2010

Nursing Home Organizational Characteristics and Utilization of Cancer-Related Medical Services

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

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May 2010

ACKNOWLEDGEMENT

This could not be completed without the support from many people. First, I would like to thank my dissertation committee members. I want to especially thank Dr. Jan Clement, my chair, who very patiently guided me throughout my doctoral studies. For the past six years, she taught me how to develop a research agenda, conduct literature reviews, organize dataset, and analyze data step by step. She also provided me opportunities to be involved in different research projects, which helped to strengthen my research skills. This experience proved to be a great foundation for my future career. I am very grateful to Dr. Cathy Bradley. She mentored me well in developing data, performing cancer research and writing proposals. No matter how busy she was, she always gave me clear guidance and support. She was very generously in sharing her research knowledge and experience with me and giving encouragement throughout the project. The last four years working with Dr. Bradley has really been priceless. I also would like to thank Dr. Gloria Bazzoli for always providing useful comments for my dissertation. Her bright insight and clear logic often pointed out many blind spots in the draft of my dissertation. Also, Dr. David Harless, from the Department of Economics, offered expertise consultation for the research methodology. He never laughed at my questions and patiently explained the reason why I should check data, test models or variables. He helped me to learn how to think like a researcher and a journal reviewer.

Other than my committee members, I would like to thank Dr. Michael McCue for providing academic guidance and assistance throughout my doctoral studies. When I had my first child in the first year of doctoral study, he kindly incorporated my course schedule to help me continuing my school work. Also, my appreciation goes to Dr. Zhanlian Feng, Center for Gerontology and Health Care Research, Brown University Warren Alpert Medical School, for generously sharing their dataset. I would like to thank Dr. Theodore J. Cicero and Dr. Yuhong Tian, Department of Psychiatry, Washington University, for sharing prescription coding information with me. I also would like to acknowledge a number of faculty and staff for their great help. Drs. Stephen Mick, Diane Dodd-McCue, Yasar Ozcan, Kelly Devers, Robert Hurley and Dolores Clement taught me fundamental health service research skills and knowledge. I really appreciate Beverly DeShazo for her administrative assistance throughout my doctoral study period. I would like to extend my appreciation to Dr. Henry Carretta, Rochelle Clarke, and Dr. Mark Diana for their technical support, and to Carroll George for her administrative support.

Many thanks go to fellow doctoral students, Cynthia Childress, Dr. Nailya DeLellis, Dr. Michelle Lee, Dr. Hsueh-Fen Chen, Dr. Mei Zhao, Dr. Hui-Min Hsieh, Dr. Tiang-Hong Chou, Dr. Veronica Sikka, Reethi Iyengar, Mark Swofford, and Albert Liu. Their assistance and encouragement supported me while completing this doctoral program. My appreciation also goes to those friends who enrich my study life in Richmond, particularly Steven Castle, Ken Chen family, Dr. Hsing-Jung Chen, Dr. Hsueh-Fen Chen family, Dr. Tiang-Hong Chou family, Lu-Chen Cheng family, and Dr. Masanori Yasuo family.

The greatest appreciation is extended to my family, particularly to my husband, Wayne, for his endless support and love. Because of his encouragement, I was able to pursue and fulfill my dream of doctoral study. Many thanks to my in-laws, Chin-Chai Huang and Jih-Hsiung Fu,

and my parents, Yueh-Chu Chang and Chin-Sheng Lin, and my sister Jauyu Lin for flying, in the past six years, more than 60,000 miles from Taiwan to Richmond in order to care for my children throughout my doctoral study. Finally, I would like to thank my daughter, Sandra and my son, Kyle for understanding my busy school schedule and for being the sweetest kids in the world.

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ABSTRACT

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Cancer is the second leading cause of death in the U.S and is more common among the elderly. Since frailty and other age related conditions put the elderly at risk for nursing home care, nursing homes may be the site of care and death for many elderly cancer patients. However, there is a large gap in knowledge concerning cancer treatment of elderly nursing home residents. Since residents rely heavily on their nursing facilities, nursing homes might influence them in their treatment decisions.

After controlling for resident and nursing home market characteristics, this study applies Andersen's Behavioral Model to examine whether nursing home organizational characteristics (nurse staffing level, nursing skill mix, and quality deficiencies) are related to the use of cancer-related medical services for treatment (oncologist visits, cancer-directed surgery, chemotherapy or radiation therapy), and palliative care (pain medication and hospice services) among 1,183

Medicaid and Medicare insured residents of nursing homes in Michigan from 1996-2000. Using data from the Medicare claim file, Medicaid claim file, Michigan tumor registry, Area Resource File, Michigan Medicaid Nursing Home Cost Report, and Online Survey, Certification and Reporting (OSCAR), the study used logistic regression to predict the utilization of cancer-related medical services.

The results generally did not support the hypotheses. Nursing staffing level and nursing skill mix did not predict any cancer-related medical service utilization. Cancer care may be more associated with patient characteristics, such as age, which are usually taken into consideration when physicians suggest treatments, than nursing home organizational characteristics. However, relative to residents of nursing homes with the highest quartile of quality deficiencies, residents of nursing homes in the lowest quartile of quality deficiencies had a decreased likelihood of utilizing hospice care (OR=.509; 95%CI=.325 to .796; p=.003). Residents in high quality nursing homes may want to stay in the same place and not transfer to another facility for hospice care while residents in poor quality nursing homes may be motivated to use hospice care.

Even though this study did not successfully find that higher nurse staffing level, nursing skill mix, quality of care are associated with greater opportunity of utilizing cancer-related medical services, this study was successful in laying out an empirically sound base framework to analyze this association. Future research can incorporate other states or nationwide data to re-examine this relationship using this study as a base model.

CHAPTER 1: INTRODUCTION

The Study Problem

Cancer is the second leading cause of death in the U.S (Kung, Hoyert, Xu, & Murphy, 2008) and is more common among the elderly. About 55.2% of all cancer cases are diagnosed among those aged 65 and older (Surveillance Epidemiology and End Results [SEER], 2009). Since frailty and other age related conditions put the elderly at risk for nursing home care, nursing homes may be the site of care and death for many elderly cancer patients. Johnson et al. (2005) found that nearly 1 in 10 nursing home residents had a cancer diagnosis in 1999. The rate is likely to increase because of the aging population.

However, relatively little is known about cancer diagnosis and care in these facilities. Many studies have addressed diagnosis, care guidelines, treatment, costs and disparities in cancer detection and survival among younger populations residing in the community (Albano et al., 2007; Howard et al., 2000; Grigg et al., 2007; Bradley et al., 2007; Edwards et al., 2005; Hoffman et al., 2003). Only a few studies have discussed diagnosis, treatment (Bradley, Clement, and Lin, 2008), hospice or palliative care (Johnson et al., 2005; Rodin, 2008) and pain management (Bernabei et al., 1998) among elderly nursing home residents diagnosed with cancer and they generally find that care could be improved. For example, compared to cancer patients who did not reside in nursing homes, Epstein et al. (2005) found that nursing home residents with oropharyngeal cancer have significantly lower five-year survival rates than community residents. They suspect the reasons for reduced survival rates are delayed diagnosis

or lack of attention to symptoms. Clement, Bradley & Lin (2009) is the first study to explore the relationship between cancer diagnosis and nursing home organizational characteristics and found residents of nursing homes with lower nurse staffing levels were more likely to be diagnosed with cancer at death than their counterparts. Other than the Clement et al. (2009) study, no other research has addressed the variations in cancer care across nursing homes.

In contrast, numerous studies have found that organizational characteristics (e.g., ownership and nurse staffing) are related to certain resident outcomes (e.g., urinary tract infections, pressure ulcers, weight loss) or facility care processes (e.g., deficiency citations) (Chou, 2002; Bostick et al., 2006; Anderson, Hsieh, & Su, 1998; Bostick, 2004; Harrington & Zimmerman, 2000). Cancer-related medical services are outpatient services, but there is no research regarding nursing home residents' utilization of outpatient services. Most prior studies of medical services utilization by nursing home residents have focused on inpatient care. Because nursing home residents can suffer physical and emotional stress from a transfer to the hospital (Castle & Mor, 1996; Castle, 2001a), most studies argue that a higher hospitalization rate means worse nursing home quality (Grabowski et al., 2008) and probably, unnecessary health care costs (Grabowski et al., 2008). However, nursing home residents with certain diseases such as cancer may benefit from the acute care and technology available in the hospital. Even though nursing homes do not directly deliver cancer-related medical services to residents, they are the health care delivery system that interacts with residents daily. Nursing homes provide direct daily care to each individual, monitor resident health status, contact or alert medical service providers when a resident needs further assessment of his or her emergent health problem, and coordinate care plans for residents. Residents may also benefit if they received good quality of care at the nursing home. Therefore, the organizational characteristics of nursing

homes are the focus of the study. Among organizational characteristics, higher nurse staffing level indicates more direct care; higher nursing skill mix provides better supervised care, and lower quality deficiencies means better process of care in nursing homes. Hence, the purpose of the study is to investigate the association between nurse staffing level, nursing skill mix, quality deficiencies and cancer care of nursing home residents.

Research Questions

A retrospective cross-sectional design is used to examine this relationship. After controlling for resident and nursing home market characteristics, the study examines whether nursing home organizational characteristics are related to the use of cancer-related medical services for treatment (oncologist visits, cancer-directed surgery, chemotherapy or radiation therapy), and palliative care (pain medication and hospice services) among Medicaid and Medicare insured residents of nursing homes in Michigan from 1996-2000. The organizational variables of interest are nurse staffing level, nurse skill mix, and quality as indicated by inspection deficiencies.

The two research questions for the study are:

1. Are nursing home organizational characteristics associated with cancer-related treatment, and palliative medical service utilization for residents with a cancer diagnosis?
2. Is nursing home quality of care (deficiencies) associated with cancer-related treatment and palliative medical service utilization for residents with a cancer diagnosis?

Conceptual Framework

Andersen's Behavioral Model of health service utilization (Andersen, 1968, 1995; Aday & NetLibrary, 2004) is applied to this study's research objectives in understanding the association between nursing home organizational characteristics and their residents' utilization of

cancer-related medical services. This model has frequently been used to explain the use of health services among nursing home residents (Kamble, Chen, Sherer, & Aparasu, 2008) and the elderly (Bazargan, Bazargan, & Baker, 1998; Blalock et al., 2005; Park, 2005; Shibusawa & Mui, 2008); evaluate health policy influence on the use of health services (Henton, Hays, Walker, & Atwood, 2002; Smith-Campbell, 2000); assess the equity of access to medical care (Couture, Nguyen, Alvarado, Velasquez, & Zunzunegui, 2008; Palacio, Shiboski, Yelin, Hessol, & Greenblatt, 1999); and identify factors associated with utilization of health services (Palacio et al., 1999).

This study uses Andersen and Aday model to conceptualize how health policy changes (Balance Budget Act of 1997) during the study period may influence the delivery system (nursing home and community resources) and the population (the residents) and, ultimately, use of health care services (cancer-related medical services). The conceptual framework in Figure 1 presents the conceptual model used in current research.

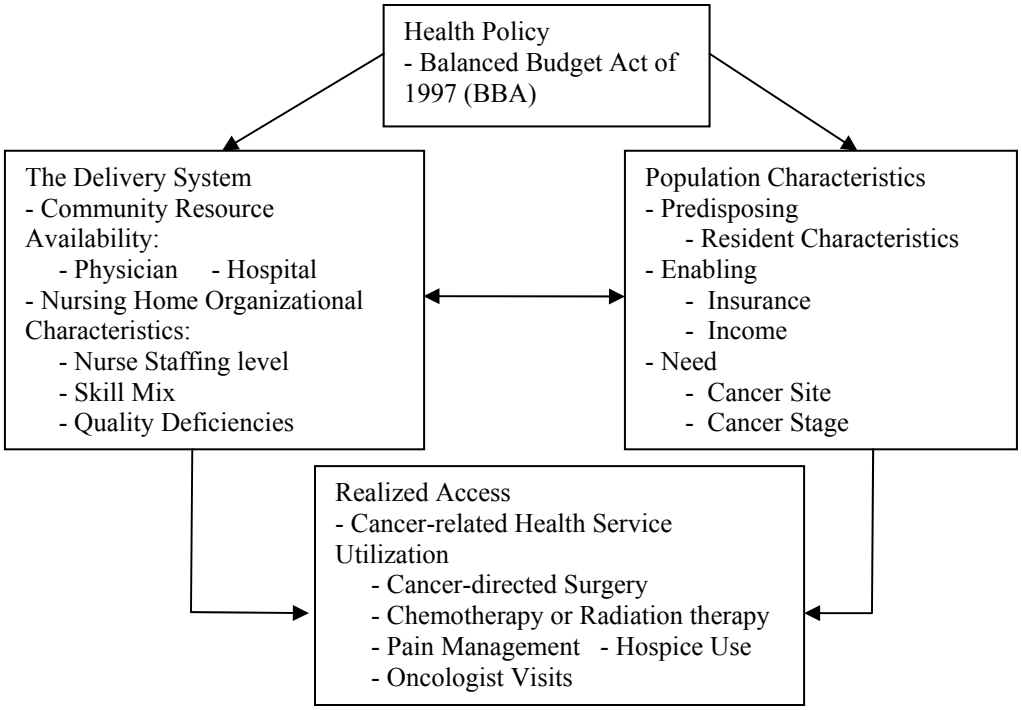

Figure 1. Conceptual Framework Adapted from Andersen and Aday

Scope and Approach

The study group is comprised of Michigan Medicaid and Medicare insured nursing home residents, also known as "dually-eligible," diagnosed with cancer during the period 1996 through 2000 from the Michigan Tumor Registry. The study identified Medicare beneficiaries through linking the Medicare denominator file with Michigan Tumor Registry. Medicaid eligibility is identified by matching the Medicaid eligibility files with the Michigan Tumor Registry. Nursing home residency was recognized from Medicaid nursing home claim files.

To examine the role nursing homes play in resident cancer-related health service utilization, this study selected residents diagnosed with cancer after entering a nursing home. Since initial cancer treatments usually take place within six months after diagnosis, this study focuses on cancer-related medical services within the first six months after the diagnosis date.

All cancer-related medical service utilization is retrieved from Medicare claim files (inpatient, outpatient, physician, hospice claims) and Medicaid claim files (pharmaceutical claims) during the period from 1996 to 2000. The availability of delivery system resources (physician and hospital availability) is obtained from Area Resource File (ARF) and residents are matched by the county code where nursing homes are located in resident's diagnosis year.

Nursing home organizational characteristics are extracted from the Online Survey, Certification and Reporting (OSCAR). The organizational characteristics extracted from the OSCAR are nurse staffing level, nursing skill mix, chain membership, ownership, quality deficiency scores, and payer mix.

A retrospective cross-sectional design is used to examine the relationships among nursing home organizational characteristics and cancer-related medical service utilization. This study uses logistic regression to examine the hypotheses derived from the research questions.

Significance of the Study

This study contributes to a very limited body of literature in several respects. First, this study applies Andersen and Aday behavioral model to discuss the utilization pattern of cancer-related medical services among elderly nursing home residents, which was not been substantially studied. Second, this study is among the very first few studies linking Medicare claim files, Medicaid claim files, Tumor Registry, Medicaid nursing home cost reports, and the Online Survey Certification and Reporting (OSCAR) to examine the association between nursing home organizational characteristics and their elderly residents' utilization of cancer treatments. Third, this study investigates the influence of the Balanced Budget Act of 1997 in the utilization of cancer-related medical services. Fourth, this study allows the observation of wide-range cancer-related medical services among elderly nursing home residents, which includes cancer-directed surgery, chemotherapy or radiation therapy, oncologist visits, pain management and hospice use. Finally, this study provides evidence indicating the absence of cancer care among elderly nursing home residents.

Summary of Remaining Chapters

The forthcoming chapters provide detailed information regarding relevant literature, conceptual framework, analytical methods, results and discussion in the context of the study hypotheses. Chapter 2 summarizes relevant literature and identifies gaps that the research fills. It provides background information regarding cancer, relevant U.S. population demographics and nursing homes, empirical studies of cancer care in nursing homes, empirical studies of cancer treatment among the elderly and empirical studies of medical services utilization not related to cancer among nursing home residents. Chapter 3 discusses the study's conceptual framework adapted from the Andersen and Aday behavioral model and develops a series of

hypotheses. Chapter 4 presents the research methodology for this study. It includes the research design, data sources, study population, variable measures, and analytical approach used for this study.

Chapter 5 presents the results of analysis, including the descriptive analysis and multiple logistic regressions. Chapter 6 summarizes the results based on the hypotheses and discusses the limitations, policy implications and future research directions.

CHAPTER 2: LITERATURE REVIEW

This chapter briefly summarizes relevant literature and identifies gaps that the study will fill. It first provides background information regarding cancer, relevant U.S. population demographics and nursing homes. Then, empirical studies of cancer care in nursing homes are discussed. Due to a limited number of studies focused on cancer care among nursing home residents, the chapter will briefly review the small number of empirical studies of cancer treatment among the elderly and empirical studies of medical services utilization not related to cancer among nursing home residents.

Background

The Prevalence of Cancer and the Aging of Population

Cancer is a disease in which abnormal cells in the body divide without control and are able to invade other tissues. It can spread to other parts of the body through the blood and lymph systems and cause mortality. Cancer is a significant public health concern with a projected 1,437,180 new cancer cases in the U.S. in 2008 (Jemal et al., 2008). It is the second leading cause of death in the U.S. (Kung et al., 2008). More than 565,650 deaths from cancer are projected in the U.S. in 2008 (Jemal et al., 2008). The most common cancer sites in the U.S. are nonmelanoma skin cancer, lung cancer (including bronchus), prostate cancer, breast cancer and colorectal cancer (Jemal et al., 2008).

Cancer is more common among the elderly with the median age of 67 at diagnosis of cancer for all sites. About 55.2% of all cancer cases are diagnosed among those aged 65 and

older (Surveillance Epidemiology and End Results [SEER], 2009). In addition, cancer accounted for more than 388,000 deaths in the elderly in 2005 (Kung et al., 2008). As the number of elderly people in the U.S. is projected to increase rapidly from 35 million (12.4% of population) in 2000 to 71.5 million (19.6% of population) in 2030 (U.S. Census Bureau, 2001), more elderly people are expected to be diagnosed with cancer.

Many of newly diagnosed elderly cancer patients may have other pre-existing health problems or age-related chronic conditions, or comorbidity, which makes them at higher risk for functional disabilities, requiring more complex care. Because of the complexity of their health issues, informal care at home may not be sufficient. Many of them, as a result, required nursing home care. Johnson et al. (2005) reported that nearly 1 in 10 nursing home residents had a diagnosis of cancer. Buchanan and his colleagues (2005) also found that about 11.3% of nursing home residents had a diagnosis of cancer at admission to a nursing home during 2002. Thus, nursing homes may become the site of care and death for many elderly with cancer.

Nursing Home

Nursing homes are the facilities that "…provide care to people who can't be cared for at home or in the community. Nursing homes provide a wide range of personal care and health services. For most people, this care generally is to assist people with support services such as dressing, bathing, and using the bathroom for people who can't take care of themselves due to physical, emotional, or mental problems" (U.S. Department of Health & Human Services, 2009). They provide skilled nursing or/and intermediate care. Skilled nursing care includes services of trained medical professionals (e.g. a skilled nurse or therapist) that are needed for a period of time following an injury, a major surgery or illness. The services can be post-acute care, rehabilitation services (e.g. physical therapy, speech therapy, or occupation therapy), or other skilled care (e.g. injections, ventilation). Intermediate care is custodial care for people who are

mentally disabled or have low ability to perform daily living activities, such as feeding, dressing, or bathing independently.

Based on the National Nursing Home Survey (NNHS) of 2004 (National Nursing Home Survey [NNHS], 2006), there are 16,100 nursing homes in the U.S. with 1,730,000 beds caring for 1,492,200 residents. Proprietary nursing homes accounted for 61.5% of all nursing homes while non-for-profit nursing homes and government owned nursing homes accounted for 30.8% and 7.7%, respectively. 54.2 percent of all nursing homes are affiliated with chains. Most common nursing home size is around 100 and 199 beds (42.5%) but the range is from less than 50 beds to more than 200 beds. Nearly all nursing homes are certified by Medicare or/and Medicaid (87.6%). 67.7 percent of nursing homes are located in urban areas.

