-0.577	0.196	-2.950	0.003	-0.961	-0.193
Excellent	-0.558	0.198	-2.820	0.005	-0.946	-0.170
Physical Health Score	-0.009	0.003	-3.040	0.002	-0.015	-0.003
Mental Health Score	-0.006	0.003	-2.170	0.030	-0.011	-0.001
ADLs	0.358	0.131	2.740	0.006	0.101	0.615
IADLs	-0.004	0.073	-0.060	0.952	-0.147	0.138
Comorbidity						
Diabetes	0.110	0.183	0.600	0.548	-0.248	0.468
Hypertension	0.139	0.111	1.250	0.212	-0.079	0.357
Heart Conditions	0.076	0.071	1.080	0.279	-0.062	0.215
Cerebrovascular Disease	0.009	0.127	0.070	0.945	-0.240	0.257
COPD or Asthma	0.259	0.071	3.650	0.000	0.120	0.399
Arthritis or Joint Disorders	-0.013	0.052	-0.260	0.798	-0.115	0.089
Mental Disorders	0.017	0.096	0.180	0.857	-0.172	0.207
Constant	0.946	0.337	2.810	0.005	0.285	1.608

Appendix 6: Coefficients of Fixed Effects Model for Inpatient Days among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Inpatient Days	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	0.102	0.295	0.350	0.730	-0.477	0.681
Geographic Region						
Northeast	(reference)					
Midwest	-0.087	0.778	-0.110	0.911	-1.614	1.439
South	0.085	0.591	0.140	0.886	-1.075	1.244
West	-0.311	0.755	-0.410	0.681	-1.791	1.170
Age						
65-74	(reference)					
75-84	0.000	(omitted)				
85 and Older	0.000	(omitted)				
Gender						
Male	(reference)					
Female	0.000	(omitted)				
Race						
White	(reference)					
Black	0.000	(omitted)				
Other	0.000	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.000	(omitted)				
Marital Status						
Married	(reference)					
Widowed	1.158	1.160	1.000	0.318	-1.117	3.434
Divorced	-4.711	3.586	-1.310	0.189	-11.744	2.323
Separated	-0.412	2.388	-0.170	0.863	-5.095	4.271
Never Married	0.000	(omitted)				
Household Size	0.000	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-0.528	0.613	-0.860	0.389	-1.731	0.675
Medicare and Other Public Insurance	0.090	0.527	0.170	0.864	-0.943	1.123
Uninsured	1.642	1.386	1.180	0.236	-1.076	4.360
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.000	(omitted)				

Some College	0.000	(omitted)				
4-Year college or Bachelor's Degree	0.000	(omitted)				
Master's or Doctorate or Professional Degree	0.000	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	0.968	0.903	1.070	0.284	-0.802	2.738
Low Income	1.164	0.800	1.460	0.146	-0.405	2.733
Middle Income	1.692	0.978	1.730	0.084	-0.226	3.609
High Income	1.501	0.846	1.770	0.076	-0.158	3.161
Perceived Health Status						
Poor Health	(reference)					
Fair	-2.924	1.639	-1.780	0.075	-6.138	0.290
Good	-3.729	1.854	-2.010	0.044	-7.365	-0.092
Very Good	-4.156	1.881	-2.210	0.027	-7.846	-0.466
Excellent	-4.277	1.894	-2.260	0.024	-7.991	-0.564
Physical Health Score	-0.045	0.028	-1.580	0.114	-0.100	0.011
Mental Health Score	-0.063	0.021	-2.970	0.003	-0.105	-0.021
ADLs	4.552	1.874	2.430	0.015	0.877	8.227
IADLs	0.523	0.743	0.700	0.481	-0.933	1.980
Comorbidity						
Diabetes	0.451	0.726	0.620	0.534	-0.973	1.876
Hypertension	0.591	0.549	1.080	0.281	-0.485	1.667
Heart Conditions	0.331	0.439	0.750	0.451	-0.530	1.193
Cerebrovascular Disease	0.435	0.563	0.770	0.439	-0.668	1.539
COPD or Asthma	-0.338	0.316	-1.070	0.285	-0.958	0.281
Arthritis or Joint Disorders	-0.351	0.266	-1.320	0.187	-0.873	0.171
Mental Disorders	0.902	0.505	1.780	0.074	-0.089	1.892
Constant	8.179	2.332	3.510	0.000	3.605	12.754

Appendix 7: Coefficients of Fixed Effects Model for Outpatient Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Outpatient Visits	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	0.109	0.210	0.520	0.606	-0.304	0.521
Geographic Region						
Northeast	(reference)					
Midwest	-0.987	1.335	-0.740	0.460	-3.605	1.632
South	-1.633	1.143	-1.430	0.153	-3.874	0.608
West	-1.104	1.253	-0.880	0.378	-3.562	1.353
Age						
65-74	(reference)					
75-84	0.000	(omitted)				
85 and Older	0.000	(omitted)				
Gender						
Male	(reference)					
Female	0.000	(omitted)				
Race						
White	(reference)					
Black	0.000	(omitted)				
Other	0.000	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.000	(omitted)				
Marital Status						
Married	(reference)					
Widowed	-0.131	0.226	-0.580	0.562	-0.573	0.311
Divorced	-2.879	2.616	-1.100	0.271	-8.008	2.251
Separated	-2.400	1.651	-1.450	0.146	-5.638	0.839
Never Married	0.000	(omitted)				
Household Size	0.000	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	0.233	0.276	0.840	0.399	-0.308	0.774
Medicare and Other Public Insurance	0.495	0.702	0.710	0.481	-0.882	1.873
Uninsured	0.732	1.217	0.600	0.547	-1.655	3.120
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.000	(omitted)				

Some College	0.000	(omitted)				
4-Year college or Bachelor's Degree	0.000	(omitted)				
Master's or Doctorate or Professional Degree	0.000	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	-0.637	0.486	-1.310	0.190	-1.590	0.316
Low Income	-0.313	0.404	-0.770	0.439	-1.106	0.479
Middle Income	0.003	0.403	0.010	0.995	-0.788	0.793
High Income	-0.149	0.413	-0.360	0.719	-0.959	0.662
Perceived Health Status						
Poor Health	(reference)					
Fair	-1.496	1.141	-1.310	0.190	-3.734	0.742
Good	-2.353	1.258	-1.870	0.062	-4.820	0.115
Very Good	-1.961	1.341	-1.460	0.144	-4.592	0.669
Excellent	-2.426	1.382	-1.760	0.079	-5.136	0.284
Physical Health Score	-0.061	0.021	-2.940	0.003	-0.102	-0.020
Mental Health Score	-0.005	0.018	-0.260	0.794	-0.040	0.030
ADLs	1.075	0.647	1.660	0.096	-0.193	2.343
IADLs	-0.119	0.434	-0.270	0.784	-0.970	0.733
Comorbidity						
Diabetes	0.412	0.389	1.060	0.289	-0.350	1.175
Hypertension	-1.454	0.958	-1.520	0.129	-3.333	0.425
Heart Conditions	-0.722	0.698	-1.030	0.301	-2.092	0.647
Cerebrovascular Disease	0.160	0.698	0.230	0.819	-1.209	1.529
COPD or Asthma	0.057	0.335	0.170	0.864	-0.599	0.714
Arthritis or Joint Disorders	-0.392	0.269	-1.460	0.145	-0.920	0.136
Mental Disorders	0.428	0.371	1.150	0.248	-0.299	1.155
Constant	8.956	3.177	2.820	0.005	2.725	15.187