Most nursing home residents are 65 years and older (Institutes of Medicine (IOM), 2001). More than half are 85 years or older (51%), female (74%) and white (87%) (National Center for Health Statistics [NCHS], 2007). The most common health conditions these elderly nursing home residents had at admission were hypertension (57.7%), depression (29.9%), diabetes (27.8%), dementia (other than Alzheimer's disease) (24.5%) and allergies (24.2%) (Buchanan, Rosenthal, Graber, Wang, & Kim, 2008).

In addition, the majority of these elderly nursing home residents needed assistance for their personal care with three or more activities of daily living (ADLs) (Institutes of Medicine (IOM), 2001). Activities of daily living (ADL) are "the activities usually performed in the course of a normal day in a person's life, such as eating, toileting, dressing, bathing, or brushing the teeth" (Mosby's Medical Dictionary, 8th edition, 2009). A higher ADL score indicates that residents are less likely to live independently and need more assistance for their daily living.

There are three primary payers for nursing home care. The first is Medicare. The Medicare program pays for skilled nursing care for Medicare beneficiaries who need intensive

subacute care or rehabilitation services following hospitalization for three or more days. Yet, Medicare coverage is limited for 100 days. For the first 20 days of services, Medicare covers 100% cost. Starting from the 21st day to 100th day, Medicare beneficiaries need to pay a co-payment, which, in 2008, was about $128. After 100 days, Medicare beneficiaries are responsible for all the costs as private payers. If they spend down all their assets and become eligible for Medicaid, their cost will be covered by Medicaid. The other two payers are private payers and Medicaid, mainly for custodial care. Custodial care is not reimbursed by Medicare. In 2008, the average private pay price for a private room in a nursing home was $69,715 per year (The MetLife Market Survey of Nursing Home and Home Care Costs, 2008). Most private payment is out-of-pocket because few residents have long term care insurance. In 2002, only two percent of all people in the U.S. have long term care insurance (Health Insurance Association of America [HIAA], 2003). Others may need to spend down all their assets before becoming eligible for Medicaid. The Medicaid program only covers nursing home care costs for people who meet State poverty guidelines and require at least custodial care. Since nursing home care is quite expensive, many private pay long-stay residents will eventually be eligible for Medicaid. Among the payers, Medicaid is the primary payer accounted for 45% of revenue for skilled nursing homes in 2003 (Centers of Medicare and Medicaid Services [CMS], 2003), but it has the lowest payment rate when compared to Medicare and private payers.

The Institute of Medicine report "Improving the Quality of Long-Term Care" (2001) noted that the quality of care of nursing homes has been a concern for a long time. Prior studies pointed out some of the quality problems in the nursing home settings, such as the prevalence of physical restraints that deteriorate the mobility, social engagement, and depression of restrained residents (Castle, 2006; Decker, 2008a; Engberg, Castle, & McCaffrey, 2008); unintentional weight loss that is caused by residents receiving inadequate or poor quality feeding assistance

during meals and induces malnutrition problems, and causes adverse clinical conditions (Dyck, 2007; Simmons, 2007); the prevalence of urinary incontinence that may cause severe depression (Lawhorne, Ouslander, Parmelee, Resnick, & Calabrese, 2008; Zorn, Montgomery, Pieper, Gray, & Steers, 1999); failure to manage pain that affects resident quality of life (Won et al., 2004; Zanocchi et al., 2008); and failure to prevent falls that results in fracture or/and hospitalization (Vu, Weintraub, & Rubenstein, 2004). Therefore, assessing quality of care in nursing home settings has become an important topic for researchers and policy makers.

Empirical Studies of Cancer Care in Nursing Homes

Many cancer-related medical services are delivered outside of the nursing homes. However, nursing home residents rely mostly on their family members, if any or the nurse staff in the facility to watch over their health conditions and arrange medical services. If the illness is detected early by nurse staff, residents may have better chance to get treatments. Also, the custodial care residents received in the nursing homes affect their other health conditions, which are often taken into consideration when physicians suggest the possible treatments. The nurse staff and the quality of care in the nursing homes are part of nursing home organizational characteristics. Therefore, the major interest of this study is to find out the association between nursing home organizational characteristics and the utilization of cancer-related medical services. Following section provides a review of previous studies regarding cancer screening, diagnosis, and treatment, which includes oncologist visits, cancer-directed surgery, chemotherapy, radiation therapy, pain management, and hospice use, among nursing home residents.

Cancer Screening and Diagnosis

Even though screening may help detect cancer among elderly nursing home residents at an earlier stage, few nursing homes follow the American Cancer Association guidelines for

routine screening (Kenny and Keenan, 1991; Kolcaba and Wykle, 1994; Ludwick, 1992; Bassett and Smyer, 2003; Coll et al., 1990) and there are no regulations that require them to do so.

Kenny and Keenan (1991) conducted telephone interviews in 54 nursing homes and 25 health-related facilities on Long Island. They found that only 6 out of 79 facilities had breast cancer detection procedures in their guidelines, and only 10% facilities offered Pap smears and breast cancer screening. Kolcaba and Wykle (1994) expanded on the Long Island survey and examined 140 nursing homes in a Midwestern metropolitan area. Only 4% of facilities had guidelines for Pap smears, 5% for mammography, 13% for skin cancer and 15% for colorectal cancer. Since the survey also found that doctors and nurses rely on symptoms for ordering cancer screening procedures, the authors suggested that nurses in nursing homes can take the lead to promote health screening to increase the chance of detection of cancer in its presymptomatic stages, which has the most successful treatment rate.

Ludwick (1992) surveyed registered nurses' knowledge and practices of teaching and performing breast exams among their elderly female residents in 23 nursing homes in northeastern Ohio during the fall of 1989. The results showed that 70.6% of nurses did not perform breast exams on their residents, and 80% of the nurses did not teach breast self exam to their residents. The authors concluded that health care providers did not promote enough cancer screening.

Bassett and Smyer (2003) surveyed 30 nursing homes in a rural Midwestern state regarding cancer screening policy and practices. Only 13% nursing homes had a written policy on breast self-examination (BSE) and only 3% had written policies on clinical breast examination. No nursing homes had a written policy on mammography, manual prostate examination and Prostate-specific antigen testing (PSA). Among nursing homes with written policies on cancer screening, only 23% followed them for BSE, 17% for clinical breast

examination, 10% for mammography, 17% for manual prostate examination and 0% for PSA. Thus, even though the majority of Director of Nursing (DON) in nursing homes had knowledge of American Cancer Society (ACS) guidelines for cancer screenings, nursing homes did not implement them.

Similarly, other studies have found low mammography use among nursing home residents. A mammogram utilization study for women aged over 50 years old in a Connecticut nursing home by Coll et al. (1990) found that only one mammogram was done in the study year.

Thus, these studies all show little or no cancer screening in nursing homes. Only Kerin et al. (2000) study mentioned how many residents have their cancer detected through screening. No study discussed the association between nursing home organizational characteristics and utilization of cancer screening. Without routine cancer screening, nursing home residents may get diagnosis of cancer in later stage and miss the opportunity to utilize treatments. Bradley, Clement and Lin (2008) found that among those who entered a nursing home without a cancer diagnosis, only one of four was diagnosed at an early stage. Clement, Bradley, and Lin (2009) also pointed out that about 25% of Medicaid-Medicare insured nursing home residents were diagnosed at or near death.

Yet, the benefit of cancer screening in elderly patients may be outweighed by the risk or potential harm from the screening procedures, especially when the life of expectancy of patients is less than five years (Ko & Sonnenberg, 2005; Zappa, Visioli, & Ciatto, 2003). Furthermore, each cancer has multiple ways to screen with various time intervals. For example, screening colorectal cancer can use annual fecal occult blood tests, flexible sigmoidoscopy every five years, or colonoscopy every ten years. It is not easy to identify whether patients have done cancer screening if the research dataset is limited to several years only.

Cancer Treatment

Once patients are diagnosed with cancer, they may be referred to an oncologist for consultation before or after surgical treatment. Oncologists explain the cancer diagnosis and stage, discuss all kinds of treatment options, deliver cancer treatment and manage the care plan. Cancer treatment can be divided into curative and palliative treatment. Curative treatments are intended to cure cancer. Surgery, chemotherapy and radiation therapy are the three most common forms of curative cancer treatment. Cancer-directed surgery is the primary treatment option for the majority of cancer sites. Chemotherapy uses drugs to stop or slow the growth of cancer cells and then, cure or control cancer or ease the symptoms. Radiation therapy uses ionizing radiation to kill cancer cells or shrink tumors. Palliative treatments are treatments not intended to cure cancer, but to ease or relieve the symptoms and provide a better quality of life. Pain management can help to ease the pain that most cancer patients suffer. Hospice services, which provide more symptom relief to cancer patients and support care to family members, improve the quality of end-of-life care.

In the following section, all studies examining the various cancer treatments among nursing home residents are discussed and organized by type of treatment.

Oncologist Visits

Medical professionals explain the cancer diagnosis and stage; discuss all kinds of treatment options; deliver cancer care; follow up patients after successful treatment; understand the prognosis; help to manage pain and side effects; and involve in palliative care for terminal ill patients. There are three types of oncologists. Medical oncologists (MO) specialize in treating cancer with chemotherapy; surgical oncologists specialize in the biopsy and surgical removal of the cancer; and radiation oncologists (RO) who specialize in treating cancer with radiation therapy.

Studies showed that elderly cancer patients seeing an oncologist were more likely to receive chemotherapy (Earle, Neumann, Gelber, Weinstein, & Weeks, 2002; Luo, Giordano, Freeman, Zhang, & Goodwin, 2006; Wang, Kuo, Freeman, Markowitz, & Goodwin, 2008), utilize radiation therapy (Steyerberg, Neville, Weeks, & Earle, 2007), and receive guideline-recommended care (Keating, Landrum, Ayanian, Winer, & Guadagnoli, 2003; Spencer et al., 2008) than patients who did not visit an oncologist. Also, Keating et al. (2001) study found that cancer patients have greater satisfaction with their treatment choice after seeing an oncologist. Overall, having a consultation with oncologists is crucial for cancer patients to understand the next steps and best treatment options for providing them a better quality of life.

Even though the issue of access to oncologists for the elderly has received attention recently, it has been studied mainly among community-dwelling elderly, or has failed to identify their residence. There is no study exploring the variation of utilizing oncologist visits among elderly nursing home residents.

Cancer-directed Surgery

For certain types of cancer, surgical removal of the tumor is the most common and efficient treatment. However, if the cancer has spread to other areas of the body, or the tumor cannot be removed without damage to vital organs, surgery may not be the best option. Surgery may be used alone or along with chemotherapy or radiation therapy.

There is little information regarding the variation of nursing home residents in receiving cancer-directed surgery. The Bradley et al. (2008) study is the only study to examine variations of utilization of cancer-directed surgery among nursing home residents. The authors examined 1,840 Michigan Medicare and Medicaid dully-eligible nursing home residents who were diagnosed with cancer from 1996 through 2000 to explore the stage at cancer diagnosis, and use of cancer-directed surgery and hospice. The study found that among 432 residents diagnosed

with breast, colorectal, lung, or prostate cancer at in situ, local, or regional stage, nursing home residents aged 66-70 and aged 71-75 were more likely to have cancer-directed surgery than residents aged 86 and older, and African Americans and other than white race residents were less likely to receive cancer-directed surgery than whites. Charlson comorbidity burden was not significantly related to receiving cancer-directed surgery (Bradley, Clement, & Lin, 2008). However, this study did not look at variations in utilizing cancer-directed surgery across different nursing homes.

Other than the Bradley et al. (2008) study, most studies discussed the variation of utilizing cancer-directed surgery among the elderly without identifying whether they resided in the community or in nursing homes. Although these studies did not focus on nursing home residents, they focus on age and comorbidity as factors related to receiving surgery, complication from surgery and survival rate. Their findings may be informative for the current study and will be discussed in a later section.

Chemotherapy

Chemotherapy uses medicines to destroy cancer cells. However, chemotherapy also can harm healthy cells and cause side effects, such as hair loss, nausea, vomiting and mouth sores. It is used to cure, or to control the growth of tumors, or to relieve symptoms for patients with cancer in later stages. It also is known as antineoplastic therapy and cytotoxic therapy. Chemotherapy can be used alone, or in conjunction with radiation therapy or surgery. Neoadjuvant chemotherapy is the therapy given before surgery or radiation to shrink the tumor. Adjuvant chemotherapy is the therapy given after surgery to kill unseen cancer cells. The use of adjuvant chemotherapy after surgery in helping to decrease cancer recurrence rates and improve overall survival rates has been documented in many studies (Brown, Nayfield, & Shibley, 1994; Fata et al., 2002).

Yet, based on a study using the national MDS data from 1999, Johnson et al. (2005) reported that only 3.9% of elderly nursing homes residents with a cancer diagnosis were treated with chemotherapy. When Buchanan et al. (2005) examined national 2002 MDS data, 4.9% of elderly nursing home residents with cancer received chemotherapy within 14 days after admission to nursing homes. Bradley et al. (2008) also found that 5.8% of dually eligible elderly Michigan nursing home residents with a cancer diagnosis received chemotherapy from 1997 to 2000. However, none of these studies examined the variations in utilizing chemotherapy across different nursing homes.

Radiation Therapy

Radiation therapy delivers high radiation doses only in cells in and around the cancer. For some cancers that have not spread to other areas yet, radiation can be used alone to cure or shrink the cancer. Radiation is used before surgery to shrink the tumor, and is known as a pre-operative therapy or after surgery to prevent the cancer recurrence, and is known as adjuvant therapy. Radiation also can be used along with chemotherapy. For cancers that have spread too far, radiation may not be able to cure, but can help to relieve symptoms.

Based on national MDS data, Johnson et al. (2005) and Buchanan et al. (2005) pointed out only 4.5% (in 1999) and 4.7% (in 2002) of elderly nursing home residents nationwide with cancer were treated with radiation therapy. Bradley et al. (2008) found that only 6.6% of elderly Michigan nursing home residents with cancer diagnosis received radiation therapy from 1997 to 2000. Still, these studies did not include nursing home facility characteristics to explain the variation in utilizing radiation therapy.

Pain Management

Pain is one of the most prevalent, disturbing, and under treated symptoms experienced by cancer patients (Kozachik & Bandeen-Roche, 2008). It affects 50% to 70% of patients

undergoing active cancer treatment (Christo & Mazloomdoost, 2008; Keefe, Abernethy, & Campbell, 2005) and up to 90% of those with advanced cancer (Breivik et al., 2009). Pain severely impairs quality of life (Green, Montague, & Hart-Johnson, 2008). Hence, aside from selecting curative treatment, residents with cancer need appropriate pain management to control the side effects of cancer and its treatment.

Among various cancer pain management guidelines, the three-step analgesic ladder developed by the World Health Organization (WHO) has been extensively adapted and validated in studies (Bernabei et al., 1998; Patrick et al., 2004; Zech, Grond, Lynch, Hertel, & Lehmann, 1995). The analgesic ladder of the WHO was created in 1982, and applies three different tiers of analgesic drugs based on patient's pain severity to provide adequate pain relief. The first step is to offer nonsteroidal anti-inflammatory drugs (NSAIDs). The second step is to add weak opioids to the NSAID if pain is increasing. And then, if pain still is severe, the third step is to substitute strong opioids for week opioids. Even though numerous ways to manage cancer pain had been discussed in plentiful studies (Delgado-Guay & Bruera, 2008; Mercadante & Arcuri, 2007; Patrick et al., 2004; Zech et al., 1995), unfortunately, nursing home residents with cancer often do not receive optimal pain management (Duncan, Forbes-Thompson, & Bott, 2008; Green et al., 2008; Keefe et al., 2005; Kozachik & Bandeen-Roche, 2008).

Previous studies used several ways to assess the pain management among nursing home residents. Many studies looked at pain assessment records. The most commonly used dataset is the Minimum Data Set (MDS). Since 1991, all Medicare and/or Medicaid certified nursing homes have been required to perform clinical assessments for all residents on admission and periodically regardless of source of payment for each resident under the 1987 Nursing Home Reform Act. In most cases, registered nurses employed by the nursing home are the ones to perform the assessments. The assessment can provide information on each resident's functional

capabilities and helps nursing home staff identify health problems. The assessment information is reported to states and the Centers for Medicare and Medicaid Services (CMS) where it is stored as the Minimum Data Set (MDS). Before 1998, the MDS assessed resident pain only as "none" or "daily." After 1998, the MDS collected not only the frequency of pain, such as "no pain," "pain less than daily," or "pain daily," but also the intensity of pain, such "mild pain (pain less than daily)," "moderate pain (pain daily)," or "horrible or excruciating (pain daily)."

Buchanan and co-authors (2005) identified 61,890 residents with cancer in the nursing homes through the national MDS records of 2002. One third (37.3%) residents with cancer suffered moderate or excruciating daily pain when admitted to nursing homes. Furthermore, Johnson et al. (2005) also used the national MDS within 60 days before or after April 1, 1999 to identify 190,769 nursing home residents with a diagnosis of cancer. The results showed that 56.9% of nursing home residents with a diagnosis of cancer suffer any pain at admission and 8.7% of them have daily excruciating pain. Among those residents suffering any pain at admission, 51.3% had persistent daily moderate or excruciating pain in their following MDS assessment 60 to 180 days later.

Sawyer and colleagues (2007) used the MDS of year 2002 assessment to investigate the variation of the prevalence of pain by nursing homes among 27,628 residents in Alabama. The authors found that nursing home residents with cancer, anemia, and musculoskeletal disease and who were younger, white, female, married and admitted within one year were more likely to report substantial daily pain. Also, nursing homes residents in facilities located in a non-rural area, with not-for-profit and government ownership, and having higher occupancy were more likely to report higher prevalence of substantial daily pain.

The reliability and validity of the MDS assessment has been discussed in numerous studies (Poss et al., 2008). However, some researchers have shown their concern in using the

MDS to evaluate pain management among nursing home residents. They suspect that low levels of reported pain may not always reflect appropriate management, but possible inadequate assessment (Cadogan, Schnelle, Yamamoto-Mitani, Cabrera, & Simmons, 2004). For example, some residents with cognitive impairment may not communicate clearly with nurses and their pain level was underestimated (Teno, Kabumoto, Wetle, Roy, & Mor, 2004). Some residents' pain was more likely to be recognized because they were resided in the facility longer and more familiar to nursing home staff (Jones et al., 2004; Sawyer et al., 2007).

In addition, Wu and co-authors (2005) examined the variation of pain documentation among 3,469 non-hospice residents from 178 nursing homes in California, Illinois, Missouri, Ohio, Pennsylvania, and Tennessee by using On-line Survey Certification and Reporting data (OSCAR) in 2001, Medicare Claims data in 2000, and the MDS from 2000 through 2002. The authors compared the MDS pain data recorded by nursing home nurses and the pain data recorded by the study nurses, which was considered as gold standard, to check the quality of the MDS data. The results showed that facility characteristics and different states were systematically associated with overrating or underrating resident's severe pain. Residents with cancer were more likely to have their severe pain underrated in the MDS; nurse hours per resident did not make a difference in overrating or underrating severe pain; facilities with an occupancy rate less than 80% were less likely to underrate resident's pain, but more likely to overrate resident's severe pain compared with facilities with occupancy rate 80% or more; chain facilities were more likely to underrate resident's severe pain than independent facilities; facilities with more than 100 beds were less likely to underrate resident's severe pain than facilities with less than 100 beds; facilities with higher deficiencies were not associated with overrating or underrating pain; and facilities with higher percentage of residents enrolled in hospice services were less likely to have overrated or underrated severe pain.

On the other hand, some studies interviewed or surveyed residents and nursing staff to see whether there was disagreement between the prevalence of pain reported by residents and observed by nurse staff. If there was great disagreement between residents and nurse staff in prevalence of pain, residents may have less likelihood of appropriate pain management. In Durham, North Carolina, Weiner and co-authors (1999) preliminarily performed pain assessment through surveying 158 residents and 31 nurses within two nursing homes. There was poor agreement in perceptions of pain between residents and nurse staff. Nurse staff did not detect 20% to 24% of their residents who were in pain and over reported 12% to 22% of their residents who were not in pain. Horgas and Dunn (2001) also investigated 45 pairs of nursing home residents and nursing assistants in their perceptions of pain. The authors found that residents and nursing assistants disagreed in 62.2% of cases, including underdetection (37.8%) and overreporting (24.4%). Residents whose pain was not recognized by nursing assistants were more likely to suffer depression. In addition, nursing assistants' characteristics (age, education, work experience) were not significantly associated with disagreement in perceptions of pain.