Appendix 8: Coefficients of Fixed Effects Model for Office-based Visits among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Office-based Visits	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	-0.052	0.701	-0.070	0.941	-1.426	1.322
Geographic Region						
Northeast	(reference)					
Midwest	-3.443	8.951	-0.380	0.701	-20.998	14.113
South	4.070	7.988	0.510	0.610	-11.595	19.735
West	-2.842	9.448	-0.300	0.764	-21.371	15.686
Age						
65-74	(reference)					
75-84	0.000	(omitted)				
85 and Older	0.000	(omitted)				
Gender						
Male	(reference)					
Female	0.000	(omitted)				
Race						
White	(reference)					
Black	0.000	(omitted)				
Other	0.000	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.000	(omitted)				
Marital Status						
Married	(reference)					
Widowed	0.850	3.096	0.270	0.784	-5.221	6.921
Divorced	4.889	4.992	0.980	0.328	-4.902	14.679
Separated	6.348	4.862	1.310	0.192	-3.186	15.883
Never Married	0.000	(omitted)				
Household Size						
	0.000	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	1.062	1.427	0.740	0.457	-1.736	3.860
Medicare and Other Public Insurance	3.300	2.151	1.530	0.125	-0.918	7.519
Uninsured	2.066	1.804	1.150	0.252	-1.472	5.604
Education Level						
Less Than High School	(reference)					

GED or High School Graduate	0.000	(omitted)				
Some College	0.000	(omitted)				
4-Year college or Bachelor's Degree	0.000	(omitted)				
Master's or Doctorate or Professional Degree	0.000	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	2.189	1.342	1.630	0.103	-0.444	4.821
Low Income	1.390	1.355	1.030	0.305	-1.266	4.047
Middle Income	1.864	1.177	1.580	0.113	-0.444	4.171
High Income	1.290	1.258	1.030	0.305	-1.177	3.757
Perceived Health Status						
Poor Health	(reference)					
Fair	3.216	2.997	1.070	0.283	-2.662	9.094
Good	0.095	3.266	0.030	0.977	-6.309	6.500
Very Good	-0.916	3.385	-0.270	0.787	-7.554	5.722
Excellent	-2.349	3.476	-0.680	0.499	-9.165	4.468
Physical Health Score	-0.203	0.044	-4.590	0.000	-0.290	-0.116
Mental Health Score	-0.068	0.040	-1.720	0.085	-0.146	0.009
ADLs	1.104	1.592	0.690	0.488	-2.018	4.226
IADLs	-1.782	1.026	-1.740	0.083	-3.794	0.231
Comorbidity						
Diabetes	-0.391	1.731	-0.230	0.821	-3.786	3.004
Hypertension	0.288	1.724	0.170	0.867	-3.093	3.669
Heart Conditions	1.164	1.022	1.140	0.255	-0.841	3.168
Cerebrovascular Disease	-2.284	2.054	-1.110	0.266	-6.312	1.743
COPD or Asthma	3.459	1.043	3.320	0.001	1.413	5.504
Arthritis or Joint Disorders	1.697	0.865	1.960	0.050	0.001	3.394
Mental Disorders	0.523	1.566	0.330	0.738	-2.548	3.595
Constant	19.645	8.300	2.370	0.018	3.367	35.922

Appendix 9: Coefficients of GLM for ED Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

ED Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	-0.213	0.137	-1.550	0.123	-0.483	0.058
PCMH	-0.180	0.161	-1.120	0.266	-0.499	0.139
Year						
2008	(reference)					
2009	0.306	0.179	1.710	0.088	-0.046	0.658
2010	0.198	0.195	1.010	0.313	-0.187	0.582
2011	0.038	0.208	0.180	0.854	-0.373	0.450
2012	0.315	0.154	2.040	0.042	0.011	0.620
2013	0.478	0.172	2.780	0.006	0.139	0.818
Geographic Region						
Northeast	(reference)					
Midwest	0.064	0.197	0.330	0.745	-0.324	0.452
South	-0.473	0.188	-2.510	0.013	-0.844	-0.102
West	0.143	0.215	0.670	0.506	-0.281	0.567
Age						
65-74	(reference)					
75-84	0.289	0.134	2.160	0.032	0.025	0.552
85 and Older	0.213	0.165	1.290	0.198	-0.112	0.538
Gender						
Male	(reference)					
Female	0.022	0.143	0.150	0.880	-0.260	0.303
Race						
White	(reference)					
Black	0.354	0.267	1.330	0.186	-0.172	0.880
Other	0.039	0.305	0.130	0.899	-0.563	0.640
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.336	0.287	1.170	0.242	-0.229	0.902
Marital Status						
Married	(reference)					
Widowed	0.105	0.155	0.680	0.498	-0.200	0.410
Divorced	0.030	0.177	0.170	0.868	-0.321	0.380
Separated	-0.038	0.493	-0.080	0.939	-1.012	0.936
Never Married	-0.290	0.293	-0.990	0.322	-0.868	0.287
Household Size						
	0.060	0.058	1.030	0.304	-0.055	0.174
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.025	0.110	0.230	0.820	-0.191	0.241
Medicare and Other Public Insurance	-0.057	0.254	-0.220	0.824	-0.558	0.445
Uninsured	-0.116	0.607	-0.190	0.849	-1.314	1.082
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	-0.053	0.161	-0.330	0.741	-0.371	0.265
Some College	-0.034	0.169	-0.200	0.840	-0.367	0.299
4-Year college or Bachelor's Degree	-0.291	0.208	-1.400	0.164	-0.701	0.120
Master's or Doctorate or Professional Degree	0.012	0.225	0.050	0.958	-0.433	0.456
Poverty Level						
Poor	(reference)					
Near Poor	-0.643	0.246	-2.610	0.010	-1.129	-0.158
Low Income	-0.414	0.209	-1.980	0.049	-0.826	-0.002
Middle Income	0.017	0.196	0.090	0.929	-0.369	0.404
High Income	-0.133	0.245	-0.540	0.587	-0.616	0.350
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.250	0.273	-0.910	0.362	-0.788	0.289
Good	-0.305	0.269	-1.130	0.259	-0.836	0.227
Very Good	-0.870	0.307	-2.830	0.005	-1.476	-0.264
Excellent	-0.796	0.333	-2.390	0.018	-1.454	-0.138
Physical Health Score	-0.019	0.006	-3.050	0.003	-0.032	-0.007
Mental Health Score	-0.012	0.006	-1.950	0.053	-0.025	0.000
ADLs	0.007	0.191	0.040	0.970	-0.371	0.385
IADLs	0.139	0.188	0.740	0.461	-0.232	0.509
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.557	0.230	2.420	0.017	0.102	1.011
Skin Cancer (Melanoma)	-0.022	0.270	-0.080	0.935	-0.555	0.511
Breast Cancer	0.129	0.249	0.520	0.605	-0.363	0.622
Prostate Cancer	0.546	0.221	2.470	0.014	0.111	0.981
Colon Cancer	-0.218	0.267	-0.820	0.416	-0.745	0.309
Other Cancer	0.428	0.214	2.000	0.047	0.006	0.851
Comorbidity						
Diabetes	-0.068	0.127	-0.530	0.597	-0.319	0.184

Hypertension	0.161	0.138	1.170	0.243	-0.111	0.434
Heart Conditions	0.791	0.110	7.190	0.000	0.574	1.008
Cerebrovascular Disease	0.325	0.179	1.810	0.071	-0.029	0.679
COPD or Asthma	0.355	0.135	2.630	0.009	0.088	0.621
Arthritis or Joint Disorders	-0.094	0.119	-0.790	0.429	-0.328	0.140
Mental Disorders	0.148	0.133	1.110	0.267	-0.115	0.412
Constant	6.080	0.641	9.480	0.000	4.815	7.345

Appendix 10: Coefficients of GLM for Inpatient Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Inpatient Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.089	0.137	0.640	0.520	-0.182	0.359
PCMH	0.169	0.176	0.970	0.336	-0.177	0.516
Year						
2008	(reference)					
2009	0.279	0.215	1.300	0.196	-0.145	0.703
2010	-0.128	0.182	-0.700	0.483	-0.487	0.231
2011	-0.052	0.190	-0.280	0.784	-0.428	0.323
2012	-0.225	0.195	-1.150	0.250	-0.610	0.160
2013	-0.229	0.193	-1.190	0.237	-0.610	0.152
Geographic Region						
Northeast	(reference)					
Midwest	0.024	0.233	0.100	0.919	-0.435	0.483
South	-0.261	0.178	-1.470	0.144	-0.613	0.090
West	-0.205	0.198	-1.030	0.304	-0.596	0.187
Age						
65-74	(reference)					
75-84	0.043	0.151	0.280	0.777	-0.255	0.341
85 and Older	-0.199	0.224	-0.890	0.376	-0.641	0.243
Gender						
Male	(reference)					
Female	-0.154	0.127	-1.220	0.225	-0.404	0.096
Race						
White	(reference)					
Black	-0.173	0.205	-0.840	0.401	-0.578	0.232
Other	0.244	0.301	0.810	0.419	-0.350	0.837
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.075	0.214	-0.350	0.728	-0.496	0.347
Marital Status						
Married	(reference)					
Widowed	0.206	0.157	1.310	0.191	-0.104	0.517
Divorced	0.109	0.183	0.590	0.553	-0.253	0.471
Separated	-1.189	0.409	-2.910	0.004	-1.996	-0.382
Never Married	-0.004	0.375	-0.010	0.992	-0.743	0.736
Household Size						
	0.008	0.062	0.130	0.897	-0.114	0.130
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.153	0.132	1.160	0.247	-0.107	0.413
Medicare and Other Public Insurance	-0.310	0.209	-1.480	0.140	-0.723	0.103
Uninsured	-1.250	0.582	-2.150	0.033	-2.399	-0.101
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.004	0.155	0.020	0.981	-0.302	0.309
Some College	0.083	0.153	0.540	0.588	-0.219	0.385
4-Year college or Bachelor's Degree	-0.001	0.192	0.000	0.997	-0.380	0.378
Master's or Doctorate or Professional Degree	-0.028	0.209	-0.130	0.894	-0.441	0.385
Poverty Level						
Poor	(reference)					
Near Poor	-0.241	0.274	-0.880	0.381	-0.782	0.300
Low Income	-0.229	0.212	-1.080	0.282	-0.647	0.189
Middle Income	-0.058	0.191	-0.300	0.763	-0.434	0.319
High Income	-0.213	0.194	-1.100	0.274	-0.595	0.170
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.085	0.234	-0.360	0.718	-0.547	0.378
Good	-0.088	0.260	-0.340	0.735	-0.601	0.425
Very Good	-0.528	0.320	-1.650	0.101	-1.160	0.105
Excellent	-0.915	0.403	-2.270	0.024	-1.711	-0.120
Physical Health Score	-0.039	0.007	-5.860	0.000	-0.052	-0.026
Mental Health Score	-0.011	0.006	-1.790	0.075	-0.024	0.001
ADLs	0.394	0.175	2.250	0.026	0.048	0.740
IADLs	0.293	0.150	1.960	0.051	-0.002	0.589
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.340	0.262	1.300	0.196	-0.177	0.858
Skin Cancer (Melanoma)	0.209	0.335	0.620	0.534	-0.452	0.870
Breast Cancer	0.354	0.263	1.350	0.180	-0.165	0.873
Prostate Cancer	0.485	0.252	1.930	0.056	-0.012	0.982
Colon Cancer	1.011	0.292	3.460	0.001	0.434	1.588
Other Cancer	0.930	0.228	4.090	0.000	0.481	1.379
Comorbidity						
Diabetes	-0.274	0.141	-1.950	0.053	-0.551	0.004

Hypertension	0.248	0.125	1.990	0.048	0.002	0.494
Heart Conditions	0.678	0.125	5.430	0.000	0.432	0.924
Cerebrovascular Disease	0.271	0.181	1.500	0.136	-0.086	0.628
COPD or Asthma	0.124	0.119	1.040	0.299	-0.111	0.358
Arthritis or Joint Disorders	0.131	0.105	1.250	0.212	-0.075	0.338
Mental Disorders	-0.180	0.135	-1.330	0.184	-0.447	0.086
Constant	9.350	0.598	15.630	0.000	8.169	10.530