Some other studies evaluated pain management through examining the pain medication utilized by nursing home residents. Bernabei and his colleagues (1998) identified 13,625 residents with cancer aged 65 and older admitted from hospitals to 1,492 Medicare and/or Medicaid certified nursing homes in Kansas, Maine, Mississippi, New York, and South Dakota during 1992 to 1995, using the data from the Systematic Assessment of Geriatric Drug Use via Epidemiology (SAGE) and the MDS. Approximately 4,000 residents (29%) reported daily pain and female, non white, cognitively impaired, and older residents were less likely to report pain. Twenty-six percent of residents who reported daily pain did not receive any pain medicine. Sixteen percent of residents who reported daily pain received WHO step one pain medicines, One third of them received WHO step two pain medicines, and 26% of them received WHO step

three pain medicines. More than one third (37%) of residents who did not report daily pain received some pain medicines. The results indicated that residents aged 75 and older in pain were less likely to receive any pain medicine to relieve their pain than residents aged 65 to 74 ($p<.001$). Also, African Americans, males, those taking multiple medicines simultaneously, cognitively impaired, and residents with an explicit terminal prognosis were less likely to receive any pain medicine even though they were in pain.

Although the Bernabei et al. (1998) study showed that nursing home residents with cancer lacked pain management, this study only examined the first 7 to 15 days of the pain management experience residents had after being admitted to a nursing home following discharge from a hospital. The variation of pain management may be more likely to be associated with the discharging physicians, or hospitals and may be less related to the cancer care those residents received in their nursing homes.

Few studies have explored the association between cancer pain management and nursing home characteristics. Clement, Bradley and Lin (2009) found that among 973 Michigan Medicaid-Medicare insured residents with late or unknown stage cancer diagnosed after admitted into nursing homes, only 61% of them received pain medicine during the month of or the month after diagnosis. The authors reported that residents in nursing homes with a higher Medicaid payer mix and a higher Medicare payer mix are less likely to receive pain medication. Several other studies have investigated the role nursing home organizational characteristics can play in pain management, but they did not focus on residents with cancer.

Jones and her colleagues (2005) interviewed 2,033 nursing home residents from 12 rural and urban nursing homes in Colorado to discover the reasons why residents in pain did not request pain treatment and explored the association between nursing home facility characteristics (i.e., location) and residents in pain without requesting pain medicine. More than half of

residents had pain in the past 24 hours and 59.5% of them did not request pain medicine even though they were in pain. Residents who were white, older, suffered both constant and intermittent pain and lived in nursing homes located in rural area were less likely to request pain medicine when they were in pain. Medicaid residents did not have a significantly lower likelihood of requesting pain medicine compared to non-Medicaid residents. The reasons behind not requesting pain medicines were the ability to handle the pain (23.5%), concerns about medication in general or pain medicine specifically (21.7%), concerns about staff response if they requested pain medicine (16.9%), and worry about bothering staff (10.1%).

In another related study (Jones et al., 2004), the results further pointed out that nurse staff filtered resident pain reports based on their long-standing relationship with the residents and how they understood a resident's usual behavior. Therefore, high staff turnover may contribute to failure in recognizing residents in pain. In addition, the investigators found that short nurse staffing was the reason why those nurses did not have adequate pain management training to improve their skill in assessment and management of pain. Through a qualitative study in four nursing home facilities in Ontario, Canada, Kaasalainen et al. (2007) also found that lack of time or high workload is one of the major barriers for nursing staff to provide optimal pain management.

Williams and her colleagues (2005) investigated characteristics associated with the prevalence of pain and pain treatment in 331 residents with dementia from 35 residential care/assistant living (RC/AL) and 10 nursing home facilities. The authors used the Philadelphia Geriatric Center-Pain Intensity Scale (PGC-PIS; Parmelee et al., 1991) to measure pain and then identified residents with pain if the PGC-PIS score was 2 or more. There was 62% agreement between residents self-reported presence of pain and nurse staff observed pain. More than 90% of nursing staff in nursing home facilities or RC/AL felt adequately trained to assess and treat

residents' pain while nursing staff in nursing home facilities had most of their training in the facility. Residents in for-profit facilities were more likely to have a higher prevalence of pain. The authors found that residents in for-profit facilities were less likely to have professional pain assessment and were less likely to receive pain medicine among those with pain. However, facility size does not make a difference in the prevalence of pain or pain treatment.

Hospice Care

When residents and their families decide against treating their cancer and are in terminal stage, they may select hospice care prior to death. Hospice care is a program designed to emphasize palliative rather than curative treatment to promote end-of-life quality. It provides more symptom relief and supportive care, but limits utilization of life-prolonging treatment. The resident can refer himself/herself, or be referred by family members, nursing home staff, or physicians to hospice care if the resident has a life expectancy of six months or less under normal disease progression. Nursing homes contact hospice agencies to provide palliative care. Once a resident has enrolled in hospice care, the hospice agency and nursing home will create a care plan. Hospice agencies will manage the palliative care while nursing homes continue to provide the same personal care as before hospice.

Hospice care is covered by Medicare if residents are medically eligible. However, Zerzan, Stearns and Hanson (2000) pointed out that because Medicare did not cover nursing home room and board costs, residents who are Medicare eligible only are less likely to select hospice service. Nevertheless, if residents are Medicare and Medicaid dually eligible, their nursing home stay will be covered by Medicaid. Thus, Medicare and Medicaid dually eligible residents may not have special preference in using hospice or not using hospice.

The benefit of hospice for nursing home residents with terminal illness has been documented in many studies. Baer and Hanson (2000) surveyed 292 family members of nursing

home residents who had received hospice and died between December, 1997 and May, 1998 in North Carolina regarding the quality of care residents received before and after hospice. Half residents received hospice because of cancer. One third (39%) residents in hospice care stayed in nursing homes for more than 12 months. Half residents receiving hospice care enrolled in the service less than one month before death. After the decedents received the hospice care, family members of the decedents rated the quality of care for pain and other physical symptoms as good or excellent improving from 64% before hospice care to 93% after hospice care ($p < .001$) and the quality of care for emotional and spiritual support as good or excellent improving from 64% before hospice care to 91% after hospice care ($p < .001$).

In a report published by the US Department of Health and Human Services, Miller and her co-authors (2002) identified 2,644 hospice residents and 7,929 non-hospice residents who died during 1992 to 1997 and resided in Kansas, Maine, Mississippi, New York and South Dakota. The authors constructed an organizational variable--hospice concentration, which is a ratio of the total number of hospice patients in a nursing facility in a one year period to the total number of residents in that nursing facility during the same time period. A higher hospice concentration rate means a greater hospice presence in the facility, a better hospice-nursing home relationship, and may benefit non-hospice residents who resided in the same nursing home. The study found that residents with cancer were more likely to have their daily pain recognized if they resided in nursing homes with higher hospice concentration. Also, hospice residents with cancer were 43% to 53% more likely to have their daily pain recognized compared to non-hospice residents with cancer. Hospice residents in daily pain were twice more likely to receive better pain management by receiving WHO level 3 pain medications than non-hospice residents.

Although studies showed hospice can deliver better symptom relief for cancer residents in terminal stage, not many residents with cancer utilized hospice service before their death.

Johnson et al. (2005) reported that only about one third (29%) of all terminally ill nursing home residents with a diagnosis of cancer received hospice services based on 1999 MDS national data. Bradley et al. (2008) found that 28% of Michigan dual-eligible nursing home residents with a cancer diagnosis at distant or later stage during 1997 to 2000 used hospice services before their death. On the contrary, the Buchanan et al. (2005) study based on national MDS data of 2002 found that about two in three residents with cancer in terminal stage at admission received hospice care in a nursing home. Nevertheless, since the MDS data Buchanan et al. (2005) used was evaluated when residents were admitted to nursing homes, many of the residents with cancer in the terminal stage may have decided to enroll in hospice before becoming a nursing home resident. The care in the nursing home may not have made any difference in their enrollment of hospice care.

A few studies explore the influence of nursing home organizational characteristics on utilization of hospice care, but they do not limit their study population to residents with cancer. Petrisek and Mor (1999) applied contingency theory to investigate the influence of nursing home organizational and market characteristics on resident enrollment in the Medicare hospice benefit using nationwide OSCAR data during period of July 1995 to April 1997. Near two third nursing homes (70%) did not have any residents utilizing hospice service during inspection and only 4.2% of nursing homes had more than 5% of their residents in hospice care. Nursing homes that were for-profit, not hospital based, part of a chain, lacking full-time physician coverage, and Medicare certified as well as having a lower number of nurses per 100 beds, lower proportion of residents requiring skilled nursing services, and a hospice special care unit were more likely to have at least one resident in hospice care ($p < .001$). Among nursing homes with at least one resident in hospice care, nursing homes with the following characteristics: for-profit ownership ($p < .05$), hospital-based ($p < .001$), serving higher percentage residents on Medicare ($p < .001$)

and lower percentage residents on Medicaid ($p < .001$) patients, fewer certified beds ($p < .001$), lower occupancy rates ($p < .001$), greater number of nurses per 100 beds ($p < .001$), and higher proportion of residents receiving pain management ($p < .001$) and skilled nursing services ($p < .001$) were more likely to have higher percentage of residents utilizing hospice care during the inspection period.

Gozalo and Miller (2007) also identified 185,750 nursing home residents who died from 1995 through 1997 and resided in Kansas, Maine, New York, Ohio, and South Dakota by using the MDS and Medicare hospice claim files. Only 8.6% of residents utilized hospice care before death and 47.4% of them had a diagnosis of cancer. Residents who utilized hospice care were more likely to stay in nursing homes that had a higher percentage of private-pay patients ($p< .05$), lower percentage of non-white residents ($p< .05$), higher average nursing case-mix-index ($p<.001$) and presence of any special care unit ($p<.05$). For-profit status, chain affiliation, and number of health deficiencies were not associated with enrollment in hospice.

Summary

Overall, little is known about diagnosis and treatment of nursing home residents with cancer. There are few studies that examine the utilization of oncologist visits, cancer-directed surgery, radiation therapy, chemotherapy, pain and hospice among nursing home residents with cancer. Only a few studies include nursing home organizational characteristics in explaining the variation in diagnosis, pain management or utilization of hospice services among elderly nursing home residents. Yet, most of these latter studies do not focus on residents with a cancer diagnosis.

Empirical Studies of Cancer Treatment among the Elderly

Due to lack of studies discussing the variation of utilizing cancer treatments among elderly nursing home residents, the following section briefly reviews similar studies of the

elderly not residing in a nursing home. These findings provide insight of factors associated with utilizing cancer treatment for a similar age group as nursing home residents. The review will be organized by type of cancer treatment.

Oncologist visits

Studies show that the elderly are frequently referred to oncologists. Warren et al. (2008) found that 47% of elderly patients visited an oncologist in the first year after diagnosed with cancer from 1998 to 2003 while Oliveria et al. (2004) reported that 66% of colorectal cancer patients in one HMO program from 1997 to 1999 saw an oncologist within 4 months after diagnosis. Earle and his colleagues (2002) found that 73% of elderly patients with stage IV Non-Small-Cell Lung Cancer (NSCLC) between 1991 and 1996 had been seen by an oncologist after diagnosis. Luo and her colleagues (2006) found that 78% of stage III colon cancer elderly patients had a consultation with an oncologist at least once within 6 months of diagnosis during the period of 1992 and 1999. Most primary care physicians indicate they are willing to refer the elderly to oncologists (Townsley et al., 2003).

However, older age may decrease the likelihood of referral. Warren et al. (2008) reported that patients who are younger than 85 were more likely to visit an oncologist in the first year after diagnosis. Oliveria et al. (2004) found that age less than 70 were a major predictor for colorectal cancer patients to have oncologist visits. Steyerberg and his co-authors (2007) found that age of locoregional esophageal cancer patients was negatively associated with the likelihood of being seen by a medical oncologist, but was not related to seeing a radiation oncologist.

In addition, race may be a barrier to see an oncologist. Murphy et al. (2009) found that African American pancreatic cancer elderly patients had significant lower rates of seeing a medical oncologist ($p < .001$) or a radiation oncologist ($p < .05$) than white patients. Luo et al. (2006) also reported that non-Hispanic white Stage III colon cancer elderly patients were more

likely to see an oncologist within 6 months of diagnosis than other non-white patients (p= .0392). Earle et al. (2002) found that white lung cancer patients were significantly more likely to be seen by an oncologist than non-white patients (p< .001). Studies also found that female cancer patients were more likely to see an oncologist than male cancer patients (Luo et al., 2006; Warren et al., 2008).

As well, patient comorbidity may decrease the likelihood of seeing an oncologist. Surgeon preference for referral cancer patients to an oncologist was significant lower if patients have severe comorbidity (Krzyzanowska, Regan, Powell, Earle, & Weeks, 2009). Luo et al. (2006) found that Stage III colon cancer elderly patients with 3+ Klabunde-Charlson comorbidity scores were less likely to visit an oncologist within 6 months of diagnosis than patients with 0 comobidity score. However, higher comobidity may decrease the probability of undergoing surgery and then, increasing the likelihood to be seen by an oncologist (Steyerberg et al., 2007).

Additionally, more recent diagnosis year may increase the likelihood of being seen by an oncologist. Wang et al. (2008) reported that the proportion of elderly stage II or III lung cancer patients seen by a medical oncologist increased from 28.4% in 1992 to 57.7% in 2002 (p< .001). Luo et al. (2006) also found that the percent of stage III colon cancer elderly patients seeing an oncologist increased from 71.85% in 1992 to 82.32% in 1999.

Cancer stage at diagnosis may play a role in referral. Warren et al. (2008) found that elderly patients with a later cancer stage were more likely to visit an oncologist in the first year after diagnosis of cancer. Luo et al. (2006) reported that stage III colon cancer patients with four or more positive lymph nodes were more likely to have consultation with an oncologist than ones with less than three positive nodes. Wang et al. (2008) also found that stage III non-small cell lung cancer patients had higher likelihood of seeing an oncologist than stage II patients (p< .0001). However, Townsley and her colleagues (2003) surveyed the referral patterns among

primary care physicians and found that they were more willing to refer elderly cancer patients with early stage (86%) than ones with later stage (65%).

Also, utilization of oncologist visits may vary by cancer site. Warren et al. (2008) found 75.1% of breast cancer patients, 63.3% of lung cancer patients, 54.4% of colorectal cancer patients, and 12.5% of prostate cancer patients saw an oncologist within the first year of diagnosis.

Referral to an oncologist is important because it affects other cancer treatment decisions. For stage IV lung cancer elderly patients, Earle et al. (2002) found seeing an oncologist and patient age are the strongest predictors of whether they received chemotherapy. Luo et al. (2006) also reported that stage III colon cancer patients who had consultation with an oncologist were nearly 10 times more likely to receive chemotherapy.

In summary, studies have shown that the likelihood of utilization of cancer treatments was closely tied to seeing an oncologist. Patient age, gender, comorbidity, race, diagnosis year, cancer stage and cancer site were somewhat associated with the probability of seeing an oncologist after a diagnosis of cancer.

Cancer-directed surgery

Many studies found that patient's age affected the likelihood of undergoing cancer-directed surgery. Even though surgery is the major curative therapy, previous studies have reported that the proportion of patients receiving curative treatment decreased with increasing age. Owonikoko et al. (2007) reported that around 81% of lung cancer patients aged 70 years and younger received cancer-directed surgery and/or radiation therapy while only 47% patients 80 years and older received such treatment within 4 months after diagnosis from 1988 through 2003. In Canada, Townsley and her co-authors (2005) found that 52.2% of patients aged 70 and older did not receive surgical treatment compared to 33.8% of patients aged 69 and younger. While

controlling for comorbidity, Esnaola, Stewart, Feig, Skibber, & Rodriguez-Bigas (2008) reported that rectal cancer patients aged 65 and older were less likely to undergo cancer-directed surgery compared with patients aged 44 and younger ($p < .001$). Similarly, among 820 patients with a diagnosis of bladder cancer in 1992, Prout et al. (2005) reported patients aged 75 and older were less likely to undergo cancer-directed surgery than patients aged 55 to 64, even when their comorbidity were controlled. In the Netherlands, Janssen-Heijnen et al. (2005) found that over 95% of breast cancer patients aged younger than 80 underwent surgery compared to only 76% of those aged 80 and older ($p< .01$); 41% of prostate cancer patients aged younger than 60 underwent surgery compared to 1% of those aged 80 and older ($p<.01$); 59% of lung cancer patients aged 70 to 79 received surgical treatment compared to only 11% of those aged 80 and older.

In addition, the multiple pre-existing health problems, or comorbidity burden, may decrease the likelihood of utilizing cancer-directed surgery. Prout et al. (2005) found that among bladder cancer patients aged 55 to 74, the cystectomy rate dropped from 49% in those with no comorbidity to 27% in those with severe comorbidity burden. Among patients aged 75 and older, the cystectomy rate further dropped from 21% in those with no comorbidity to 0% in those with severe comorbidity burden. During 2002 to 2004, Hamaker et al. (2009) reported that 10 out of 19 patients did not proceed with cancer directed surgery because of the presence of comorbidities, such as moderate chronic obstructive pulmonary disease, or severe cardiovascular disease. On the contrary, Coniglio and her colleagues (2004) found that patients over 80 years old had significantly higher comobidity burden, but did not have a significantly lower likelihood of undergoing cancer directed surgery nor a significantly higher postoperative morbidity and mortality rate than younger patients.

On the other hand, race may be a predictor of utilizing cancer-directed surgery. Esnaola et al. (2009) found only 82% of African American patients with rectal cancer received surgery compared to 89.3% of white ones ($p < .001$) while 92.9% of African American patients with colon cancer received surgery compared to 94.5% of white patients from 1996 to 2002. Also, African American patients with localized non-small cell lung cancer in South Carolina were significantly less likely (44.7% vs. 63.4%, $p < .0001$) to undergo cancer-directed surgery than whites (Esnaola et al., 2008). Fitzgerald et al. (2009), furthermore, found insurance status plays a role when compared the likelihood of receiving cancer-directed surgery between African American patients and whites. Among Medicare and Medicaid dually insured patients, African American patients did not have significantly lower likelihood of utilizing surgery; while Medicare only African American patients were significantly less likely to undergo colorectal, esophageal, and gastric cancer surgery than Medicare only whites.

Many elderly patients potentially underutilize cancer-directed surgery because of concern about their tolerance for surgical treatment and possible higher postoperative morbidity and mortality. However, cancer-directed surgery can be safe and beneficial for the elderly. Bittner and his colleagues (1996) found that gastric cancer patients older than 70 did not have a significantly higher 30-day operative mortality or lower 5-year survival rate than younger patients in Germany. In Switzerland, Bernet et al. (2000) found bronchogenic cancer patients aged between 70 and 85 did not have significant lower 5-year survival rates than patients aged between 29 and 50 between 1972 and 1994. After pulmonary resection, Bolton et al. (2009) reported that elderly non-small cell lung cancer patients had no difference in combined 30-day/in-hospital mortality, one year survival rate and recurrence rate compared to patients aged 69 and younger in the United Stats. Since Bitter et al. (1996), Bernet et al. (2000) and Bolton et al. (2009) studies were not randomized clinical trials and did not adjust any co-existing health

conditions in their models, there may have a potential selection bias that only healthy elderly were selected to undergo surgery. As a result, the comparable postoperative morbidity and mortality rate may be in doubt.

So far, many of these studies found that patient's age and comorbidity affected the likelihood of undergoing cancer-directed surgery. Nevertheless, some other studies showed that the elderly may have similar survival rate as the younger people if they received curative surgery treatment.

Chemotherapy

Previous research shows many elderly do not receive, once diagnosed, guideline-suggested chemotherapy. Janssen-Heijnen et al. (2005) found 28% of lung cancer patients younger than 60 underwent chemotherapy compared to only 2% of those aged 80 and older ($p < .01$) in the Netherlands. In Michigan, Bradley, Dahman, and Given (2008) also reported that patients aged 80 and older with lung cancer diagnosed from 1997 to 2000 were 71% less likely to receive chemotherapy than those aged 66 to 69 while controlling socioeconomic status and comorbidity. Hurria et al. (2008) investigated 216 elderly breast cancer patients in New York and reported that none of patients aged 80 and older received any adjuvant chemotherapy. Schrag et al. (2001) found that age at diagnosis was the strongest predictor for receiving chemotherapy when controlling patient demographic, clinical characteristics and comorbidity.

In addition, many physicians do not administer chemotherapy to their colorectal cancer patients because of patient's advanced age and comorbid illness (Ayanian et al., 2003). Studies found patients with high comorbidity burden were less likely to receive adjuvant chemotherapy (Baldwin et al., 2005; Bradley, Given, Dahman, & Fitzgerald, 2008; Gross, McAvay, Guo, & Tinetti, 2007; Luo et al., 2006; Schrag et al., 2001; Sundararajan, Grann, Jacobson, Ahsan, & Neugut, 2001). In the Kutner et al. (2000) study, physicians ranked patient comorbidity while

patients ranked physician opinion as the most important factor to make the chemotherapy treatment decision.

Other than patient age and comorbidity, many studies pointed out that seeing an oncologist is a key factor for patients to receive chemotherapy. Through a survey to 276 elderly with stage III colon cancer and 232 physicians, Kutner et al. (2000) found that being younger than 80, being married, and having seen an oncologist were strong predictors for the elderly to receive chemotherapy. Steyerberg et al. (2007) examined 3,538 elderly patients with locaoregional esophageal cancer diagnosed between 1991 and 1999 and found the major predictors to receive chemotherapy were seeing a medical oncologist and then, being younger after seeing a medical oncologist. Earle and his colleagues (2002) looked at 12,015 Medicare-eligible patients over age 65 that were diagnosed with stage IV Non-Small-Cell Lung Cancer (NSCLC) between 1991 and 1996 and found 36% of patients who did not receive chemotherapy were never seen by an oncologist. Among those seen by an oncologist, patients with younger age, less comorbidity calculated by the Charlson comorbidity scale, and who were male and white were more likely to receive chemotherapy.

Also, African American patients with a diagnosis of cancer may have lower likelihood of utilizing chemotherapy than whites. Morris et al. (2008) found that even though African Americans have similar likelihood to see an oncologist, those elderly with rectal cancer diagnosed during 1992 to 1999 were less likely to receive chemotherapy than whites. Bradley, Given, Dahman and Fitzgerld (2008) also reported similar result among colon cancer patients in Michigan.

Many elderly did not receive chemotherapy or adjuvant chemotherapy because their physicians were concerned whether their elderly patients could tolerate the toxicity, or the side effects. The toxicity of chemotherapy can cause myelosuppression, mucositis, cardiodepression,

peripheral neuropathy, and central neurotoxisity and is often measured by the frequency and severity of nausea or vomiting, diarrhea, stomatitis, and leucopenia. However, studies showed that elderly have the same benefit from adjuvant chemotherapy as younger patients in improving their survival and reducing cancer recurrence and did not suffer worse toxic effects. Sargent and co-authors (2001) performed a pooled analysis from seven prior trials for patients with stage II or stage III colon cancer and found that patients aged 70 and older shared the same survival rate and recurrence rate without significant increase in suffering toxicities, compared to younger ones.

Fata and colleagues (2002) examined the disease free rate, survival rate and toxicity effect after chemotherapy for 120 patients with stage II or stage III colon cancer who underwent curative resection at Geisinger Medical center in Pennysylvania over 10 years. Elderly patients who had adjuvant chemotherapy did not have a significantly different 5-year disease free rate and 5-year survival rate from younger patients. Furthermore, the elderly did not experience significantly worse toxicity. Similarly, Giovanazzi-Bannon et al. (1994) found that patients aged 65 and older did not have worse tolerance of chemotherapy treatment than younger patients based on data of 33 Phase II clinical trials in Illinois Cancer Center.

Because many physicians make decisions concerning chemotherapy based on the medical literature they read (Kutner et al., 2000) and there were more clinical trials done and published in more recent years (Townsley et al., 2005), some studies found year of diagnosis may affect the likelihood of receiving chemotherapy. Schrag et al. (2001) found colon cancer patients with a later year of diagnosis (e.g. 1996) were more likely to receive adjuvant chemotherapy than patients with an earlier year of diagnosis (e.g. 1991 to 1995). Neugut et al. (2006) reported that colon cancer patients with a more recent year of diagnosis (e.g. 1999) were more likely to follow guidelines by completing 5 to 7 months of treatment leading to a better survival rate.

Thus, even though some studies presented evidence to advocate that the elderly can benefit from appropriate chemotherapy, many studies still showed that patient age and comorbidity were reasons of underuse of chemotherapy.

Radiation Therapy

The use of radiation therapy or combining surgery with adjuvant radiation therapy improves overall survival (Lally et al., 2006; Van Houtte, 2001). However, previous research showed many elderly patients do not receive radiation therapy as guideline recommended (Du Xianglin & Gor, 2007; Litvak & Arora, 2006). Owonikoko et al. (2007) reported that lung cancer patients aged 80 and older were less likely to receive radiation only therapy or surgery plus adjuvant radiation therapy compared to patients younger than 70, using the national SEER database from 1988 through 2003. Du and Gor (2007) found that patients with early stage breast cancer diagnosed from 1992 to 2002 aged 70 and older were less likely to receive radiation therapy after surgery. However, based on data from 2,626 Michigan Medicare elderly patients with lung cancer diagnosed between 1997 to 2000, Bradley, Dahman, and Given (2008) found patients who were aged 75 and older were more likely to receive radiation therapy.

Many physicians may not have administered radiation therapy mainly because there was lack of clinical evidence supporting its use many years ago (Ayanian et al., 2003). Research regarding the benefit of adjuvant radiation therapy became available in later 1990s. Punglia et al. (2006) reported that breast cancer patients with year of diagnosis after 1996 were more likely to receive adjuvant radiation therapy. Strauss et al. (2009) also found that gastric cancer elderly patients with a diagnosis year of 2000 to 2002 were more likely to use adjuvant chemotherapy and radiation therapy than those with diagnosis year of 1991 to 1999. Nevertheless, Owonikoko et al. (2007) examined 316,682 elderly patients with lung cancer diagnosed from 1988 through 2003 and found that there was a trend in reducing usage of radiation between the periods of 1998

to 2003, compared to the periods of 1988 to 1997. Du and Gor (2007) also reported that women with more recent year of breast cancer diagnosis were less likely to receive guideline treatment, which is surgery and adjuvant radiation therapy.

In addition, African Americans may have lower socioeconomic status and confront higher barrier to obtain guideline-based treatment (Berz et al., 2009). Therefore, African American cancer patients may have greater likelihood of underusing radiation therapy than whites. Ayanian et al. (2003) found that African Americans with colorectal cancer diagnosed from 1996 to 1997 were less likely to receive radiation therapy. Even though African Americans have similar likelihood seeing an oncologist, elderly African Americans with rectal cancer diagnosed during 1992 to 1999 were less likely to receive radiation therapy than whites (Morris et al., 2008). Similary, Bickell et al. (2006) found black women with stage I or II breast cancer in 1999 to 2000 were significantly less likely to receive radiation therapy (73% vs. 84%, $p < .0001$)

Cancer stage is also a predictor of receiving radiation therapy. For early stage patients, surgical treatment alone may be significant and the toxicity of radiation therapy may outweigh its benefit. Strauss et al. (2009) found that gastric cancer elderly patients with stage II, III, and IV were more likely than those with stage I to use chemotherapy and radiation therapy after surgery. Studies also showed that adjuvant chemotherapy and radiation therapy significantly improved survival rate for advanced stage gastric cancer patients (Coburn et al., 2008; Strauss et al., 2009).

Evaluating by a radiation oncologist is also a key factor for patients to receive radiation therapy. Steyerberg et al. (2007) examined 3,538 elderly patients with locaoregional esophageal cancer diagnosed between 1991 and 1999 and found the major predictor for receiving radiation therapy was seeing a radiation oncologist. Bickell et al. (2006) also reported that referral to an oncologist was highly associated with receiving radiation therapy among breast cancer patients.

Thus, even though many treatment guidelines have recommended adjuvant radiation therapy, studies still showed that patient age, race, gender, comorbidity and year of diagnosis were the possible reasons of underuse of radiation therapy.

Summary

Although some researchers believe that elderly cancer patients may benefit if they are treated, studies show that many elderly patients with cancer do not receive curative cancer treatments, which may lead to worse health outcomes. Patient age, race, gender, comorbidity, cancer stage, and year of diagnosis were factors affecting the utilization pattern. Since nursing home residents were more likely to be older, have worse activities of daily living (ADL), and have higher comorbidity burden than community-dwelling elderly (Cai, Salmon, & Rodgers, 2009; Smith, Kokmen, & O'Brien, 2000), they potentially have higher barriers in getting cancer care.

Empirical Studies of Medical Service Utilization by Nursing Home Residents

Little is known about the association between nursing home organizational characteristics and the utilization of cancer-related medical services. In order to acquire more insight for current research, the following sections will briefly review studies that discuss the association of nursing home organizational characteristics and the utilization of non-cancer-related medical services.

Relatively few studies look at the issue of whether or not nursing home residents get necessary and proper medical services for detecting or treating their illnesses during their stay in nursing homes. Most nursing home residents are elderly and have one or more chronic diseases at admission. Data from the national Minimum Data Set (MDS) collected during 2002 shows that 55% of residents have hypertension, 36% have heart disease, 28% suffer with depression, 26% have diabetes, 25% have dementia, and 11% have cancer at admission (Buchanan et al.,

2008). After admission to nursing homes, residents may need continuous medical services to control and manage their health conditions, as well as additional medical services to detect or treat their new impairments. Undetected diagnoses or inadequate treatment of the underlying disease will speed up deteriorating health status. The one-year mortality rate among nursing home residents is relatively high. For newly admitted residents, the rate is about 33%. For residents who stay in a nursing home for more than one year, the one-year mortality rate is around 21% (Flacker & Kiely, 2003). Therefore, the need of these elderly and frail nursing home residents to receive medical services to keep them healthy and alive should not be overlooked. And, timely access to appropriate medical care services is important to prevent an illness from becoming life threatening or creating further deterioration in health status.

Medical services used by nursing home residents during their stays include hospitalization, primary care, specialist care, procedures, therapy (physical, occupational and speech), x-ray and laboratory tests. Most are outpatient care and are delivered in specialized cancer care facilities or practices. The decision to use medical services is made jointly by residents, residents' families, nursing home staff, and physicians. Few studies have discussed the extent to which medical services are utilized by nursing home residents. Phillips et al. (2000) looked closely at 350 residents who lived in two nursing home facilities in California between September 1995 and February 1996; they counted what and how many medical services they utilized during those six months. The results indicated that residents who resided in the facility with more care given by geriatricians used more primary care but had less hospitalization. However, this study did not look at disease specific health services and did not discuss the difference of organizational characteristics across these two facilities.

Although most medical services are provided outside of nursing home facilities, nursing homes provide direct daily care to each individual, monitor resident health status, contact or alert

medical service providers when a resident needs further assessment of his or her emergent health problem, and coordinate care plans for residents. Caregivers in nursing home facilities are expected to follow specially-designed guidelines for evaluating symptoms of nursing home residents, such as the guidelines from the Infectious Diseases Society of America to evaluate fever and infection in nursing home residents. Caregivers also are expected to be the front-line observers to assess suspected symptoms and communicate with medical providers more effectively (High et al., 2009). Harrington (2008) also comments that if the caregivers in nursing homes can adopt the assessment guideline for heart failure designed especially for nursing home facilities, they can recognize residents' symptoms earlier, help residents get further assessment, and prevent avoidable hospitalization. Therefore, the caregivers, who usually are the nursing staff in the nursing homes, are the eyes of medical service providers and may influence how much care and/or how timely the care residents receive.

Many cancer-related medical services are outpatient services. However, there is no research regarding nursing home residents' utilization of outpatient services. Most prior studies of medical services utilization by nursing home residents have focused on inpatient care. In their review of such studies from 1980 to 2006, Castle and Mor (1996) and Grabowski et al. (2008) found that nursing home organizational characteristics as well as resident clinical condition and demographics are related to hospitalization. Although none of the studies addressed hospitalization for cancer care specifically or outpatient services, they are informative for the present study because they show what factors influence referral decisions.

Most studies that discuss the relationship between nursing home organizational characteristics and resident utilization of inpatient services focus on structural quality of care variables. Donabedian (1980) defines "structures" as the organizational features or settings associated with the provision of care, such as nursing staffing level and ownership. Previous

studies showed that nursing home ownership, payer mix and staffing are related to hospitalization of residents. Ownership characteristics reveal nursing homes' objectives, resources and management perspectives. Residents staying in not-for-profit nursing homes may receive higher quality of care and then, have less risk of inpatient service utilization (Carter & Porell, 2003; Freiman & Murtaugh, 1993; Spector, Selden, & Cohen, 1998). These results are likely to be related to financial incentives. Residents who are ill may require more time and other resources. To minimize costs, nursing homes have an incentive to hospitalize the residents. Since most nursing home residents are elderly, they are insured by Medicare, which pays for hospital care. Instead of taking care of suspected sick residents in house and incurring associated cost, hospitalizing residents reduces nursing home care costs. For-profit nursing homes, whose primary goal is to maximize profits may be more likely than not-for-profit or governmental facilities to hospitalize residents. Konetzka, Spector, & Shaffer (2004) found that 29.2% of 766 residents with suspected pneumonia in 1996 were hospitalized and reported that the hospitalization rate in for-profit nursing homes was twice that for not-for-profit ones.

Grabowski and Angelelli (2004) suggest that nursing homes with a higher Medicaid reimbursement rate were more likely to deliver better quality of care. Studies found that residents staying in nursing homes with a higher Medicaid reimbursement rate have lower odds of utilizing inpatient services (Intrator et al., 2007; Intrator & Mor, 2004). However, since the Medicaid payment rate is the lowest among all payers, nursing homes that relied more on Medicaid reimbursement may deliver poorer quality of care, and then, increase the risk of hospitalization among their residents. Carter and Porell (2003) found that residents in Massachusetts nursing homes with a higher percentage of Medicaid-paid patient days from 1991 to 1994 were more likely to use inpatient services.

In addition, residents staying in nursing homes with higher nurse staffing may receive more direct personal care and then, have better health outcomes (Konetzka, Stearns, & Park, 2008), and may have lower likelihood of using inpatient services. More skilled nursing staff, with a higher skill mix, may evaluate resident health condition more precisely, monitor ongoing treatment, recognize symptoms that need physician attention in a timelier manner, and then, help residents receive treatment. Among 1,376 residents with high risk of pressure ulcers, Horn et al. (2005) reported that more RN direct care time per resident per day was associated with lower likelihood of hospitalization. Based on the assumption that residents admitted from hospitals to nursing homes may have a higher risk to use inpatient service, Decker (2008b) found that higher Register Nurse (RN) hours per bed, higher level of licensed nurse staffing ratio (RN+LPN hours per bed/total nurse hours per bed) and higher level of RN nurse staffing ratio (RN hours per bed/total nurse hours per bed) reduced the likelihood of hospitalization among residents admitted from hospitals. Carter and Porell (2003) pointed out that LPNs do not have as much training or knowledge as RNs to evaluate residents condition, and then, concluded that residents in nursing homes using LPNs instead of RNs have greater likelihood of hospitalization rate. On the contrary, Intrator and Mor (2004) suggested that a higher licensed nurse staff vs. aides per bed may increase the chance of recognizing any emergent clinical problems among residents and increase the likelihood of using inpatient services. For-profit nursing homes are more likely to have lower nurse staffing.

Hospitalization may also relate to the quality of care provided inside nursing homes. Research concerning hospitalization of nursing home residents recognizes that nursing home residents can suffer physical and emotional stress from the transfer to a hospital (Castle & Mor, 1996). Thus, most studies argue that higher inpatient service utilization means worse nursing home quality and more health care system expense. This argument would be applicable to those

with ambulatory-care-sensitive (ACS) diagnoses, which have been used to define "avoidable" hospitalization. However, nursing home residents with cancer may benefit from the intensive acute care and technology available in the hospital.

On the other hand, only few studies have used process of care quality variables to discuss the relationship between nursing home organizational characteristics and resident utilization of inpatient services. Donabedian (1980) defines "processes" as the activities between health care providers and patients. One example of process measurement is the number of inspection deficiencies. A number of studies have used the number of deficiencies as a process of care quality measure. All nursing homes that provide services to Medicare and/or Medicaid beneficiaries are required to be certified from Centers for Medicare and Medicaid Services (CMS). State agencies perform the actual inspections of nursing homes every year. The inspections cover over 185 items including everything from resident care processes, interaction between staff and residents, food storage, to any physical or oral abuse of residents. One example of the inspection questions is whether the facility provides sufficient fluid intake to maintain proper hydration and health. The inspection results are reported as deficiency citation scores. The higher the deficiency citation score, the worse the nursing home quality.

Based on the assumption about the relationship between hospitalization and quality of care in nursing home in previous studies (Grabowski et al., 2008), researchers suggested that hospitalization rate is more likely to be higher in nursing homes with worse quality of care. Yet, Carter and Porell (2003) study found that residents in nursing homes with higher quality deficiencies were less likely to use inpatient services while holding other factors constant. The authors suspected that aggressiveness of care may link to certain organizational structures, which account for better performance on the inspection processes.

Summary

Many cancer-related medical services are delivered outside of the nursing homes. However, nursing homes may play a critical role when their residents access to cancer care. Nursing homes provide direct daily care to each individual, monitor resident health status, contact or alert medical service providers when a resident needs further assessment of his or her emergent health problem, and coordinate care plans for residents. However, there is a large gap in literatures relates to cancer treatment of elderly nursing home residents. Little is known whether nursing home organizational characteristics are related to cancer diagnosis and care.

To date, many literatures discussed cancer treatment utilization among community-dwelling elderly patients but only a few studies examined variations of utilization of cancer treatments among nursing home residents. Studies showed that younger and non-white nursing home residents were more likely to receive cancer-directed surgery and only around 5% of cancer residents underwent chemotherapy or radiation therapy (Bradley et al., 2008; Buchanan et al., 2005; Johnson et al., 2005). A little more than half of residents with cancer diagnosis received some pain medicine (Clement et al., 2009). Approximately one third of terminal ill cancer residents utilized hospice care before their death (Bradley et al., 2008; Johnson et al., 2005). However, most of these studies did not explore whether there is variation of utilization patterns by different nursing home providers or organizational characteristics. By further examining literatures related to non-cancer medical services utilization patterns among nursing home residents, the study has a better idea in picturing the possible relationship between organizational characteristics (nurse staffing level, nursing skill mix and quality of care) and cancer-related medical service utilization. Therefore, the major goal of this study is to fill the gap in knowledge of the association between cancer care and nursing home characteristics.

CHAPTER 3: CONCEPTUAL FRAMEWORK

This chapter addresses the conceptual framework for the study, which is derived from Andersen's Behavioral Model of health service utilization (Andersen, 1968, 1995; Aday & NetLibrary, 2004). First, Andersen's model is described. Second, its application to the current study is presented. This is followed by discussion of the control variables included in this study, which may be related to cancer-related medical service utilization. Finally, hypotheses are generated from the conceptual framework.

Behavioral Model of Health Service Utilization

Andersen (1968) created original behavioral model of health service utilization in his dissertation in sociology at Purdue University. In the original model, he used a family as the unit of analysis and proposed a framework of predisposition to use health services, ability to obtain them, and need to use them to understand "how" and "why" families use health services. Later, Andersen and Aday revised the model by adding health policy and delivery system features. Shown in Figure 2, Andersen and Aday's model shows the relationships among health policy, delivery system, population characteristics and realized access. Although he originally developed the model for understanding family use patterns in health services, Andersen later shifted the unit of analysis to the individual because of the complexity of constructing family-level data and the difficulty in interpreting use patterns across all family members. The model has also been developed further to provide a basis for evaluating the effectiveness, efficiency and equity of the health system (Aday & NetLibrary, 2004).