Appendix 11: Coefficients of GLM for Outpatient Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Outpatient Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.059	0.119	0.490	0.623	-0.177	0.295
PCMH	0.136	0.133	1.020	0.309	-0.127	0.398
Year						
2008	(reference)					
2009	0.453	0.175	2.590	0.010	0.108	0.798
2010	0.165	0.175	0.940	0.347	-0.181	0.511
2011	0.099	0.189	0.520	0.603	-0.275	0.473
2012	-0.019	0.163	-0.120	0.905	-0.341	0.302
2013	0.237	0.158	1.500	0.135	-0.074	0.549
Geographic Region						
Northeast	(reference)					
Midwest	0.176	0.158	1.110	0.267	-0.136	0.489
South	-0.215	0.147	-1.460	0.145	-0.506	0.075
West	-0.342	0.168	-2.030	0.044	-0.674	-0.010
Age						
65-74	(reference)					
75-84	-0.347	0.125	-2.770	0.006	-0.594	-0.100
85 and Older	-0.581	0.204	-2.850	0.005	-0.983	-0.179
Gender						
Male	(reference)					
Female	-0.493	0.132	-3.740	0.000	-0.754	-0.233
Race						
White	(reference)					
Black	0.230	0.236	0.970	0.332	-0.236	0.695
Other	-0.019	0.294	-0.060	0.949	-0.600	0.562
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.548	0.275	-1.990	0.048	-1.092	-0.005
Marital Status						
Married						
Widowed	-0.005	0.133	-0.040	0.967	-0.268	0.257
Divorced	0.092	0.176	0.520	0.602	-0.255	0.439
Separated	-1.485	0.383	-3.880	0.000	-2.240	-0.729
Never Married	-0.337	0.258	-1.300	0.194	-0.847	0.173
Household Size						
	-0.057	0.052	-1.100	0.273	-0.159	0.045
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.277	0.112	2.480	0.014	0.057	0.497
Medicare and Other Public Insurance	0.333	0.237	1.400	0.162	-0.135	0.802
Uninsured	-0.409	0.329	-1.250	0.214	-1.058	0.239
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	-0.119	0.182	-0.650	0.514	-0.477	0.240
Some College	0.015	0.196	0.080	0.938	-0.372	0.402
4-Year college or Bachelor's Degree	0.142	0.205	0.690	0.490	-0.263	0.547
Master's or Doctorate or Professional Degree	0.076	0.212	0.360	0.720	-0.342	0.494
Poverty Level						
Poor	(reference)					
Near Poor	-0.100	0.231	-0.430	0.664	-0.555	0.355
Low Income	0.105	0.227	0.460	0.646	-0.344	0.553
Middle Income	0.193	0.205	0.940	0.347	-0.211	0.597
High Income	0.030	0.213	0.140	0.890	-0.391	0.450
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.120	0.215	-0.560	0.577	-0.546	0.305
Good	-0.385	0.236	-1.630	0.105	-0.851	0.082
Very Good	-0.799	0.250	-3.200	0.002	-1.292	-0.306
Excellent	-1.257	0.322	-3.900	0.000	-1.893	-0.622
Physical Health Score	-0.019	0.006	-3.350	0.001	-0.031	-0.008
Mental Health Score	-0.004	0.006	-0.640	0.525	-0.016	0.008
ADLs	-0.038	0.196	-0.190	0.848	-0.424	0.349
IADLs	-0.191	0.177	-1.080	0.283	-0.540	0.159
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	-0.158	0.174	-0.900	0.367	-0.501	0.186
Skin Cancer (Melanoma)	-0.327	0.226	-1.440	0.151	-0.773	0.120
Breast Cancer	0.323	0.195	1.650	0.100	-0.062	0.708
Prostate Cancer	-0.487	0.200	-2.440	0.016	-0.881	-0.093
Colon Cancer	-0.322	0.230	-1.400	0.163	-0.776	0.131
Other Cancer	0.232	0.179	1.300	0.196	-0.121	0.586
Comorbidity						
Diabetes	-0.006	0.113	-0.060	0.956	-0.229	0.217

Hypertension	-0.176	0.118	-1.490	0.139	-0.409	0.058
Heart Conditions	0.203	0.107	1.910	0.058	-0.007	0.413
Cerebrovascular Disease	0.128	0.214	0.600	0.550	-0.294	0.551
COPD or Asthma	-0.112	0.117	-0.960	0.339	-0.344	0.119
Arthritis or Joint Disorders	0.100	0.104	0.960	0.338	-0.106	0.306
Mental Disorders	0.020	0.115	0.170	0.864	-0.207	0.246
Constant	8.627	0.558	15.470	0.000	7.527	9.728

Appendix 12: Coefficients of GLM for Office-based Visits Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Office-based Visits Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.022	0.054	0.410	0.686	-0.084	0.128
PCMH	-0.054	0.058	-0.930	0.354	-0.168	0.060
Year						
2008	(reference)					
2009	0.082	0.073	1.130	0.261	-0.061	0.225
2010	0.096	0.103	0.930	0.354	-0.108	0.300
2011	0.023	0.080	0.290	0.772	-0.135	0.182
2012	0.056	0.074	0.750	0.451	-0.090	0.202
2013	-0.010	0.079	-0.130	0.898	-0.166	0.146
Geographic Region						
Northeast	(reference)					
Midwest	-0.133	0.066	-2.000	0.047	-0.264	-0.002
South	-0.104	0.069	-1.510	0.133	-0.240	0.032
West	0.034	0.071	0.490	0.628	-0.105	0.173
Age						
65-74	(reference)					
75-84	-0.067	0.061	-1.100	0.271	-0.186	0.053
85 and Older	-0.199	0.086	-2.320	0.021	-0.368	-0.030
Gender						
Male	(reference)					
Female	-0.209	0.060	-3.480	0.001	-0.328	-0.091
Race						
White	(reference)					
Black	0.063	0.147	0.430	0.670	-0.228	0.354
Other	-0.181	0.125	-1.450	0.148	-0.427	0.065
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.097	0.134	-0.730	0.467	-0.361	0.166
Marital Status						
Married	(reference)					
Widowed	-0.014	0.072	-0.190	0.849	-0.156	0.128
Divorced	-0.130	0.086	-1.510	0.132	-0.299	0.039
Separated	-0.457	0.247	-1.850	0.066	-0.943	0.030
Never Married	-0.237	0.114	-2.080	0.039	-0.462	-0.012
Household Size						
	-0.066	0.028	-2.330	0.021	-0.122	-0.010
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.244	0.059	4.140	0.000	0.128	0.361
Medicare and Other Public Insurance	0.052	0.101	0.520	0.606	-0.147	0.251
Uninsured	-0.099	0.268	-0.370	0.712	-0.628	0.430
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.233	0.076	3.060	0.003	0.083	0.383
Some College	0.224	0.089	2.510	0.013	0.048	0.399
4-Year college or Bachelor's Degree	0.189	0.084	2.240	0.026	0.023	0.355
Master's or Doctorate or Professional Degree	0.356	0.090	3.960	0.000	0.179	0.533
Poverty Level						
Poor	(reference)					
Near Poor	0.248	0.135	1.830	0.069	-0.019	0.514
Low Income	0.166	0.094	1.760	0.080	-0.020	0.353
Middle Income	0.173	0.083	2.080	0.039	0.009	0.337
High Income	0.184	0.084	2.190	0.030	0.018	0.349
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.348	0.172	-2.020	0.044	-0.686	-0.009
Good	-0.462	0.174	-2.660	0.009	-0.805	-0.119
Very Good	-0.732	0.183	-4.000	0.000	-1.093	-0.371
Excellent	-0.878	0.208	-4.220	0.000	-1.289	-0.467
Physical Health Score	-0.009	0.003	-2.920	0.004	-0.016	-0.003
Mental Health Score	-0.001	0.003	-0.300	0.767	-0.006	0.005
ADLs	-0.028	0.109	-0.260	0.797	-0.244	0.187
IADLs	-0.128	0.086	-1.500	0.136	-0.297	0.041
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.198	0.084	2.350	0.020	0.032	0.364
Skin Cancer (Melanoma)	0.055	0.092	0.600	0.550	-0.127	0.238
Breast Cancer	0.252	0.101	2.490	0.014	0.052	0.451
Prostate Cancer	0.036	0.100	0.360	0.719	-0.161	0.233
Colon Cancer	0.016	0.111	0.140	0.885	-0.203	0.235
Other Cancer	0.349	0.075	4.620	0.000	0.200	0.498
Comorbidity						
Diabetes	-0.075	0.063	-1.180	0.239	-0.200	0.050