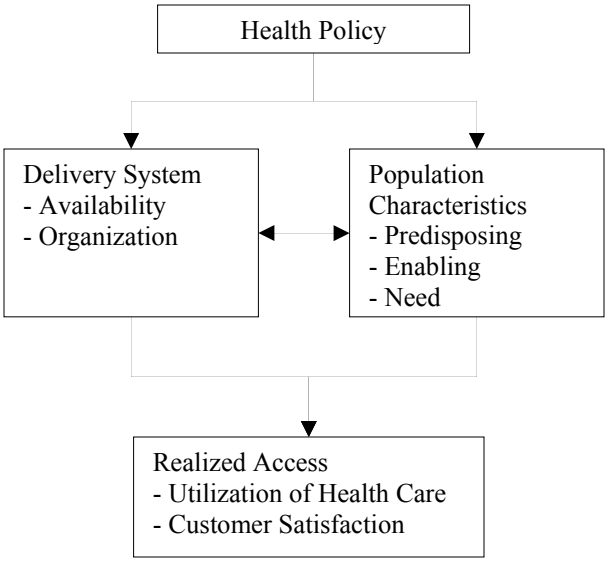

Figure 2. The Revised Behavioral Model of Health Services Utilization (Aday & NetLibrary, 2004)

The model shows that health policy influences the delivery system to provide health services and affects population use of health services. Characteristics of the delivery system affect population use of health services, influencing how many health services are utilized, and affecting consumer satisfaction with health services. In addition, population characteristics influence what and how many health services are utilized and how satisfied people are with health services. Realized access includes the actual use of health services as well as consumer satisfaction. Each component will be described in greater detail later.

This model has frequently been used to explain the use of health services among nursing home residents (Kamble, Chen, Sherer, & Aparasu, 2008) and the elderly (Bazargan, Bazargan, & Baker, 1998; Blalock et al., 2005; Park, 2005; Shibusawa & Mui, 2008); evaluate health policy influence on the use of health services (Henton et al., 2002; Smith-Campbell, 2000); assess the equity of access to medical care (Couture, Nguyen, Alvarado, Velasquez, & Zunzunegui, 2008; Palacio, Shiboski, Yelin, Hessol, & Greenblatt, 1999); and identify factors associated with utilization of health services (Palacio et al., 1999).

Since the current research examines major changes in health policy (the Balanced Budget Act of 1997) and characteristics of the delivery system (nursing home organizational characteristics and community resources) that influence individual utilization of cancer-related medical services, the 2004 version of Andersen-Aday model serves as the conceptual framework. Philips et al. (1998) summarized how the behavioral model clarified the role of the health care delivery system in the use of health services. Some studies have used the model to explain utilization of cancer screening (Birch, Haas, Savage, & Gool, 2007; Mobley, Kuo, & Andrews, 2008; Somkin et al., 2004) and palliative care (Francoeur, 2006) among community-dwelling elderly but did not used the model to examine nursing home residents' medical services usage. Due to lack of data on consumer satisfaction among the study population, the current study will not include customer satisfaction in the realized access component of the theoretical framework. The following sections discuss current research adaptation in detail.

The Conceptual Framework of the Study

The current study focuses on whether nursing home organizational characteristics and quality of care are related to the use of cancer-related medical services for treatment and palliative care among Medicaid and Medicare insured residents of nursing homes in Michigan from 1996 to 2000.

Figure 3 presents the conceptual model used in current research to predict cancer-related medical service utilization (cancer-directed surgery, oncologist visits, chemotherapy, radiation therapy, pain management, and hospice care), and is adapted from Andersen and Aday (2004). This model conceptualizes that health policy changes during study period may influence the delivery system and the population and, ultimately, use of health care services. The delivery system in this study includes nursing homes and community resources. Changes in health policy may affect nurse staffing, skill mix and quality of care in nursing homes. Nursing homes that

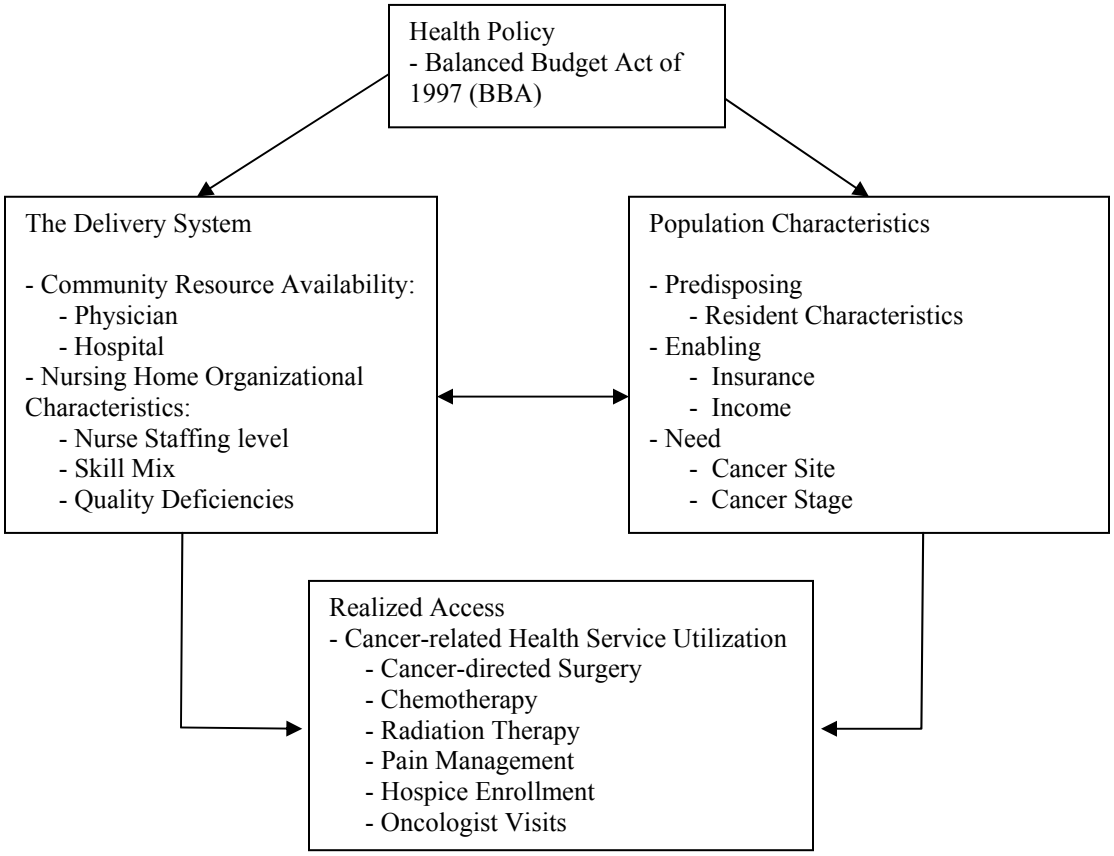

Figure 3. Conceptual Framework adapted from Andersen and Aday

have more nurse staffing, higher skilled nurses, and have fewer quality deficiencies may recognize residents' needs in a timely manner and arrange for residents to use more cancer related health services. The availability of community health care resources matters when the population seeks health services. The population in the current research is dually eligible nursing home residents with a diagnosis of cancer. Their predisposing characteristics, enabling resources, and needs determine whether these patients want treatment and the types of treatment desired, whether they have means to access treatments, and whether they have enough support from the nursing home for after-treatment care. The adaptation of each component in the model will be discussed in detail in the following sections.

Health Policy

Health policy is a decision regarding a goal in health care, such as promoting the quality of care in nursing home facilities, and a plan for achieving that goal, such as a program for evaluating the quality of care. Health policies affect the practice, priorities, and values underlying the health care system. It involves in different levels – federal, state and local. The ultimate goal of health policy is to improve the health of individuals and the population.

In the Andersen and Aday behavioral model, health policy affects the health care delivery system by altering the type and level of care provided. It also affects the population by changing their utilization patterns. The key health policy for this study is the Balanced Budget Act (BBA) of 1997. The major goal of the BBA was to reconcile and balance the federal budget by 2002. Major health care related changes in the BBA were to reduce the rapid growth of Medicare expenses to extend the life of the Medicare Trust fund, and to use the money saved to establish the new state Children's Health Insurance Program to improve the health of children, and expand assistance for low-income Medicare beneficiaries. There are four provisions of the BBA that may influence the study population or nursing homes.

First, to reduce Medicare spending, the BBA changed Medicare payment to skilled nursing homes for post-acute care and rehabilitation services from cost-based reimbursement to a prospective payment system (PPS). After the PPS phase in, skilled nursing homes were paid using national per diem reimbursement rate adjusted by the case-mix and local wage index, regardless of the actual cost incurred. The prospective payment system was phased in over four years beginning with nursing home fiscal years starting on or after July 1, 1998. Each skilled nursing home had a facility specific rate which was based on their facility cost in 1995 and shared a federal rate which was the average cost of nationwide facilities in 1995. In the first year of PPS implementation, the reimbursement rate combined 25% federal rate and 75% facility

specific rate. In the second year, the reimbursement rate was 50% federal rate and 50% facility specific rate. In the third year, the reimbursement rate was 75% federal rate and 25% facility specific rate. In the last year, the reimbursement rate was the 100% federal rate. However, if nursing homes were Medicare certified after 1995, there was no phase-in and 100% federal rate applied immediately. As a result of the BBA, high cost nursing homes had cuts in payment based on a national average adjusted for case mix index and wage index.

Medicare skilled nursing residents made up 8.7% of residents but brought in 11.9% of revenue in most nursing homes in 1998 while Medicaid residents made up 67.7% of residents but only accounted for 46.3% of revenue (GAO, 2000; AHCA, 2001). Since the average Medicare per diem rate is much higher than the Medicaid rate ($250 versus $100 in 1998 (Swan et al., 2001)), many analysts concluded that the historically generous Medicare payment subsidized the cost of Medicaid patients.

As a result, although the goal of the BBA of 1997 was to push nursing homes to provide cost efficient care, it dramatically affected nursing home financial stability (Scott, 1999) and the delivery of quality care (Chen & Shea, 2002; Konetzka, Norton, & Stearns, 2006; White, 2005). Chen and Shea (2002) examined 4,635 nursing homes and reported that after the implementation of the prospective payment system, nursing homes reduced cost by cutting quality, not by increasing efficiency. White (2005) found that after the BBA, total nurse staffing time per resident per day decreased by 13 minutes and quality deficiencies increased. Konetzka et al. (2004, 2006) also confirmed that the BBA resulted in lower RN hours or RN and LPN hours per resident day, increased quality deficiencies, and higher incidence of urinary tract infections and pressure ulcers.

Second, the BBA gave state governments more flexibility in deciding the amount to pay for deductibles and coinsurance for medical services for the Medicare and Medicaid dually

insured. Normally, Medicare pays for 80% of the medical service fee and Medicaid pays the rest. Mitchell and Haber (2004) reported that Michigan decreased this Medicaid payment for physician services by 75% after the BBA, which significantly reduced the likelihood of visiting an outpatient physician and the number of visits among the Medicare and Medicaid dually insured community-dwelling patients when compared to non-dually insured ones. Since a physician visit is a first step for diagnosing cancer and an oncologist visit is the key to receiving cancer treatment, Medicare and Medicaid dually insured nursing home residents with cancer may have had less access to physician services and utilized fewer cancer treatments after the BBA.

Third, after the BBA, Medicare covered more preventive cancer care benefits. Medicare covers several colorectal cancer screening tests, a screening pap smear, pelvic exam and clinical breast exam every three years for most women or every year for women at high risk for cervical or vaginal cancer, and annual screening mammograms for all women age 40 and over.

Also, the BBA expanded the coverage of cancer treatment including paying for antiemetic drugs used as part of an anticancer chemotherapy regimen, Group C cancer drugs, and off-labeled use of some drugs (Bagley & McVearry, 1998). Even though the BBA only increased coverage for screening colonoscopies for patients with increased colon cancer risk, the use of colonoscopy increased 212% and the proportion of patients diagnosed at early stage increased from 22.5% to 25.5% ($p < .001$) (Gross et al., 2006). Therefore, the BBA may increase screening of nursing home residents resulting in diagnosis in an earlier stage and more cancer treatment.

Finally, the BBA adjusted the hospice service reimbursement rate for different geographic locations and waived patient liability if their coverage was denied. The BBA also extended the coverage period of physician certification from 30 days to 60 days with unlimited renewals. Kilgore et al. (2009) found the use of hospice services among elderly cancer patients

who were diagnosed with cancer between 1995 and 2002 significantly increased after the BBA. Therefore, the BBA may encourage more providers to deliver hospice services and more residents to use hospice services.

In summary, the BBA affected nursing home residents with cancer in several ways. The BBA reduced nursing home resources resulting in lower nurse staffing ratios and quality of care; gave state governments flexibility in paying Medicare cost-sharing liability for Medicare and Medicaid dually eligible patients that may have reduced the likelihood of visiting physicians or oncologists; expanded the coverage for several cancer screening tests and cancer drugs that may encourage cancer screening and cancer treatment; and improved the reimbursement rate for hospice services, waiving patient liability and expanding the coverage period, which may encourage residents to use palliative care when they are terminally ill.

Population Characteristics

Population in the model is the people that may be affected by the change in the health system, or the introduction of new health policies. Population characteristics are divided into three components: predisposing, enabling and need. The original Andersen and Aday behavioral model suggests that there is a sequential relationship among these three population characteristics. It makes sense when discussing preventive care. Yet, the current study focuses on what cancer-related medical services are received after diagnosis of cancer. All the health services are triggered by the event of diagnosis of cancer, which actually is the need component. The sequential relationship in the original model, therefore, may not exist and will not be emphasized in the current study.

The first, predisposing characteristics, indicates that some people have a greater propensity to use health services than others. Those propensities exist before the beginning of illness. These propensities are related to demographic factors (e.g. age and gender), social

structures (e.g. education and ethnicity) and health beliefs (e.g. attitudes and knowledge of health and health services). People with certain demographic factors may be more likely to use health services. Some demographic factors, such as age or gender, may be difficult to decide whether group them as predisposing characteristics or need characteristics. Andersen and Newman (1973) explained "age (or sex) per se is not considered a reason for seeking health care" and then considered them as predisposing characteristics. Also, past illness is another demographic factor. People with a prior health problem history may have different attitude toward seeking health services. Social structures indicate that people with different social status may have different behaviors regarding the use of health services. For example, people with a higher educational background may use more preventive health services. Health beliefs are attitudes toward health or health services. For example, people who believe the effectiveness of colonoscopy to screen for colorectal cancer will utilize colonoscopy services more.

In this study, predisposing characteristics include nursing home resident age, race, sex, comorbidity and stay length in nursing homes before diagnosis of cancer. Although there are few studies of utilization of cancer-related medical services among nursing home residents, they show that older residents are less likely to utilize cancer-directed surgery (Bradley et al., 2008) and receive fewer pain medicines (Bernabei et al., 1998; Jones et al., 2005). Male residents are more reluctant to request pain medicine even when they are in pain (Bernabei et al., 1998) when compared to female residents. African American residents are less likely to utilize cancer-directed surgery (Bradley et al., 2008), less likely to receive pain management (Bernabei et al., 1998; Jones et al., 2005) but more likely to use hospice service when terminal ill (Bradley et al., 2008) when compared to white residents. Residents who have stayed in nursing homes less than 90 days are less likely to enroll hospice services than residents who have stayed longer than 90 days (Gozalo, Miller, Intrator, Barber, & Mor, 2008). Residents with some co-existing health

conditions are less likely to visit an oncologist (Krzyzanowska et al., 2009) or receive cancer surgery (Prout et al., 2005; Steyerberg et al., 2007), chemotherapy (Bradley et al., 2008), and radiation therapy (Firat, Byhardt, & Gore, 2002) than residents with no comorbidity. Among all kinds of comorbid conditions, Alzheimer's disease or dementia has been separately discussed. For example, residents with impaired cognitive conditions, such as Alzheimer's disease, are more likely to underreport their illness and receive less cancer treatment or pain control than patients without it (Bernabei et al., 1998).

To utilize health services, people need to know how to get to the health services and how to pay for them. This is the enabling component. People need to have the means and knowledge to utilize the health services. For example, they need to have health insurance coverage or enough income to pay for health services. In this study, all study subjects are Medicare and Medicaid insured. Their income level falls into the poverty level to be qualified for the Medicaid program. Their health care expenses are covered by Medicare and subsidized by Medicaid. So, all study subjects have the same enabling resources to obtain health services. Therefore, this study will not include enabling characteristics in the empirical model.

People must feel that they may be sick, have symptoms, or have concerns about their health in order to use health services. This is the need component. It is the "most immediate cause of health service use" (Andersen, 1968, p.17). Andersen and Newman (1973) relabeled need as the illness level. It is measured by perceived need (e.g. perceived symptoms) and evaluated need (e.g. diagnosed health status). Andersen (1995) indicated that perceived need provided better understanding of the care-seeking process but evaluated need is more closely related to actual treatment received.

In this study, need is the resident's evaluated need -- cancer stage and primary cancer site -- when they were diagnosed with cancer. Cancer treatments are closely related to cancer site

and cancer stage. For example, the National Comprehensive Cancer Network (NCCN) lists all cancer treatment guidelines by cancer site. Under each cancer site, surgical treatment, chemotherapy, radiation therapy, or other treatment options are recommended based on tumor characteristics and stage at diagnosis. Penberthy et al. (1999) showed that elderly Medicare patients with breast cancer and colorectal cancer utilized more surgical treatments than patients with lung cancer and prostate cancer. Bradley et al. (2008) indicated that the utilization pattern of chemotherapy, radiation therapy or hospice services among elderly nursing home residents varied by cancer site and cancer stage. Therefore, resident cancer site and stage at diagnosis may affect their utilization pattern of cancer treatment or palliative care.

Delivery System

The delivery system is the availability and organization of the health care system that interacts with the population and affects their utilization of health services. The availability of health care personnel and facilities near or in the community where the population lives is essential for utilizing health services. The organization of the health care system indicates the context within which utilization occurs and may influence people's health service utilization.

In this study, the availability of health care is physician and hospital availability in the community where a nursing home resident lives. Cancer treatments involve intensive physician visits and may require inpatient care preceding some aggressive treatments. Thus, the availability of health care is physician services and inpatient service availability where a nursing home resident lives.

In this study, the primary organization relevant for resident use of health care is the nursing home. Nursing homes play a key role for residents who need cancer-related medical services. Even though nursing homes do not directly deliver cancer-related medical services to residents, they are the health care delivery system that interacts with residents daily. They

ensure residents' well-being, observe and monitor resident health conditions, act as agents to communicate with physicians and help residents arrange health services if needed.

Therefore, the organizational characteristics of nursing homes are the focus of the study. Within nursing homes, nursing staff are the most important for assessing resident needs. In some cases, residents or their family members notice symptoms or concerns about their health condition and communicate them to the nursing staff. In other situations, residents or their families do not know that they are sick or are not able to communicate about their illness. Nursing staff must notice the symptoms while evaluating a resident's health condition during routine care and contact physicians to arrange an office visit or other medical services, such as a biopsy, if needed. With earlier diagnosis, residents with cancer may have more treatment options available and may utilize more cancer-related health services. Therefore, when nursing staff pay more attention or provide more care to residents, they may have a better chance to recognize resident symptoms, communicate with physicians, arrange health services, and coordinate a treatment plan for residents to utilize needed cancer treatments.

Previous research has shown that residents staying in nursing homes with higher nurse staffing have better health outcomes (Konetzka et al., 2008). Higher nurse staffing levels also mean lower staff workloads and lower nurse staffing turnover rates (Castle & Engberg, 2007) which leads to better quality (Bostick, Rantz, Flesner, & Riggs, 2006; Castle & Engberg, 2007; Harrington, 2008). In a literature review, Bostick et al. (2006) summarized that residents staying in nursing homes with higher nurse staffing levels are less likely to have pressure ulcers, functional decline, and weight loss issues. Many previous studies found that higher nurse staffing levels provides more direct care and are associated with reduced hospitalization rates. Among 1,376 residents with a high risk of pressure ulcers, Horn et al. (2005) reported that more registered nurse (RN) direct care time per resident per day was associated with lower likelihood

of hospitalization. Decker (2008c) found that higher RN hours per bed reduced the likelihood of re-hospitalization among residents admitted from hospitals.

In contrast, Intrator, Zinn, and Mor (2004) found that nursing homes with higher total nurse staffing levels have a higher hospitalization rate. High et al. (2009) suggested that nursing staff, as the front line observers, can help to assess suspected symptoms and communicate with medical providers more effectively. Also, cancer treatment options sometimes depend on patient's health condition. If residents in nursing homes with higher nurse staffing levels have a better overall health, they may have more opportunities to receive appropriate cancer treatment. Other than deciding which cancer treatment, residents and their families also need to consider the intensity of post-acute care and potential side effects from the treatment. Since many cancer treatments are administered on an outpatient basis, the resident will need supportive care at the nursing home. If residents stay in nursing homes with higher nurse staffing levels, they and their families may feel that they can get needed care after treatment and may be more willing to proceed with cancer treatment. Therefore, current study hypothesizes that residents in nursing homes with a higher nurse staffing level, that is, more direct care hours per resident per day, utilize more cancer-related medical services.

Type of staffing is also important. More professional nurse staffing, such as RNs or LPNs versus aides, may be better able to supervise resident care, assess resident symptoms and help them be diagnosed at an earlier stage, and then, receive treatment. Many previous studies claimed that residents staying in nursing homes with more skilled nurse staffing have better health outcomes and a lower likelihood of utilizing inpatient care. Intrator, Zinn, and Mor (2004) found that nursing homes with higher RN-to-nurse ratio have a lower hospitalization rate. Decker (2008c) found that a higher licensed nurse staffing ratio and higher level of RN nurse staffing reduced the likelihood of hospitalization among residents admitted from hospitals. These claims

may be true if these hospitalizations are avoidable, such as with ambulatory-care sensitive (ACS) conditions. However, many cancer treatments require more technical treatment which is only available in hospitals. Utilizing inpatient care may be appropriate treatment for cancer patients.

On the other hand, Intrator and Mor (2004) suggested that a higher licensed nurse staff per bed may increase the chance of recognizing any emergent clinical problems among residents and increase the likelihood of using inpatient services (Intrator & Mor, 2004). Hutt et al. (2008) found residents of nursing homes with a higher level of licensed nurse staffing are more likely to utilize guideline-recommended hospitalization for nursing home-acquired pneumonia. Therefore, current study hypothesizes that residents staying in nursing homes with more skilled nurses, RNs and LPNs, have more opportunities to receive more cancer-related medical services.

Care processes are also important. They indicate how the system coordinates its resources to provide health services. In this study, quality deficiencies, which measure the care process in the nursing home, are used to describe care process decisions. Quality deficiencies, which are generated from the Centers for Medicare and Medicaid Services (CMS) inspection report, sum up all kinds of deficiencies ranging from resident care processes, interactions between staff and residents, food storage, to any physical or oral abuse of residents. For example, failure to provide comprehensive care plans and failure to meet the standard for using physical restraints will be cited in the deficiency report. All nursing homes that provide services to Medicare and/or Medicaid beneficiaries are required to be inspected approximately once a year to be certified by the Centers for Medicare and Medicaid Services (CMS). The higher the number of deficiencies, the worse the nursing home quality is. Since inspection covers everything that is related to how residents are treated and cared for in nursing homes, the inspection result, which is quality deficiencies, reflects how each nursing home coordinates its resources to provide services to residents including cancer-related health services.

Studies have shown that residents in nursing homes with higher quality deficiencies have worse health outcomes, such as, higher risk-adjusted pressure ulcer prevalence (Dellefield, 2006), more consumer complaints about care (Stevenson, 2005), more decline in functional status and a higher physical restraint rate (Mukamel, 1997) and higher hospitalization rate (Carter & Porell, 2003). Residents with better health before diagnosis may have a better opportunity to receive needed cancer treatments. Also, since some cancer treatments require intensive post-acute care or have unpleasant side-effects that need supportive care, residents and their families may be more willing to pursue cancer treatment if they are in nursing homes that they provide better overall quality of care. Therefore, residents who stay in nursing homes with fewer quality deficiencies may have better health status and receive more cancer treatment.

Other nursing home organizational characteristics, such as ownership, chain membership, and payer mix will be included in the model as control variables. Studies found that for-profit nursing homes, whose primary objective is to maximize profit, have lower nurse staffing (Aaronson, Zinn, & Rosko, 1994; Comondore et al., 2009; Grabowski & Stevenson, 2008) and more deficiencies (Harrington et al., 2000, 2001; Castle, 2001a) than not-for profit nursing homes. Chain affiliated nursing homes may benefit from economies of scale and systematic management and have higher adoption rates for quality improvement programs than free standing nursing homes. However, chain membership is associated with higher rates of hospitalization for infections (Zimmerman, Gruber-Baldini, Hebel, Sloane, & Magaziner, 2002). For-profit chain ownership is also related to higher nurse turnover rates (Castle & Engberg, 2007) because chain affiliated nursing homes require more extensive documentation giving staff more stress. Since the Medicaid payment rate is the lowest among payers, nursing homes with a higher Medicaid percentage have fewer financial resources to provide good benefits to staff and have higher nurse staffing turnover rates (Castle and Engberg, 2006), fewer RN hours per resident day

(Decker, 2008a), and lower quality of care (Grabowski, 2001a, 2001b).

Realized Access

Realized access is the actual use of health services. It counts utilization of health services and patient satisfaction. Utilization of health care services is the outcome of primary interest for this study. It can be characterized by its type, site, purpose, and the time interval. Type of utilization indicates what kind of health care services are received, such as inpatient services, primary care, or dental visits. Site of utilization specifies where health care services received, such as a hospital, nursing home, or patient's home. The purpose of utilization refers to preventive, curative or palliative care. Time interval indicates the contact or volume of health care services received. Contact measures whether a patient used health care services in certain time frame to determine whether some people have difficulty to access to certain health care services. Volume measures the number of contacts in a period of time to see how often patients use it. Patient satisfaction is the attitude toward the health care system after one has experience with it. The quantity and quality of the health services is evaluated by the person who intends to use it or already used it. However, due to lack of data on patient satisfaction within the current study population, the current study will not include satisfaction factor in realized access component.

In this study, utilization of health care services will focus on cancer-related medical services. Type of utilization includes oncologist visits, cancer-directed surgery, chemotherapy, radiation therapy, pain management and hospice care. These cancer-related medical services can be inpatient care or outpatient care utilized in hospitals or centers specialized for cancer care (cancer-directed surgery, chemotherapy, and radiation therapy), physician offices (oncologist visits), and nursing homes (pain management and hospice care). Cancer-directed surgery, chemotherapy and radiation therapy are curative treatments while pain management and hospice

care are palliative treatments. This study will measure whether each resident utilized cancer-related medical services within the first six months after diagnosis of cancer. Normally, these elderly residents should see an oncologist to understand the possible treatment plan and make decisions. Either they can have curative treatments or/and have palliative treatments.

For elderly nursing home residents, utilization of cancer-related medical care services may not be in the resident's best interests because they are frail or they may suffer stress. However, if they do not receive any cancer-related medical services, these elderly residents may be under treated. For cancer-related medical services, oncologist visits, hospice services and pain management are unambiguously preferred. Hospice services provide better quality of end-of-life care. Pain management releases cancer residents from daily severe pain and improves quality of life. Also, a consultation with an oncologist can at least give residents with cancer and their families an idea what options they have.

Cancer-directed surgery, chemotherapy or radiation therapy may be either desirable or undesirable for a particular nursing home resident. Some physicians are concerned that these active treatments may do more harm than benefit. However, without them, residents may die from cancer sooner or experience more pain and discomfort. Treatment or non-treatment decisions also depend on the cancer site, cancer stage, predisposing resident characteristics, and resident's health condition. If residents receive good quality of care from the nursing homes, they may survive cancer treatment better and be more likely to choose active treatment. After residents receive treatment, they may be very vulnerable and need significant after-treatment care at the nursing home. If residents and their family members do not think they will have good support from the nursing home, they may have less willingness to go through the treatment process.

Therefore, this study's conceptual model suggests that nursing homes that provide better quality of care, have higher nurse staffing, or have higher nurse skill mix will keep residents healthier, provide more direct care to residents and help residents access cancer-related medical services they need. The research questions are:

1. Are nursing home organizational characteristics associated with cancer-related treatment, and palliative medical service utilization for residents with a cancer diagnosis?
2. Is nursing home quality of care (deficiencies) associated with cancer-related treatment and palliative medical service utilization for residents with a cancer diagnosis?

Therefore, hypotheses generated from research questions that flow from the conceptual model follow.

H1: Residents of nursing homes with higher nurse staffing levels are more likely to utilize cancer-related medical services than residents of nursing homes with lower nurse staffing levels, ceteris paribus.

H2: Residents of nursing homes with higher nurse skill mix are more likely to utilize cancer-related medical services than residents of nursing homes with lower nurse skill mix, ceteris paribus.

H3: Residents of nursing homes with fewer quality deficiencies are more likely to utilize cancer-related medical services than residents of nursing homes with a more quality deficiencies, ceteris paribus

CHAPTER 4: METHODOLOGY

This chapter discusses the research design of this study, followed by a discussion of the study population, data sources, and variable measurement. Then, the analytical approach is discussed. Finally, a summary of this chapter is presented.

Research Design

A cross-sectional design is used to examine the relationships among nursing home organizational characteristics and cancer-related medical service utilization. The design is retrospective and non-experimental. The dependent variables are cancer-related medical service utilization. The independent variables are health policy, population characteristics, and health care delivery system.

Study Population and Data Sources

The study group is comprised of Michigan Medicaid and Medicare insured nursing home residents, also known as "dually-eligible," diagnosed with cancer during the period 1996 through 2000. Medicaid is a state administered health insurance program but co-funded by the federal government. It covers most health care costs, including long-term care costs, for people who are children, pregnant women, disabled, blind, or aged with low income and resources. Medicare is a federal health insurance program for people age 65 or older, people under age 65 with certain disabilities, or people with end-stage renal disease. The Medicare program has three parts. Part A covers inpatient care in hospitals and skilled nursing homes, hospice care and some home care. Part B covers physician services and outpatient care. The last part is prescription drug coverage

which started on January 1, 2006. Before 2006, the prescription benefit was under the Medicaid program for those eligible for Medicaid. Generally speaking, for elderly nursing home residents who are Medicaid and Medicare insured, Medicaid pays for nursing home living costs and Medicare pays for the majority of their medical care costs.

To extract the study population, this study selected all patients with a first primary cancer diagnosed between January 1, 1996 and December 31, 2000 from the Michigan Tumor Registry. The Michigan Tumor Registry is operated by the Michigan Cancer Surveillance Program which is certified by the North American Association of Central Cancer Registries (NAACCR). The Michigan Tumor Registry provides information on cancer cases including patient demographic characteristics (birth date, sex, race, and address), Social Security Number (SSN), cancer site, cancer stage, diagnosis date, method of diagnosis, death date and cause of death if applicable.

Second, the study identified Medicare beneficiaries among patients who were diagnosed with cancer from 1996 and 2000 through linking Medicare denominator file. The Medicare denominator file provides demographic and enrollment information for each Medicare beneficiary during a calendar year. However, the Medicare denominator file uses CMS created health identification code (HIC) as a unique identifier while the Michigan Tumor Registry uses Social Security Number as the identifier. The study used the CMS-generated SSN-to-HIC cross-reference file to link the Michigan Tumor Registry and Medicare denominator file. All claims for inpatient, outpatient, physician, and hospice services during the study period are extracted from Medicare claim files for all patients that are correctly matched to the Michigan state segment of the Medicare Denominator file and were enrolled in Medicare Parts A and B and in a fee-for-service plan. Medicare claim files are not available for services provided to beneficiaries enrolled in managed care plans.

Medicare and Medicaid-insured residents were identified by matching the Medicaid eligibility files with the Michigan Tumor Registry. Medicaid eligibility is recorded monthly since a resident's qualifying criteria may change over time. Nursing home residency was recognized from Medicaid nursing home claim files. The Medicaid nursing home claim file contains monthly nursing home claim records of Medicaid eligible people who stayed in nursing homes. The study focused on those residents who had nursing home claims in the month of cancer diagnosis to confirm their nursing home residency during cancer diagnosis period.

Furthermore, to examine the role nursing homes play in resident cancer-related health service utilization, this study selected residents diagnosed with cancer after entering a nursing home. Residents diagnosed with cancer before entering a nursing home may have a pre-existing treatment plan which nursing homes may not affect. Thus, they are excluded from the sample. To be included in the study, a resident had to have stayed in the same nursing home for at least 30 days before diagnosis. Residents who were diagnosed through death certificate or autopsy and did not have any opportunity to be treated are excluded from this study. Since initial cancer treatments usually take place within six months after diagnosis, this study will focus on cancer-related medical services within the first six months after the diagnosis date. Due to Medicare claim files available for this study is from January 1, 1996 to December 31, 2000, the study selects residents who had at least six months claim data available or who died before the end of 2000.

All cancer-related medical service utilization is retrieved from Medicare claim files (inpatient, outpatient, physician, hospice claims) and Medicaid claim files (pharmaceutical claims) during the period from 1996 to 2000. The availability of delivery system resources (physician and hospital availability) was obtained from Area Resource File (ARF) and residents

were matched by the county code where nursing homes are located in resident's diagnosis year.

Nursing home organizational characteristics are extracted from the Online Survey, Certification and Reporting (OSCAR). Since the nursing home identification number extracted from the Medicaid long term care claim files is a Michigan state Medicaid provider identification number while the OSCAR identifies nursing homes by Medicare provider identification number, the study used Medicaid nursing home cost reports obtained from the Michigan Department of Community Health, Medical Service Administration, which contain both Michigan state Medicaid provider ID and Medicare provider ID, to do the cross match. For nursing homes that did not have a Medicare provider ID, the study used nursing home name and address to match in the OSCAR files. Because the state inspection is done at least once during a 15-month period, not all of nursing homes have new inspection results recorded in the OSCAR in every fiscal year. In order to match the nursing home environment to the diagnosis time period, the study only selected the inspection date within one year before or after the diagnosis date. If there was more than one inspection record, the study chose the record with the inspection date closest to the diagnosis date. The organizational characteristics extracted from the OSCAR are nurse staffing level, nursing skill mix, chain membership, ownership, quality deficiency scores, and payer mix. In cleaning the OSCAR dataset, the study followed the methodology used in Kash, Hawes and Phillips (2007) excluding facilities falling into the highest 1% and lowest 1% distribution in nurse staffing level and nursing skill mix (n=47).

The final sample includes 1183 residents in 396 nursing homes located in 78 counties in Michigan. Nursing homes that could not be matched to OSCAR have more residents diagnosed after BBA, fewer direct nursing hours per patient day, lower Medicaid payer mix, higher Medicare payer mix, more for-profit ownership, less government ownership, and less physician

availability in the county than nursing homes that matched to OSCAR. Each resident has one observation only. The number of nursing home residents in a county ranges from 1 to 315. Oakland county (n=96) and Wayne county (n=315) were the two counties with more than 90 residents. Since nursing home characteristics (e.g. staffing level, skill mix, or quality deficiencies) can change over time, nursing homes in each calendar year will be counted as a unique nursing home. For example, nursing home A in 1996 is different from nursing home A in 1997. In a nursing home of a calendar year, the number of residents ranges from 1 to 6. Around 70% nursing homes (n=590) had only 1 resident a year. 26 nursing homes had more than 3 residents in a calendar year. Table 1 summarizes all exclusion criteria and number of sample excluded.

Table 1. Sample Exclusion List

	Number of Patients
Medicare patients who have Medicaid long term care claims 1996-2000	4661
Exclusion details:	
The first claim record did not have admission date to verify whether patients were diagnosed cancer before admitted or after	(34)
Patients aged younger than or equal to 65 when diagnosed with cancer	(1)
Patients were diagnosed of cancer before their first admission to NH	(2233)
Patients did not stayed in nursing homes more than 30 days before diagnosed of cancer	(110)
Patients were diagnosed through death certificate or autopsy	(543)
Since the study focused on the first six month medical claims, if patients survived longer than six months but did not have six month claims available, they were excluded	(95)
Patients got discharged from nursing home before diagnosis month	(341)
Patients had hospice care claims after their death	(1)
Patients had hospice care claims before diagnosed with cancer	(17)
Patients had cancer diagnosis and treatments before diagnosis date	(9)
Patients could not link to Michigan Medicaid Nursing Home Cost Report and OSCAR records	(43)
Patients of nursing homes with highest and lowest 1% nurse staffing level or skill mix	(51)
Final Sample Size	1183

IRB

The study is approved by the institutional review boards at the Michigan Department of Community Health (Lansing), Michigan State University, and Virginia Commonwealth University.

Variable Measurement

According to the conceptual framework in Chapter 3, the variables include dependent variables, independent variables, and control variables. All variables are extracted from the relevant datasets from 1996 to 2000 as discussed previously.

Dependent Variables

There are six dependent variables for the study: cancer-directed surgery, chemotherapy, radiation therapy, oncologist visit, pain management, and hospice use.

Cancer-directed surgery

Since surgery is not a treatment option for all types of cancer, this study limits the analysis of this variable to residents diagnosed with in situ, local, or regional stage of breast, colon/rectal, prostate, and bladder cancer. Surgery may improve the health condition and may extend life for residents with these cancer sites and stages. This study will examine whether residents who had breast, colon/rectum, prostate and bladder cancer received any cancer-directed surgery within six months following diagnosis of cancer. The International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT) codes are used to identify cancer-directed surgery.

The surgical treatment options for breast cancer are lumpectomy (ICD-9-CM code 85.21), partial or segmental mastectomy (ICD-9-CM code 84.23 or 85.22), simple mastectomy (ICD-9-CM code 85.41 or 85.42), modified radical mastectomy (ICD-9-CM code 85.43 or 85.44), and

radical mastectomy (ICD-9-CM code 85.45 or 85.46). The CPT procedure codes are 19120-19126 and 19140-19240.

The most common bladder cancer procedures are transurethral excision or destruction of bladder cancer (ICD-9-CM code 57.4), other transurethral excision or destruction of lesion or tissue of bladder (ICD-9-CM code 57.49), other excision or destruction of bladder tissue (ICD-9-CM code 57.5), open excision or destruction of other lesion or tissue of bladder (ICD-9-CM code 57.59), partial cystectomy (ICD-9-CM code 57.6), and radical cystectomy (ICD-9-CM code 57.71). The CPT procedure codes are 51020-51530, 51550-51565, 51570, 51575, 51580, 51585, 51590-51597, 52234-52240, and 52640.

The colorectal cancer surgeries are identified by colon resection surgeries (ICD-9-CM code 45.70-45.79, 45.8) and rectal resection surgeries (ICD-9-CM codes 48.40-48.49, 48.50, 48.60-48.69). The CPT procedure codes are 44140, 44141, 44143-44147, 44150-44160, 44393, 45383, 45384, 45385, 45333, 45338 and 45110, 45111, 45112, 45113, 45114, 45116, 45119, 45120, 45123 to 45121, 45308, 45309, 45315, 45190, 45320, 46937, 46938, 45160, 45170 (Cooper et al., 2002; Temple, Hsieh, Wong, Saltz, & Schrag, 2004).

Cancer-directed surgeries for prostate cancers are transurethral prostatectomy (ICD-9-CM code 60.2) transurethral (ultrasound) laser guided induced prostatectomy (ICD-9-CM code 60.21), other transurethral prostatectomy (ICD-9-CM code 60.29), suprapubic prostatectomy (ICD-9-CM code 60.3), retropubic prostatectomy (ICD-9-CM code 60.4), and radical prostatectomy (ICD-9-CM code 60.5). The CPT procedure codes are 52601, 52612-52614, 55801, 55821, 55831, 55810-55815, and 55840-55845 (Cooper et al., 2002).

Residents diagnosed with breast, colon/rectal, prostate, and bladder cancer in situ, local, or regional stage were considered to have received cancer-directed surgery if any of the above

codes were found in their claim files within six months following diagnosis of cancer and coded as 1. Otherwise, they are coded as 0.

Chemotherapy or Radiation Therapy

Since chemotherapy or radiation therapy is not always a treatment option for all types and stages of cancer, this study limits the analysis of this variable to residents diagnosed with local, regional, distant or unknown stage of breast, colon/rectal, lung, prostate, and bladder cancer. The study examines whether these residents received any chemotherapy or radiation therapy within 6 months following diagnosis of cancer. The study identified chemotherapy use from Medicare claims using the International Classification of Diseases, 9th Revision (ICD-9), diagnostic code V58.1 and procedure code 9925, and the Diagnostic Related Group code 410 for chemotherapy administration, and CMS Common Procedure Coding System codes for chemotherapy administration (Q0083-Q0085, G0355-G0359, G0360-G0362, or J9000-J9999), and the American Medical Association's Current Procedural Terminology (CPT) codes (96400 - 96549), as well as the relevant revenue center codes (0331, 0332, and 0335) were also used where applicable.