Hypertension	0.062	0.056	1.110	0.268	-0.048	0.172
Heart Conditions	0.204	0.053	3.860	0.000	0.100	0.308
Cerebrovascular Disease	-0.116	0.075	-1.560	0.120	-0.263	0.031
COPD or Asthma	0.157	0.049	3.210	0.002	0.060	0.253
Arthritis or Joint Disorders	0.172	0.055	3.110	0.002	0.063	0.281
Mental Disorders	0.115	0.068	1.680	0.096	-0.020	0.249
Constant	8.355	0.318	26.300	0.000	7.728	8.982

Appendix 13: Coefficients of GLM for Total Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Total Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.040	0.044	0.920	0.359	-0.046	0.126
PCMH	0.034	0.057	0.600	0.553	-0.079	0.147
Year						
2008	(reference)					
2009	0.104	0.074	1.400	0.164	-0.043	0.251
2010	0.056	0.069	0.820	0.413	-0.079	0.192
2011	0.002	0.071	0.030	0.979	-0.138	0.142
2012	-0.045	0.064	-0.700	0.484	-0.171	0.081
2013	-0.028	0.065	-0.430	0.664	-0.156	0.100
Geographic Region						
Northeast	(reference)					
Midwest	-0.091	0.068	-1.330	0.185	-0.225	0.044
South	-0.155	0.054	-2.900	0.004	-0.261	-0.049
West	-0.088	0.059	-1.500	0.135	-0.204	0.028
Age						
65-74	(reference)					
75-84	-0.066	0.049	-1.350	0.178	-0.161	0.030
85 and Older	-0.168	0.070	-2.410	0.017	-0.306	-0.031
Gender						
Male	(reference)					
Female	-0.176	0.047	-3.740	0.000	-0.269	-0.083
Race						
White	(reference)					
Black	-0.010	0.082	-0.130	0.899	-0.173	0.152
Other	0.034	0.097	0.350	0.726	-0.158	0.227
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.126	0.102	-1.230	0.221	-0.328	0.076
Marital Status						
Married	(reference)					
Widowed	0.016	0.052	0.310	0.757	-0.086	0.118
Divorced	-0.016	0.067	-0.240	0.809	-0.148	0.115
Separated	-0.408	0.163	-2.510	0.013	-0.729	-0.087
Never Married	-0.185	0.086	-2.150	0.033	-0.355	-0.015
Household Size						
	-0.050	0.021	-2.410	0.017	-0.091	-0.009
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	0.181	0.046	3.900	0.000	0.089	0.272
Medicare and Other Public Insurance	0.074	0.086	0.860	0.390	-0.095	0.243
Uninsured	-0.399	0.135	-2.960	0.003	-0.665	-0.133
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.098	0.067	1.460	0.147	-0.035	0.230
Some College	0.168	0.071	2.380	0.018	0.029	0.308
4-Year college or Bachelor's Degree	0.116	0.071	1.630	0.105	-0.025	0.258
Master's or Doctorate or Professional Degree	0.242	0.079	3.060	0.003	0.086	0.399
Poverty Level						
Poor	(reference)					
Near Poor	0.113	0.105	1.080	0.284	-0.094	0.320
Low Income	0.102	0.078	1.300	0.194	-0.052	0.256
Middle Income	0.156	0.075	2.080	0.039	0.008	0.304
High Income	0.135	0.076	1.790	0.076	-0.014	0.285
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.183	0.106	-1.730	0.086	-0.392	0.026
Good	-0.319	0.116	-2.750	0.007	-0.548	-0.090
Very Good	-0.618	0.122	-5.080	0.000	-0.858	-0.378
Excellent	-0.776	0.150	-5.180	0.000	-1.071	-0.480
Physical Health Score	-0.016	0.002	-6.890	0.000	-0.020	-0.011
Mental Health Score	-0.004	0.002	-1.780	0.078	-0.009	0.000
ADLs	0.377	0.080	4.690	0.000	0.218	0.535
IADLs	0.133	0.067	1.970	0.050	0.000	0.265
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.096	0.094	1.020	0.310	-0.090	0.283
Skin Cancer (Melanoma)	0.019	0.089	0.210	0.833	-0.156	0.194
Breast Cancer	0.176	0.106	1.660	0.098	-0.033	0.384
Prostate Cancer	-0.013	0.092	-0.140	0.891	-0.195	0.170
Colon Cancer	0.189	0.100	1.900	0.060	-0.008	0.385
Other Cancer	0.340	0.076	4.450	0.000	0.189	0.491
Comorbidity						
Diabetes	0.008	0.045	0.180	0.856	-0.081	0.098

Hypertension	0.080	0.047	1.710	0.089	-0.012	0.173
Heart Conditions	0.336	0.047	7.200	0.000	0.244	0.428
Cerebrovascular Disease	0.122	0.075	1.610	0.109	-0.027	0.270
COPD or Asthma	0.171	0.043	4.000	0.000	0.087	0.255
Arthritis or Joint Disorders	0.106	0.041	2.560	0.011	0.024	0.187
Mental Disorders	0.151	0.050	3.050	0.003	0.053	0.249
Constant	9.913	0.237	41.840	0.000	9.445	10.380

Appendix 14: Coefficients of GLM for Medicare Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS 2008-2013

Medicare Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
Partial PCMH	0.058	0.060	0.960	0.337	-0.061	0.177
PCMH	0.107	0.078	1.360	0.175	-0.048	0.262
Year						
2008	(reference)					
2009	0.145	0.097	1.510	0.134	-0.045	0.336
2010	0.102	0.104	0.980	0.329	-0.104	0.308
2011	0.059	0.095	0.630	0.530	-0.127	0.246
2012	-0.007	0.088	-0.080	0.933	-0.180	0.166
2013	0.047	0.088	0.540	0.593	-0.126	0.220
Geographic Region						
Northeast	(reference)					
Midwest	-0.071	0.093	-0.760	0.446	-0.253	0.112
South	-0.193	0.079	-2.450	0.015	-0.349	-0.037
West	-0.103	0.087	-1.180	0.238	-0.274	0.069
Age						
65-74	(reference)					
75-84	0.054	0.069	0.790	0.429	-0.081	0.190
85 and Older	-0.129	0.105	-1.220	0.222	-0.337	0.079
Gender						
Male	(reference)					
Female	-0.158	0.065	-2.440	0.016	-0.286	-0.030
Race						
White	(reference)					
Black	-0.071	0.101	-0.710	0.481	-0.270	0.128
Other	-0.139	0.125	-1.110	0.269	-0.385	0.108
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	-0.092	0.125	-0.740	0.462	-0.339	0.155
Marital Status						
Married	(reference)					
Widowed	0.077	0.076	1.020	0.311	-0.073	0.227
Divorced	0.001	0.083	0.020	0.987	-0.162	0.165
Separated	-0.489	0.208	-2.350	0.020	-0.900	-0.078
Never Married	-0.176	0.127	-1.390	0.167	-0.426	0.074
Household Size						
Household Size	-0.030	0.029	-1.030	0.302	-0.087	0.027
Insurance						
Medicare Only	(reference)					