The study identified radiation therapy use from Medicare claims using the International Classification of Diseases, 9th Revision (ICD-9), diagnostic code V58.0 or the relevant revenue center codes (0333) and CPT codes for radiation therapy administration or management (19296-19298, 31643, 55875, 55876, 57155, 58346, 61770, 61793, 77261-77499, 77520-77620, 77750-77799, 79005-79445, and 79999), and CMS HCPCS codes (A9500-A9507, A9517, A9527, A9530, A9543, A9545, A9563, A9564, A9600, A9699, G0173, G0243, G0251, G0339, G0340, Q3001) as well as ICD-9-CM procedure codes (92.21-92.26, or 92.29), and DRG code 409 were also used where applicable.

Residents with breast, colorectal, lung, prostate, or bladder cancer at local, regional, distant or unknown stage were considered to have received chemotherapy or radiation therapy if any of these codes were used within six months following diagnosis of cancer and coded as 1. Otherwise, they are coded as 0.

Oncologist Visits

This study examines whether residents of any cancer site and stage visited an oncologist within 6 months following diagnosis of cancer. Oncologists can specialize in medical, surgical, or radiation oncology. Medical oncology (MO) specializes in treating cancer with chemotherapy; surgical oncology specializes in the biopsy and surgically removing the cancer; radiation oncology (RO) specializes in treating cancer with radiation therapy. Oncologists are identified if physicians are identified as a subspecialist in medical oncology (CMS specialty code 83), or hematology-oncology (CMS specialty code 90), or radiation oncologist (CMS specialty code 92) or if the physician has ever prescribed chemotherapy or radiation therapy from the Medicare Carrier Claim files (CPT codes 77260-77499, 77750-77799, 96400-96549; ICD-9-CM codes V58.0, V66.1, V67.1; ICD-9-Procedure codes 92.20-92.29; and revenue center codes 0330, 0333, 0339) during 1996 and 2000. In this way, both noncertified physicians who practice oncology and board-certified oncologists are captured.

However, including all physicians who had practiced any oncology during 1996 to 2000 may over-identify oncologists and reduce the chance of observing a significant finding (Bradley et al., 2008), the study examines the frequency of oncology practice with cancer diagnosis for all physicians and found that 75% of physicians practiced oncology 100 or fewer times, 50% of them had 14 or less practices and 25% of them only practiced 3 or less oncology over five years. Therefore, the study will recognize physicians who practiced oncology more than 3 times over

five years as an oncologist. Residents were considered to have received oncologist visits if they visited one of these oncologists within six months following diagnosis of cancer and coded as 1. Otherwise, they are coded as 0.

Pain Management

For pain management, this study examines whether residents with regional, distant or unknown cancer stage received any pain medication within six months following diagnosis of cancer. According to the analgesic ladder of the World Health Organization (WHO) that was created in 1982, there are three different tiers analgesic drugs. The first step is to offer nonsteroidal anti-inflammatory drugs (NSAIDs). The second step is to add weak opioids to the NSAID if pain is increasing. And then, if pain still is severe, the third step is to substitute strong opioids for weak opioids. Residents with regional, distant or unknown cancer stage are more likely to suffer moderate or intense pain (Marinangeli et al., 2004). Therefore, the study will focus on whether these residents received WHO level II or III analgesic drugs.

Opioid medicines are identified by using the AHFS Pharmacologic-therapeutic classification code 28:08:08. The AHFS classification is created by American Society of Health System Pharmacists and has been in use in hospitals in the United States since 1959. The AHFS classification allows the grouping of drugs with similar pharmacologic, therapeutic, and/or chemical characteristics.

Then, if residents with regional, distant or invasive but unknown cancer stage have any Medicaid pharmaceutical claims containing any opioids medicines within six months after diagnosis of cancer, they are considered to have received pain management and coded as 1. Otherwise, they are coded as 0.

Hospice Use

Finally, when residents or their families decide against cancer treatment and residents have a life expectancy of six months or less under normal disease progression, they can select hospice care. Since the Medicare hospice claim data for this study is available up to December 31, 2000, this study will examine whether residents who died before December 31, 2000 used any hospice services. Usage of hospice service is identified if residents have any hospice service claim in Medicare hospice claim files after diagnosis of cancer. Residents who are identified as utilizing hospice service are coded as 1. Otherwise, they are coded as 0.

Independent Variables

Health Policy

The primary health policy of interest is the BBA. The study used three variables to examine the BBA influence on nursing homes and their residents. First, the BBA changed Medicare payment from cost-based reimbursement to a prospective payment system and implemented in phases from July 1, 1998. By adopting the method from Konetzka et al. (2004) study, the study coded PPS phase-in as 0 for residents whose diagnosis date was earlier than July 1, 1998. For residents whose diagnosis date was later than July 1, 1998, they were still coded as 0 if nursing home fiscal year their diagnosis date fell in started before July 1, 1998; 0.25 if nursing homes fiscal year started after July 1, 1998 and before June 30, 1999; 0.50 if nursing home fiscal year started after July 1, 1999 and before June 30, 2000, and .75 if nursing home fiscal year started after July 1, 2000 but before June 30, 2001. Also, there would not be a phase in implementation for nursing homes certified by Medicare after 1995. Thus, residents of nursing home fiscal year started after July 1, 1998 were coded as 1. If nursing homes were not certified by Medicare during 1996 to 2000, their residents were coded as 0 irrespective of their diagnosis

date. For residents of nursing homes that did not have fiscal year information (n=9), the study assumed the fiscal year started on July 1 each year.

Second, the BBA reduced the Medicare reimbursement rate for physician services and gave state governments flexibility in deciding the amount to pay for deductible and coinsurance for medical services for the Medicare and Medicaid dually insured used. With the implementation date on July 1, 1998, the study created a binary variable BBA to code residents whose diagnosis date was after July 1, 1998 as 1; otherwise, coded as 0.

Third, in order to limit the effect of excessive payment reduction resulting from the BBA of 1997, the government passed the Balanced Budget Refinement Act (BBRA) of 1999 and implemented from April 1, 2000. Since the study period covered until the end of 2000, the effect of BBRA will be discussed in the model. If nursing homes are certified by Medicare during 1996 to 2000 and residents whose diagnosis date was after April 1, 2000, the study coded BBRA as 1. If nursing homes are certified by Medicare during 1996 to 2000 but residents were diagnosed with cancer before April, 2000, the study coded BBRA as 0. Also, if nursing homes were not certified by Medicare during 1996 to 2000, the study coded BBRA as 0.

Population Characteristics

Predisposing Characteristics. Predisposing characteristics include resident age at diagnosis, gender, race, comorbidity and stay length in nursing homes before diagnosis of cancer. They are categorized into binary variables or series of binary variables. Resident age at diagnosis, gender, and race are derived from the Michigan Tumor Registry. Resident age at diagnosis categories are 65-69, 70-74, 75-84, ≥ 85. Race is categorized into white and non-white. Gender is female or male. Due to data limitations, the study does not calculate a comorbidity score, but group residents into no comorbidity, Alzheimer's disease and other comorbid

conditions. By using International Classification of Diseases 9th (ICD-9) diagnosis code in Medicare inpatient, outpatient, and carrier claim files before cancer diagnosis date, if residents did not have any diagnosis of Myocardial Infarction (ICD-9 code: 410, 412), Congestive Heart Failure (ICD-9 code: 428), Peripheral Vascular Disease (ICD-9 code: 4439, 7854, V434 and 441), Cerebral Vascular Disease (ICD-9 code: 438), Dementia (ICD-9 code: 290), Alzheimer's disease (ICD-9 code: 331), Chronic Pulmonary Disease (ICD-9 code: 490-496, 500-505, 5064), Rheumatologic Disease (ICD-9 code: 7100, 7101, 7104, 7140, 7141, 7142, 71481, 725), Peptic Ulcer Disease (ICD-9 code: 531-534), Liver Diseases (ICD-9 code: 5712-5716, 5722-5728), Diabetes (ICD-9 code: 2500-2507), Hemiplegic or Paraplegia (ICD-9 code: 342 or 3441), Renal Diseases (ICD-9 code: 582, 585, 586, 588), they are coded as no comorbidity. If residents have Alzheimer's disease or dementia only, they are grouped into Alzheimer's disease. If residents have Alzheimer's disease and other comorbid conditions, they are grouped into Alzheimer's and other. For residents who have comorbid conditions other than Alzheimer's disease, they are grouped into other comorbid condition. Residents who stayed in nursing homes before diagnosis of cancer more than 30 days but less than 90 days are identified as short-stay residents.

Since residents who survived longer after diagnosis may have more chances to utilize cancer-related medical services, this study considered controlling for survival time by including the natural log of survival time as a regressor with its coefficient constrained to 1. However, the endogeneity of survival time is highly suspected. For example, residents who only survived several days after diagnosis of cancer may not have any chance to arrange or seek any cancer treatment. On the other hand, residents who get treatments may survive longer than residents who did not. Hence, checking the endogeneity is necessary. The study considered use of a Hausman test for endogeneity, but this test required an instrument variable. A valid instrument

variable is highly correlated with survival time variable but is not correlated with the error term of study model, which predicts the probability of receiving cancer-related medical services. Theoretically, it is difficult to find a strong instrument variable for survival time in this study. For example, the co-existing health conditions at diagnosis may be well related with resident's survival time. Yet, when physicians suggest treatment options, they may also consider a resident's health conditions. As a result, it is not feasible to use survival time variable in the model. Since it may take one to two months to make appointments with specialties (surgeons and oncologists), decide treatment plans, and receive treatments, the study only selects residents who survived more than 60 days to predict the possibility of receiving curable cancer-related medical services (surgery, oncologist visit, chemotherapy, and radiation therapy). The descriptive utilization pattern among residents who survived less than 60 days will be discussed separately. Since patients usually can access palliative treatments (pain management and hospice care) in much shorter time, the study, therefore, uses all residents to run the analysis for pain management and hospice care.

Enabling Characteristics. Enabling characteristics indicate personal or family resources residents have as a means to use health services. In this study, enabling characteristics indicates family income and health insurance status. Since all study populations are Medicare and Medicaid insured nursing home residents, their family income level and health insurance status are the same. Thus, this study omits enabling characteristics in the model.

Need Characteristics. Need characteristics include cancer stage and cancer site. Cancer stage is the stage of cancer when first diagnosed and recorded in the Tumor Registry. It is categorized into in situ, local, regional, distant, and invasive, but unknown stage. When cancer patients do not have plans to cure their cancer, they may not undergo certain diagnostic tests to

define staging. The cancer is then documented as invasive, but unknown stage. Cancer site is the first diagnosed cancer site recorded in Tumor Registry as cancer site. Since different cancer site and stage may trigger different needs, this study considered inclusion of interaction terms for cancer site and cancer stage in the model. However, certain cancers, such as leukemia, lymphoma, pancreatic cancer, and brain cancer, are usually not staged. Also, about 30% of residents' cancer sites are grouped into "other cancer site," which contains more than 20 different cancers. As a result, the interpretation of interaction term of cancer site and cancer stage may not be very meaningful. Furthermore, the interaction term of cancer site and cancer stage will create 44 variables (9 cancer sites * 5 cancer stages - 1 = 44 interaction term variables). With limited samples size, adding these interaction terms in the model may cost too many degrees of freedom and decrease the power of analysis. The study, therefore, will not include cancer site and stage interaction terms.

Delivery System

The delivery system includes community health care resource availability and nursing home organizational characteristics. Community resources include physician and inpatient service accessibility. For cancer-directed surgery, the study uses number of general surgeon and surgeon specialists per 100,000 population in the county. For chemotherapy or radiation therapy and oncologist visit, the study uses a dichotomous variable to identify whether there is one or more radiation oncology specialists available in the county. For pain management and hospice use, the study uses number of general internal medicine physician per 100,000 population in the county to measure physician accessibility. Inpatient service accessibility is measured by the number of short term hospital beds per 1000 population in the county. A higher ratio means better access to primary care or/and inpatient service. The data for the construction of these

variables were retrieved from Area Resource File (ARF) based on the county code where nursing homes were located for year of diagnosis. Since the county code for nursing homes recorded in OSCAR dataset uses Social Security Administration (S.S.A.) county code while Area Resource File dataset uses Federal Information Processing Standards (FIPS) county code, this study used CMS-generated CBSA-SSA-FIPS crosswalk file to link OSCAR and ARF dataset.

As for nursing home organizational characteristics, this study includes nurse staffing level, nursing skill mix, and quality. Nurse staffing level is measured by total combined RN, LPN and aide hours per resident per day from the OSCAR. Since OSCAR recorded the number of FTE nurses over a two-week period, the study calculates working hours per resident per day by multiplying by 70 hours, diving by 14 days, and then dividing by the total number of residents in the facility (Abt Associates, 2001). Nurse staffing level is calculated by summing RN, LPN, and nurse aides working hours per resident per day. Nursing skill mix is measured by total RN working hours divided by total nurse staffing working hours (RN, LPN, and Nurse Aides) from OSCAR. Quality deficiencies are measured by quality deficiency citation scores from OSCAR. Given that a greater number of quality deficiencies mean poorer quality of care, the study used statewide quartile quality deficiencies to categorize it into high, medium and low quality accordingly.

Control Variables

Nursing home ownership is incorporated as a series of binary variables with for-profit as the referent category. Chain membership is a binary variable with free standing membership as the referent category. Payer mix is indicated with the percentage of Medicaid and Medicare residents of total residents.

Binary variables for diagnosis year have been used in several previous studies to control the time effects. Due to the study uses similar mechanism (e.g. diagnosis date) to define health policy variables in the model, there is a concern of multicollinearity issue between time effects and health policy variables. The study ran the correlation analysis and found there is a significantly high correlation between BBRA variables and year 2000 binary variable. In addition, the study compares the results with adding time variables and without it. The results show that the estimates of health policy variables become very unstable. The 95% confidence interval of time variables has unreasonable range (e.g. more than 1000). The study, therefore, determines that there is a "near" perfect collinearity relationship between health policy variables and time variables. Hence, the study will not be able add time trend variables in the model. Table 2 summarizes the variables and data sources.

Table 2. Study Variables

Dependent Variables: Cancer-Related Medical Service Utilization		
Variables	Measurement	Data Source
Cancer-directed Surgery (residents with breast, colorectal, prostate, or bladder cancer at in situ, local, and region stage)	1 if resident receives cancer-directed surgery after diagnosis; 0, otherwise	Medicare Claim file
Chemotherapy or Radiation therapy (residents with breast, colorectal, lung, prostate or bladder cancer at local, regional, distant or unknown stage)	-1 if resident receives chemotherapy or radiation therapy after diagnosis; 0, otherwise	Medicare Claim file
Oncologist Visit	-1 if resident visits oncologist after diagnosis; 0, otherwise	Medicare Claim file
Pain Management (residents with regional, distant and unknown stage)	-1 if resident receives opioid pain medicine after diagnosis; 0, otherwise	Medicare Claim file
Hospice (residents who died before 12/31/2000)	-1 if resident receives hospice service after diagnosis; 0, otherwise	Medicare Claim file

Table 2 (continued)

Variables	Measurement	Data Source
Independent Variables: Health Policy		
PS phase-in	- if nursing home is certified by Medicare before 1995, then --0 if resident's diagnosis date is before 7/1/1998 or nursing home fiscal year started before 7/1/1998 --.25 if nursing home fiscal year started after 7/1/1998 and before 6/30/1999 --.50 if nursing home fiscal year started after 7/1/1999 and before 6/30/2000 --.75 if nursing home fiscal year started after 7/1/2000 and before 6/30/2001 -1 if nursing home is certified by Medicare after 1995 and nursing home fiscal year started after 7/1/1998 -0 if nursing home is not certified by Medicare during 1996 to 2000	OSCAR Michigan Tumor Registry Michigan Medicaid Nursing Home Cost Report
BBA	1 if resident's diagnosis date is after 7/1/1998; 0, otherwise	Michigan Tumor Registry
BBRA	-1 if nursing home is certified by Medicare and resident's diagnosis date is after 4/1/2000 -0 if nursing home is certified by Medicare but resident's diagnosis date is before 4/1/2000 -0 if nursing home is not certified by Medicare during 1996 to 2000	Michigan Tumor Registry
Independent Variables: Predisposing Characteristics		
Age (series of binary variables)	65-69, 70-74, 75-79, 80-84, >=85 (referent)	Michigan Tumor Registry
Sex	1 if Female; 0 otherwise	Michigan Tumor Registry
Race	1 if non-white; 0 otherwise	Michigan Tumor Registry
Comorbidity (series of binary variables)	No comorbidity (referent), Alzeimer's only, Alzeimer's and other condition, other conditions only	Medicare Claim files
Length of Stay (series of binary variables)	Short-stay - if stayed in NH >=30 days but <90 days before cancer diagnosis Long-stay(referent)– if stayed in NH >= 90 days before cancer diagnosis	Medicaid Long term care claim files
Independent Variables: Need Characteristics		
Cancer site (series of binary variables)	Breast, colorectal, prostate, lung, other GI, pancreas, urinary bladder, leukemia, other (referent)	Michigan Tumor Registry
Cancer Stage (series of binary variables)	In situ, local, regional, distant, invasive but unknown stage (referent)	Michigan Tumor Registry

Table 2 (continued)

Variable	Measurement	Data Source
Independent Variable: Delivery System Characteristics		
Physician Accessibility	(for cancer surgery) - Number of surgeons per 100,000 population in the county (for chemo or radiation therapy and oncologist visit) – 1 if there is one or more radiation oncology specialist in the county; 0, otherwise. (for pain and hospice) – Number of general internal medicine physicians per 100,000 population in the county	Area Resource File
Inpatient Service Accessibility	Short term general hospital beds per 1,000 population in the county	Area Resource File
Nurse Staffing Level	Total RN, LPN, and aide hrs per resident per day	OSCAR
Nursing Skill Mix	Total RN hours over total nurse staffing hours	OSCAR
Quality (series of binary variables)	High – if quality deficiencies are lower than statewide 1st quartile Medium – if quality deficiencies are between statewide 1st quartile and 4th quartile Low (referent) – if quality deficiencies are higher than 4th quartile	OSCAR
Control Variables:		
Ownership (series of binary variables)	For-profit (referent), not-for-profit, government	OSCAR
Chain membership	1 if chain membership; 0 otherwise	OSCAR
Payer Mix	Percent of Medicaid paid patients / total residents Percent of Medicare paid patients / total residents	OSCAR

*OSCAR: Online Survey, Certification and Reporting

Analytical Approaches

This study uses logistic regression to estimate the model because all the dependent variables are binary variables and logistic regression can accept both continuous and categorical predictors. The logistic regression model predicts the logit of utilization of cancer-related medical services from health policy, predisposing, need and delivery system characteristics. The logit is the natural logarithm of odds of Y=1 (utilized health service). The model is formed as

ln (P/(1-P)) = log(odds) = logit = $\beta_0 + \beta_1 HP + \beta_2 PD + \beta_3 ND + \beta_4 CR + \beta_5 NC$

Where HP is a vector of health policy variables, PD is a vector of predisposing variables, ND is a vector of need variables, CR is a vector of community resource availability variables, and NC is a vector of nursing home organizational characteristics.

Hence,

Probability (Y =1(utilized cancer-related medical services)| HP= Health Policy, PD=Predisposing, ND=Need, CR=Community resource availability, NC=Nursing Home Organizational Characteristics)

= P

= exp ($\beta_0 + \beta_1 HP + \beta_2 PD + \beta_3 ND + \beta_4 CR + \beta_5 NC$) / [1+ exp ($\beta_0 + \beta_1 HP + \beta_2 PD + \beta_3 ND + \beta_4 CR + \beta_5 NC$)]

where P is the probability of utilization of cancer-related medical services, Y is the utilization of cancer-related health services including cancer-directed surgery, chemotherapy, radiation therapy, oncologist visits, pain management, and hospice use. β_0 is the constant of the equation. β_1, β_2, β_3, β_4 and β_5 are vectors of parameters corresponding to categories of variables.

β_1, β_2, β_3, β_4 and β_5 are estimated by maximum likelihood. The interpretation of β_1, β_2, β_3, β_4 and β_5 is exponentiating the parameter estimates for categorical variables to get an odds ratio and finding the marginal effect for continuous variables. Since the hypotheses of the study expect positive association between nursing home organizational characteristics and cancer-related health service utilization, the study hypotheses are supported if $\beta_5 > 0$.