Medicare and Private Insurance	-0.091	0.062	-1.480	0.142	-0.214	0.031
Medicare and Other Public Insurance	-0.065	0.092	-0.710	0.479	-0.247	0.116
Education Level						
Less Than High School	(reference)					
GED or High School Graduate	0.135	0.087	1.540	0.124	-0.037	0.308
Some College	0.116	0.090	1.290	0.200	-0.062	0.294
4-Year college or Bachelor's Degree	0.116	0.096	1.220	0.226	-0.072	0.305
Master's or Doctorate or Professional Degree	0.198	0.110	1.810	0.073	-0.018	0.415
Poverty Level						
Poor	(reference)					
Near Poor	0.118	0.123	0.960	0.340	-0.126	0.362
Low Income	0.066	0.092	0.720	0.475	-0.115	0.247
Middle Income	0.077	0.095	0.810	0.418	-0.111	0.265
High Income	0.030	0.097	0.310	0.755	-0.161	0.222
Perceived Health Status						
Poor Health	(reference)					
Fair	-0.138	0.127	-1.080	0.280	-0.388	0.113
Good	-0.280	0.139	-2.010	0.046	-0.555	-0.005
Very Good	-0.639	0.151	-4.230	0.000	-0.937	-0.341
Excellent	-0.828	0.195	-4.250	0.000	-1.212	-0.444
Physical Health Score	-0.021	0.003	-6.480	0.000	-0.027	-0.014
Mental Health Score	-0.005	0.003	-1.510	0.132	-0.011	0.002
ADLs	0.382	0.100	3.830	0.000	0.185	0.579
IADLs	0.109	0.086	1.260	0.210	-0.062	0.279
Types of Cancer						
Skin Cancer (Nonmelanoma or Unknown)	0.106	0.126	0.850	0.398	-0.141	0.354
Skin Cancer (Melanoma)	0.097	0.126	0.770	0.442	-0.152	0.346
Breast Cancer	0.234	0.129	1.810	0.071	-0.020	0.489
Prostate Cancer	0.092	0.123	0.750	0.453	-0.150	0.335
Colon Cancer	0.255	0.132	1.930	0.056	-0.006	0.516
Other Cancer	0.464	0.103	4.510	0.000	0.261	0.667
Comorbidity						
Diabetes	-0.027	0.066	-0.410	0.683	-0.157	0.103
Hypertension	0.101	0.064	1.580	0.115	-0.025	0.226

Heart Conditions	0.399	0.061	6.510	0.000	0.278	0.521
Cerebrovascular Disease	0.120	0.101	1.190	0.235	-0.079	0.319
COPD or Asthma	0.175	0.061	2.860	0.005	0.054	0.296
Arthritis or Joint Disorders	0.104	0.058	1.790	0.075	-0.011	0.220
Mental Disorders	0.128	0.066	1.930	0.055	-0.003	0.259
Constant	9.603	0.321	29.940	0.000	8.970	10.236

Appendix 15: Coefficients of Fixed Effects Model for ED Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

ED Expenditures	Coefficient	Linearized Standard Error	t	P> t	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	-43.13	55.10	-0.78	0.43	-151.19	64.92
Geographic Region						
Northeast	(reference)					
Midwest	120.97	247.61	0.49	0.63	-364.63	606.57
South	98.40	204.83	0.48	0.63	-303.32	500.11
West	-302.30	253.45	-1.19	0.23	-799.36	194.76
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	-179.40	209.81	-0.86	0.39	-590.87	232.08
Divorced	620.76	262.50	2.36	0.02	105.96	1135.57
Separated	364.28	191.01	1.91	0.06	-10.31	738.88
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	154.74	123.55	1.25	0.21	-87.56	397.05
Medicare and Other Public Insurance	-50.85	138.33	-0.37	0.71	-322.13	220.44
Uninsured	-102.00	202.48	-0.50	0.61	-499.09	295.09
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	37.71	133.10	0.28	0.78	-223.32	298.74
Low Income	-105.36	99.99	-1.05	0.29	-301.45	90.74
Middle Income	15.52	107.04	0.15	0.89	-194.39	225.43
High Income	49.80	121.03	0.41	0.68	-187.56	287.17
Perceived Health Status						
Poor Health	(reference)					
Fair	-594.81	363.92	-1.63	0.10	-1308.51	118.90
Good	-605.47	371.20	-1.63	0.10	-1333.44	122.51
Very Good	-689.27	392.33	-1.76	0.08	-1458.69	80.15
Excellent	-629.87	407.06	-1.55	0.12	-1428.18	168.44
Physical Health Score	-5.30	4.37	-1.21	0.23	-13.87	3.26
Mental Health Score	-0.81	4.62	-0.17	0.86	-9.87	8.25
ADLs	274.00	109.23	2.51	0.01	59.78	488.21
IADLs	95.37	106.02	0.90	0.37	-112.56	303.30
Comorbidity						
Diabetes	-61.33	120.47	-0.51	0.61	-297.60	174.94
Hypertension	59.24	183.24	0.32	0.75	-300.12	418.59
Heart Conditions	53.24	144.91	0.37	0.71	-230.95	337.44
Cerebrovascular Disease	-17.16	99.96	-0.17	0.86	-213.20	178.88
COPD or Asthma	211.94	74.78	2.83	0.01	65.29	358.59
Arthritis or Joint Disorders	-87.84	56.43	-1.56	0.12	-198.51	22.84
Mental Disorders	108.91	81.14	1.34	0.18	-50.22	268.05
Constant	866.19	592.17	1.46	0.14	-295.15	2027.52

Appendix 16: Coefficients of Fixed Effects Model for Inpatient Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Inpatient Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	794.77	866.02	0.92	0.36	-903.63	2493.16
Geographic Region						
Northeast	(reference)					
Midwest	-1154.64	1994.54	-0.58	0.56	-5066.24	2756.96
South	-1605.43	1565.45	-1.03	0.31	-4675.51	1464.66
West	-23.67	1755.05	-0.01	0.99	-3465.60	3418.26
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	5587.19	3916.98	1.43	0.15	-2094.62	13269.00
Divorced	-10755.26	6693.85	-1.61	0.11	-23882.96	2372.44
Separated	2475.92	4505.06	0.55	0.58	-6359.20	11311.05
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-2398.93	2008.31	-1.19	0.23	-6337.54	1539.67
Medicare and Other Public Insurance	65.26	1513.39	0.04	0.97	-2902.72	3033.25
Uninsured	3773.08	3438.82	1.10	0.27	-2970.99	10517.16
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	2153.24	2962.87	0.73	0.47	-3657.41	7963.90
Low Income	1303.42	2340.67	0.56	0.58	-3286.99	5893.83
Middle Income	2744.27	2742.51	1.00	0.32	-2634.21	8122.76
High Income	2838.78	2411.52	1.18	0.24	-1890.58	7568.14
Perceived Health Status						
Poor Health	(reference)					
Fair	-16004.13	6248.59	-2.56	0.01	-28258.60	-3749.66
Good	-16933.26	6872.24	-2.46	0.01	-30410.80	-3455.72
Very Good	-18946.57	7027.51	-2.70	0.01	-32728.62	-5164.51
Excellent	-18507.77	7102.99	-2.61	0.01	-32437.85	-4577.69
Physical Health Score	-184.55	79.71	-2.32	0.02	-340.86	-28.23
Mental Health Score	-139.43	70.84	-1.97	0.05	-278.37	-0.50
ADLs	10835.68	4955.81	2.19	0.03	1116.56	20554.80
IADLs	1979.88	1987.87	1.00	0.32	-1918.64	5878.40
Comorbidity						
Diabetes	-716.25	2188.81	-0.33	0.74	-5008.84	3576.35
Hypertension	48.02	1349.93	0.04	0.97	-2599.41	2695.45
Heart Conditions	2077.60	1074.84	1.93	0.05	-30.32	4185.53
Cerebrovascular Disease	759.88	1225.12	0.62	0.54	-1642.78	3162.54
COPD or Asthma	325.31	1620.57	0.20	0.84	-2852.88	3503.51
Arthritis or Joint Disorders	-1148.62	795.76	-1.44	0.15	-2709.22	411.98
Mental Disorders	927.01	1256.72	0.74	0.46	-1537.62	3391.63
Constant	33133.60	7889.51	4.20	0.00	17661.04	48606.16

Appendix 17: Coefficients of Fixed Effects Model for Outpatient Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Outpatient Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	146.84	168.29	0.87	0.38	-183.21	476.89
Geographic Region						
Northeast	(reference)					
Midwest	-285.99	2169.00	-0.13	0.90	-4539.73	3967.75
South	-2219.42	1635.11	-1.36	0.18	-5426.12	987.27
West	-332.19	2153.62	-0.15	0.88	-4555.78	3891.41
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	-161.83	236.50	-0.68	0.49	-625.65	301.98
Divorced	-424.18	864.44	-0.49	0.62	-2119.49	1271.12
Separated	-808.14	639.06	-1.26	0.21	-2061.45	445.16
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	631.11	400.33	1.58	0.12	-154.01	1416.23
Medicare and Other Public Insurance	1478.82	567.52	2.61	0.01	365.83	2591.81
Uninsured	-3692.92	3324.14	-1.11	0.27	-10212.09	2826.24
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	-811.04	445.95	-1.82	0.07	-1685.62	63.54
Low Income	209.52	270.83	0.77	0.44	-321.63	740.66
Middle Income	151.80	266.73	0.57	0.57	-371.29	674.88
High Income	116.45	300.57	0.39	0.70	-473.01	705.92
Perceived Health Status						
Poor Health	(reference)					
Fair	-739.68	772.46	-0.96	0.34	-2254.60	775.24
Good	-1124.70	885.90	-1.27	0.20	-2862.08	612.68
Very Good	-620.49	944.05	-0.66	0.51	-2471.92	1230.93
Excellent	-885.89	1005.47	-0.88	0.38	-2857.77	1085.99
Physical Health Score	-57.77	25.92	-2.23	0.03	-108.61	-6.94
Mental Health Score	-23.56	19.34	-1.22	0.22	-61.48	14.37
ADLs	1225.20	595.09	2.06	0.04	58.14	2392.26
IADLs	-324.03	628.20	-0.52	0.61	-1556.03	907.98
Comorbidity						
Diabetes	-76.32	490.55	-0.16	0.88	-1038.37	885.73
Hypertension	-1531.24	769.38	-1.99	0.05	-3040.11	-22.36
Heart Conditions	-732.55	590.16	-1.24	0.22	-1889.94	424.84
Cerebrovascular Disease	659.55	548.21	1.20	0.23	-415.58	1734.67
COPD or Asthma	78.38	267.56	0.29	0.77	-446.35	603.12
Arthritis or Joint Disorders	-105.69	270.43	-0.39	0.70	-636.04	424.66
Mental Disorders	656.33	472.89	1.39	0.17	-271.08	1583.74
Constant	7160.38	3078.38	2.33	0.02	1123.21	13197.56

Appendix 18: Coefficients of Fixed Effects Model for Office-based Visits Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Office-based Visits Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	-419.13	461.51	-0.91	0.36	-1324.23	485.98
Geographic Region						
Northeast	(reference)					
Midwest	-1590.40	5322.46	-0.30	0.77	-12028.57	8847.78
South	2960.64	4176.50	0.71	0.48	-5230.12	11151.40
West	232.26	5471.03	0.04	0.97	-10497.29	10961.81
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	118.18	726.60	0.16	0.87	-1306.80	1543.16
Divorced	-3656.71	2633.88	-1.39	0.17	-8822.16	1508.75
Separated	-1237.58	2859.73	-0.43	0.67	-6845.95	4370.79
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	1540.24	792.88	1.94	0.05	-14.73	3095.21
Medicare and Other Public Insurance	183.03	803.93	0.23	0.82	-1393.60	1759.67
Uninsured	-330.51	1320.63	-0.25	0.80	-2920.47	2259.46
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	-213.05	1145.17	-0.19	0.85	-2458.90	2032.81
Low Income	465.72	706.52	0.66	0.51	-919.88	1851.32
Middle Income	166.73	697.76	0.24	0.81	-1201.68	1535.14
High Income	-51.58	720.36	-0.07	0.94	-1464.32	1361.17
Perceived Health Status						
Poor Health	(reference)					
Fair	235.39	2068.36	0.11	0.91	-3820.99	4291.76
Good	-1104.65	2146.46	-0.51	0.61	-5314.19	3104.90
Very Good	-2003.06	2286.73	-0.88	0.38	-6487.69	2481.58
Excellent	-2665.11	2303.36	-1.16	0.25	-7182.35	1852.13
Physical Health Score	-34.42	22.73	-1.51	0.13	-78.99	10.15
Mental Health Score	-49.53	26.85	-1.85	0.07	-102.18	3.11
ADLs	1687.74	1090.64	1.55	0.12	-451.18	3826.66
IADLs	-407.55	460.30	-0.89	0.38	-1310.26	495.17
Comorbidity						
Diabetes	-20.38	594.90	-0.03	0.97	-1187.07	1146.32
Hypertension	235.10	877.86	0.27	0.79	-1486.52	1956.72
Heart Conditions	-288.15	551.53	-0.52	0.60	-1369.79	793.49
Cerebrovascular Disease	-682.76	751.59	-0.91	0.36	-2156.74	791.22
COPD or Asthma	660.47	484.50	1.36	0.17	-289.71	1610.64
Arthritis or Joint Disorders	-80.04	496.57	-0.16	0.87	-1053.90	893.82
Mental Disorders	139.79	618.14	0.23	0.82	-1072.49	1352.07
Constant	6858.07	4751.16	1.44	0.15	-2459.71	16175.85

Appendix 19: Coefficients of Fixed Effects Model for Total Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Total Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	260.15	1049.49	0.25	0.80	-1798.06	2318.36
Geographic Region						
Northeast	(reference)					
Midwest	-5483.22	6222.61	-0.88	0.38	-17686.73	6720.28
South	246.73	3263.08	0.08	0.94	-6152.68	6646.14
West	-2242.13	5947.20	-0.38	0.71	-13905.52	9421.27
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	4799.78	4736.73	1.01	0.31	-4489.70	14089.25
Divorced	-14408.20	7436.19	-1.94	0.05	-28991.74	175.34
Separated	1890.65	4720.34	0.40	0.69	-7366.68	11147.99
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	273.63	2368.83	0.12	0.91	-4372.03	4919.28
Medicare and Other Public Insurance	3590.53	2404.55	1.49	0.14	-1125.17	8306.22
Uninsured	161.45	3404.41	0.05	0.96	-6515.14	6838.03
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	1783.68	3191.75	0.56	0.58	-4475.85	8043.20
Low Income	2726.73	2570.72	1.06	0.29	-2314.86	7768.32
Middle Income	3574.15	2945.84	1.21	0.23	-2203.11	9351.41
High Income	3690.39	2631.06	1.40	0.16	-1469.52	8850.30
Perceived Health Status						
Poor Health	(reference)					
Fair	-16132.67	6148.52	-2.62	0.01	-28190.88	-4074.47
Good	-18937.03	6852.16	-2.76	0.01	-32375.20	-5498.87
Very Good	-21338.06	7045.73	-3.03	0.00	-35155.84	-7520.29
Excellent	-21941.26	7172.89	-3.06	0.00	-36008.42	-7874.09
Physical Health Score	-310.72	94.23	-3.30	0.00	-495.51	-125.92
Mental Health Score	-256.46	82.60	-3.10	0.00	-418.44	-94.47
ADLs	16748.97	5490.93	3.05	0.00	5980.40	27517.55
IADLs	1619.81	2461.10	0.66	0.51	-3206.79	6446.41
Comorbidity						
Diabetes	1384.59	3462.32	0.40	0.69	-5405.57	8174.75
Hypertension	-595.96	2040.09	-0.29	0.77	-4596.89	3404.98
Heart Conditions	1931.02	1441.99	1.34	0.18	-896.96	4758.99
Cerebrovascular Disease	1487.37	1638.25	0.91	0.36	-1725.50	4700.23
COPD or Asthma	1107.01	1743.56	0.63	0.53	-2312.39	4526.41
Arthritis or Joint Disorders	-1171.31	1023.08	-1.14	0.25	-3177.73	835.11
Mental Disorders	3811.95	1741.53	2.19	0.03	396.54	7227.36
Constant	52415.61	9467.00	5.54	0.00	33849.34	70981.88

Appendix 20: Coefficients of Fixed Effects Model for Medicare Expenditures among Older Cancer Survivors, Associated with Receipt of Care Consistent with a PCMH, MEPS Panels 13-17

Medicare Expenditures	Coefficient	Linearized Standard Error	t	P> t 	[95% Confidence Interval]	
PCMH Category						
No USC	(reference)					
PCMH	-221.18	880.59	-0.25	0.80	-1948.16	1505.80
Geographic Region						
Northeast	(reference)					
Midwest	-3194.31	5668.09	-0.56	0.57	-14310.32	7921.69
South	-438.25	2738.24	-0.16	0.87	-5808.38	4931.88
West	-1439.50	5430.36	-0.27	0.79	-12089.29	9210.29
Age						
65-74	(reference)					
75-84	0.00	(omitted)				
85 and Older	0.00	(omitted)				
Gender						
Male	(reference)					
Female	0.00	(omitted)				
Race						
White	(reference)					
Black	0.00	(omitted)				
Other	0.00	(omitted)				
Ethnicity						
Non-Hispanic	(reference)					
Hispanic	0.00	(omitted)				
Marital Status						
Married	(reference)					
Widowed	4969.29	3982.20	1.25	0.21	-2840.43	12779.01
Divorced	1252.30	4642.95	0.27	0.79	-7853.25	10357.84
Separated	8627.30	3520.38	2.45	0.01	1723.28	15531.31
Never Married	0.00	(omitted)				
Household Size	0.00	(omitted)				
Insurance						
Medicare Only	(reference)					
Medicare and Private Insurance	-2050.99	2330.69	-0.88	0.38	-6621.83	2519.85
Medicare and Other Public Insurance	3148.55	2260.68	1.39	0.16	-1285.01	7582.10
Uninsured	-2771.29	2612.77	-1.06	0.29	-7895.34	2352.76
Education Level						

Less Than High School	(reference)					
GED or High School Graduate	0.00	(omitted)				
Some College	0.00	(omitted)				
4-Year college or Bachelor's Degree	0.00	(omitted)				
Master's or Doctorate or Professional Degree	0.00	(omitted)				
Poverty Level						
Poor	(reference)					
Near Poor	2687.44	3087.76	0.87	0.38	-3368.13	8743.02
Low Income	2221.99	2339.39	0.95	0.34	-2365.93	6809.91
Middle Income	3371.27	2627.40	1.28	0.20	-1781.46	8524.01
High Income	3246.38	2325.09	1.40	0.16	-1313.47	7806.24
Perceived Health Status						
Poor Health	(reference)					
Fair	-11709.16	6052.82	-1.93	0.05	-23579.69	161.36
Good	-15134.51	6611.96	-2.29	0.02	-28101.59	-2167.43
Very Good	-17776.97	6791.93	-2.62	0.01	-31097.01	-4456.93
Excellent	-17759.44	6874.36	-2.58	0.01	-31241.14	-4277.74
Physical Health Score	-251.92	81.42	-3.09	0.00	-411.61	-92.23
Mental Health Score	-199.56	73.24	-2.72	0.01	-343.19	-55.92
ADLs	11880.30	4740.32	2.51	0.01	2583.79	21176.81
IADLs	1207.00	1779.38	0.68	0.50	-2282.64	4696.64
Comorbidity						
Diabetes	2009.02	3277.39	0.61	0.54	-4418.45	8436.49
Hypertension	-111.26	1673.76	-0.07	0.95	-3393.76	3171.25
Heart Conditions	1715.80	1172.63	1.46	0.14	-583.92	4015.52
Cerebrovascular Disease	942.55	1425.21	0.66	0.51	-1852.50	3737.60
COPD or Asthma	517.32	1694.65	0.31	0.76	-2806.15	3840.78
Arthritis or Joint Disorders	-941.36	920.83	-1.02	0.31	-2747.25	864.53
Mental Disorders	3185.56	1495.16	2.13	0.03	253.31	6117.80
Constant	38487.85	8787.42	4.38	0.00	21254.35	55721.36

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