The model will be estimated by logit procedure and logistic procedure in STATA 9.0 with robust standard errors and adjusting standard errors for non-independence of observations within nursing homes.

Summary

This chapter describes the research design, study population, data sources, measurement, and analytical methods. The study design is a cross sectional study design that analyzes utilization of cancer-related medical services during 1996 to 2000 among Medicare and Medicaid dually insured nursing home residents in Michigan. Several datasets are used to construct the variables needed for this study. Logistic regression is used to analyze the model.

Chapter 5 presents the results of descriptive and multivariate analysis. Chapter 6 discusses the findings, implication, and the limitations in this study.

CHAPTER 5: RESULTS

This chapter presents the results of the analysis. The first section reports descriptive statistics for the outcome as well as explanatory variables used. The comparison of characteristics and utilization patterns of cancer-related medical services between residents who survived longer versus less than 60 days are also reported. The second section presents the results of the multiple logistic regressions. The final section is the summary of findings.

Results for Descriptive Analysis

The following sections present the descriptive analysis results for the health policy, population characteristics, delivery system and utilization of health services components. The unit of analysis is the nursing home resident. Since only residents who survived more than 60 days were selected to predict the utilization of oncologist visit, cancer-directed surgery, chemotherapy or radiation therapy while all residents who survived at least one day were used to analyze the usage pattern of palliative treatment (pain management and hospice care), the descriptive characteristics of population characteristics and health service utilization are reported in three categories: all residents surviving at least one day (n=1183), residents surviving more than 60 days (n=875), and residents surviving at least one day but equal to or less than 60 days (n=308). Characteristics of residents surviving more than 60 days and residents surviving equal to or less than 60 days were compared to see if significant difference exists by using chi-square (χ^2) test for categorical variables and simple student t-tests for continuous variables at a significance level of $\alpha = 0.05$.

Health Policy

Table 3 reports the distribution of health policy characteristics. The study uses three variables to examine the BBA influence on nursing homes and their residents: PPS phase in, BBA and BBRA. More than half of residents (67.71%) were diagnosed with cancer before the PPS payment change applied to their nursing homes (n=663) or were residents of nursing homes that were never Medicare certified (n=138). Thus, their treatment would not be influenced by BBA nursing home payment changes. A little more than half of residents (55.28%) were diagnosed with cancer before BBA implementation, which is July 1, 1998. Thus, any outpatient payment provisions would not influence their care. Only 80 (6.76%) residents were diagnosed with cancer after BBRA implementation. Thus, these residents' treatment may be influenced by BBRA nursing home payment increase.

Table 3. Health Policy Characteristics

Characteristics	Definition	# of Residents
PPS phase-in		N (%)
0	Residents of Nursing Home never Medicare certified (n=138) or Residents diagnosis date and Nursing home fiscal year started before 7/1/1998 (n=663)	801 (67.71)
0.25	Residents diagnosis date and Nursing home fiscal year started after 7/1/1998 and before 6/31/1999	211 (17.84)
0.50	Residents diagnosis date and Nursing home fiscal year started after 7/1/1999 and before 6/31/2000	145 (12.26)
0.75	Residents diagnosis date and Nursing home fiscal year started after 7/1/2000 and before 6/31/2001	6 (0.51)
1	Residents diagnosis date and Nursing home fiscal year started after 7/1/1998 and Nursing Home got Medicare certified after 1995	20 (1.69)
	PPS Phase-in Mean (SD) = 0.1266 (0.2135)	
BBA		N (%)
0	Residents diagnosed with cancer before 7/1/1998 (referent)	654 (55.28)
1	Residents diagnosed with cancer at or after 7/1/1998	529 (44.72)
BBRA		N (%)
0	Residents of Nursing Home never Medicare certified (n=138) or Residents diagnosis date is earlier than 4/1/2000 (n=965)	1103 (93.24)
1	Residents diagnosis date is after 4/1/2000	80 (6.76)

Population Characteristics

Table 4 presents the descriptive results for predisposing and need characteristics. Overall, residents were more likely to be older than 85 years old (41.34%), female (66.61%), white (77.18%), in a nursing home for more than 90 days (91.55%). They were also more likely to have survived more than 150 days (57.82%) and be diagnosed with cancer sites other than breast, colorectal, lung, prostate, other gastrointestinal, pancreas, bladder, leukemia (29.25%), and with invasive but unknown stage (35%). There were some significant differences between residents who survived more than 60 days and those who survived a shorter time. A greater percentage of residents who survived more than 60 days were female (68.23% vs. 62.01%, p=.0467), were white (78.86% vs. 72.40%, p=.0203), had no comorbidity (19.43% vs. 12.99%, p=.0206), were diagnosed with breast cancer or prostate cancer (20.11% vs. 3.25%, p<.0001; 10.06% vs. 2.92%, p<.0001, respectively), and had local stage (34.74% vs. 10.71%, p<.0001).

Delivery System

Table 5 reports the descriptive characteristics for community resources and nursing homes. Overall, there was average of 29 general internal medicine physicians, 54 surgeons and 280 short term hospital beds per 100,000 population in the county where the nursing home was located when the resident was diagnosed with cancer. Near 70% of nursing homes in a county have one or more radiation oncology specialists. Nurses, which include RNs, LPNs, and nurse aides, spent an average of 3.14 hours per day with each resident. About 11% of nursing time, approximately 21 minutes per resident per day, was provided by the RNs, the higher skilled nurses. Nursing homes had an average of 10.35 deficiencies during the year of diagnosis. A greater percentage of nursing homes were for-profit than not-for-profit. A little more than half of nursing homes had chain membership. Average 71.50% of total residents in the facilities were

Table 4. Population Characteristics

Characteristics	All Residents	Residents who survived >60 days	Residents who survived ≤ 60 days	p value >60 vs. ≤60 days
Number of residents	1183	875	308	
Predisposing Characteristics				
Age				.1361
65-69	65 (5.49)	51 (5.83)	14 (4.55)	
70-74	148 (12.51)	108 (12.34)	40 (12.99)	
75-79	209 (17.67)	157 (17.94)	52 (16.88)	
80-84	272 (22.99)	214 (24.46)	58 (18.83)	
>=85	489 (41.34)	345 (39.43)	144 (46.75)	
Sex				.0467
Male	395 (33.39)	278 (31.77)	117 (37.99)	
Female	788 (66.61)	597 (68.23)	191 (62.01)	
Race				.0203
White	913 (77.18)	690 (78.86)	223 (72.40)	
Non-white	270 (22.82)	185 (21.14)	85 (27.60)	
Comorbidity				.0206
No comorbidity	210 (17.75)	170 (19.43)	40 (12.99)	
Alzheimer only	61 (5.16)	44 (5.03)	17 (5.52)	
Alz + Other condition	465 (39.31)	325 (37.14)	140 (45.45)	
Other comorbidity	447 (37.79)	336 (38.40)	111 (36.04)	
Length of NH Stay				.6399
Long-Stay	1083 (91.55)	803 (91.77)	280 (90.91)	
Short-Stay	100 (8.45)	72 (8.23)	28 (9.09)	
Survival time				<.0001
0-30	180 (15.22)	NA	180 (58.44)	
31-60	128 (10.82)	NA	128 (41.56)	
61-90	83 (7.02)	83 (9.49)	NA	
91-120	55 (4.65)	55 (6.29)	NA	
121-150	53 (4.48)	53 (6.06)	NA	
>150	684 (57.82)	684 (78.17)	NA	
Need Characteristics				
Cancer site				<.0001
Breast	186 (15.72)	176 (20.11)	10 (3.25)	
Colorectal	195 (16.48)	151 (17.26)	44 (14.29)	
Lung	182 (15.38)	104 (11.89)	78 (25.32)	
Prostate	97 (8.20)	88 (10.06)	9 (2.92)	
Other GI	49 (4.14)	30 (3.43)	19 (6.17)	
Pancreas	48 (4.06)	18 (2.06)	30 (9.74)	
Bladder	50 (4.23)	42 (4.80)	8 (2.60)	
Leukemia	30 (2.54)	22 (2.51)	8 (2.60)	
Other	346 (29.25)	244 (27.89)	102 (33.12)	
Cancer Stage				<.0001
In situ	36 (3.04)	28 (3.20)	8 (2.60)	
Local	337 (28.49)	304 (34.74)	33 (10.71)	
Regional	187 (15.81)	135 (15.43)	52 (16.88)	
Distant	209 (17.67)	114 (13.03)	95 (30.84)	
Invasive but unknown stage	414 (35)	294 (33.60)	120 (38.96)	

Table 5: Delivery System Characteristics

Characteristics	Definition	Unique Nursing Homes (n=833)
		Mean (SD)
Physician accessibility		
Number of General Internal Medicine physician		29.45 (21.68)
Number of Surgeon		54.32 (38.44)
Radiation oncology specialist availability		N (%) 559 (67.11)
		Mean (SD)
Inpatient service accessibility		2.80 (1.41)
Nurse Staffing Level		3.14 (0.65)
Nursing Skill Mix		11.35 (6.01)
Quality Deficiencies	Number of Quality Deficiencies	10.35 (7.15)
		N (%)
High Quality	Quality Deficiencies are lower than the lowest statewide quartile	184 (22.09)
Mid Quality	Quality Deficiencies are between the lowest statewide quartile and highest statewide quartile	409 (49.10)
Low Quality	Quality Deficiencies are higher than the highest statewide quartile	240 (28.81)
Control Variables:		
Ownership		N (%)
For Profit		541 (64.95)
Not for profit		194 (23.29)
Government		98 (11.76)
Network		N (%)
No Chain Membership		408 (48.98)
Chain membership		425 (51.02)
Payer Mix		Mean (SD)
Percent Medicare		10.79 (7.68)
Percent Medicaid		71.50 (14.64)

reimbursed by Medicaid and care for 10.79% of residents was reimbursed by Medicare.

Utilization of Cancer-Related Medical Services

Table 6 reports the descriptive statistics for cancer-related medical services. Overall, 68.10% of residents with breast, colorectal, prostate, and bladder cancer at in situ, local and regional stage underwent cancer-related surgery within six months after diagnosis. One tenth of the residents with breast, colorectal, lung, prostate and bladder cancer at local, regional, distant or unknown stage received chemotherapy or radiation therapy. One third of the residents diagnosed with cancer visited an oncologist. Nearly half residents with regional, distant or

Table 6: Cancer-related Medical Service Utilization

Characteristics	All Residents	Residents who survived >60 days	Residents who survived ≤ 60 days	P value >60 vs. ≤60 days
Number of residents	1183	875	308	
	N (%)	N (%)	N (%)	
Cancer-directed surgery[1]	222 (68.10) N=326	207 (69.93) N=296	15 (50) N=30	0.0256
Chemotherapy or Radiation therapy[2]	69 (10.09) N=684	61 (11.30) N=540	8 (5.56) N=144	0.0421
Oncologist visit	385 (32.54)	300 (34.29)	85 (27.60)	0.0312
Pain Management[3]	358 (44.20) N=810	253 (46.59) N=543	105 (39.33) N=267	0.0503
Hospice[4]	314 (32.91) N=954	212 (32.82) N=646	102 (33.12) N=308	0.9266

[1] breast, colorectal, prostate and bladder cancer residents with in situ, local and regional stage
[2] breast, colorectal, lung, prostate and bladder cancer residents with local, regional, distant and unknown stage
[3] residents with regional, distant, and invasive but unknown stage
[4] residents who died before December 31, 2000

invasive but unknown stage cancer received at least one opioid pain medicine within six months after diagnosis. Near one third residents who died before the end of year 2000 received hospice.

There were significantly different utilization patterns between residents who survived longer versus less than 60 days, except for hospice care. Residents who survived longer than 60 days were more likely to undergo cancer-directed surgery (69.93% vs. 50%, p=.0256), chemotherapy or radiation therapy (11.30% vs. 5.56%, p=.0421), visit an oncologist (34.29% vs. 27.60%, p=.0312) than residents who survived less than 60 days. Residents who survived longer with late stage cancer had marginally significant higher usage of opioid pain medicine (46.59% vs. 39.33%, p=.0503) than residents who survived for a shorter time. There was no significant difference in receiving hospice care between survived longer versus shorter. As expected, residents surviving under than 60 days had significantly different utilization patterns in several cancer-related medical services but not in palliative treatment. Therefore, the study excludes residents who survived for a shorter time in models of predicting the usage of cancer-directed

surgery, chemotherapy or radiation therapy, and oncologist visits and includes all residents in analyzing palliative treatment patterns.

Correlation Analysis

Regression analysis assumes that there is no perfect or exact relationship between the independent variables in the model. If there are high intercorrelations among them, the study will have a muticollinearity problem. Multicollinearity may cause the coefficient estimates to change erratically when an independent variable is added to or dropped from the model and makes it difficult to determine the significance of predictors. Therefore, a correlation analysis is performed on all independent variables to detect multicollinearity, which is designated as correlations ≥ 0.70 (Tabachnik & Fidell, 2001). Overall, the result for correlation analysis (Appendix A.1, A.2, A.3, A.4, and A.5) does not indicate multicollinearity.

Results from Logistic Regression Model

Since the study focuses on five cancer-related medical services (cancer-directed surgery, chemotherapy or radiation therapy, oncologist visit, pain management and hospice care), multiple logistic regression analyses with robust standard errors and clustering for nursing homes were used to examine the hypotheses. Given that there are five multiple comparisons in this study, the study will use a joint alpha level 0.05 to eliminate Type I error (Lander & Botstein, 1989). Therefore, the Bonferroni Corrections p-value threshold for a variable to be recognized as significant is 0.05/5=0.01.

Tables 7a, 7b and 7c present the results for each cancer-related medical service. Since most variables are categorical, a relationship of health policy, predisposing, need, community resources, and nursing home organizational characteristics to the usage of cancer treatment is detected by the odds ratio with 95% confidence intervals. For continuous variables, the study

Table 7a. Logistic Regression Model – Cancer-directed Surgery

Independent Variables	Cancer-directed Surgery		
	Odds Ratio	95%CI	p
Health Policy			
PPS phase in	0.735	(0.062, 8.680)	0.807
BBA			
Before BBA	1.0 (referent)		
After BBA	2.390	(0.945, 6.044)	0.066
BBRA			
Before BBRA	1.0 (referent)		
After BBRA	0.435	(0.109, 1.737)	0.239
Predisposing			
Age			
65-69	6.595	(1.457, 29.838)	0.014
70-74	3.209	(1.201, 8.571)	0.020
75-79	1.784	(0.781, 4.074)	0.170
80-84	2.038	(0.910, 4.564)	0.084
>=85	1.0 (referent)		
Sex			
Male	1.0 (referent)		
Female	1.087	(0.483, 2.444)	0.841
Race			
White	1.0 (referent)		
Comorbidity			
No comorbidity	1.0 (referent)		
Alzheimer only	1.907	(0.365, 9.960)	0.444
Alz + Other condition	0.946	(0.407, 2.200)	0.898
Other Comorbidity	0.969	(0.438, 2.144)	0.938
Length of stay			
Long-Stay	1.0 (referent)		
Short-Stay	1.543	(0.543, 4.381)	0.416
Need			
Cancer site			
Breast	1.289	(0.461, 3.604)	0.628
Colorectal	1.099	(0.387, 3.121)	0.859
Lung	--		
Prostate	0.198	(0.056, 0.705)	0.012
Other GI	--		
Pancreas	--		
Bladder	1.0 (referent)		
Leukemia	--		
Other			
Cancer Stage			
In situ	1.0 (referent)		
Local	1.487	(0.442, 5.002)	0.522
Regional	1.987	(0.539, 7.324)	0.302
Distant	--		
Invasive but unknown stage	--		
Delivery System			
Surgeon accessibility	1.001	(0.991, 1.011)	0.830
Inpatient service accessibility	1.042	(0.839, 1.293)	0.713
Nurse Staffing Level	0.978	(0.544, 1.760)	0.941
Nursing Skill Mix	1.031	(0.975, 1.091)	0.286

Table 7a (continued)

Independent Variables	Cancer-directed Surgery		
	Odds Ratio	95%CI	p
Quality			
Low Quality	1.0 (referent)		
Mid Quality	1.488	(0.729, 3.038)	0.275
High Quality	1.537	(0.671, 3.520)	0.309
Control Variables:			
Ownership			
For Profit	1.0 (referent)		
Not for profit	0.875	(0.427, 1.794)	0.715
Government	1.093	(0.321, 3.721)	0.887
Network			
No Chain Membership	1.0 (referent)		
Chain Membership	1.279	(0.658, 2.489)	0.468
Payer Mix			
Percent Medicare	0.993	(0.939, 1.049)	0.793
Percent Medicaid	1.008	(0.979, 1.038)	0.572

** p<0.002; * p<0.01

Table 7b. Logistic Regression Model – Chemotherapy or Radiation Therapy and Oncologist Visit

Independent Variables	Chemotherapy or Radiation Therapy			Oncologist Visit		
	Odds Ratio	95%CI	p	Odds Ratio	95%CI	P
Health Policy						
PPS phase in	2.847	(0.467, 17.364)	0.257	1.815	(0.596, 5.532)	0.294
BBA						
Before BBA	1.0 (referent)			1.0 (referent)		
After BBA	1.326	(0.602, 2.919)	0.484	1.094	(0.701, 1.708)	0.692
BBRA						
Before BBRA	1.0 (referent)			1.0 (referent)		
After BBRA	0.171	(0.021, 1.409)	0.101	0.521	(0.233, 1.165)	0.112
Predisposing						
Age						
65-69	8.726**	(2.687, 28.343)	0.000	2.929**	(1.504, 5.706)	0.002
70-74	1.929	(0.654, 5.686)	0.234	1.523	(0.915, 2.533)	0.105
75-79	1.650	(0.648, 4.204)	0.294	1.270	(0.816, 1.978)	0.289
80-84	1.482	(0.594, 3.702)	0.399	1.087	(0.725, 1.629)	0.688
>=85	1.0 (referent)			1.0 (referent)		
Sex						
Male	1.0 (referent)			1.0 (referent)		
Female	1.513	(0.558, 4.101)	0.416	1.175	(0.776, 1.779)	0.446
Race						
White	1.0 (referent)			1.0 (referent)		
Non-white	1.347	(0.578, 3.140)	0.490	0.713	(0.452, 1.127)	0.148
Comorbidity						
No comorbidity	1.0 (referent)			1.0 (referent)		
Alzheimer only	1.948	(0.330, 11.491)	0.461	1.643	(0.766, 3.525)	0.202
Alz + Other condition	2.954	(1.090, 8.007)	0.033	2.625**	(1.606, 4.292)	0.000
Other Comorbidity	2.807	(0.945, 8.338)	0.063	2.604**	(1.601, 4.235)	0.000
Length of stay						
Long-Stay	1.0 (referent)			1.0 (referent)		
Short-Stay	0.975	(0.363, 2.621)	0.960	1.002	(0.552, 1.819)	0.995

Table 7b (continued)

Independent Variables	Chemotherapy or Radiation Therapy			Oncologist Visit		
	Odds Ratio	95%CI	p	Odds Ratio	95%CI	P
Need						
Cancer site						
Breast	0.118*	(0.029, 0.485)	0.003	0.820	(0.520, 1.293)	0.393
Colorectal	0.064**	(0.014, 0.307)	0.001	0.584	(0.350, 0.974)	0.039
Lung	0.649	(0.187, 2.255)	0.496	1.027	(0.601, 1.755)	0.923
Prostate	1.879	(0.536, 6.580)	0.324	2.942**	(1.499, 5.774)	0.002
Other GI	--			0.706	(0.282, 1.765)	0.457
Pancreas	--			0.681	(0.199, 2.336)	0.542
Bladder	1.0 (referent)			4.001*	(1.605, 9.975)	0.003
Leukemia	--			0.750	(0.276, 2.036)	0.572
Other	--			1.0 (referent)		
Cancer Stage						
In situ	--			0.723	(0.261, 2.003)	0.532
Local	1.893	(0.823, 4.356)	0.133	2.489**	(1.696, 3.652)	0.000
Regional	5.412**	(2.118, 13.825)	0.000	3.321**	(2.098, 5.258)	0.000
Distant	2.409	(0.756, 7.672)	0.137	2.433*	(1.382, 4.284)	0.002
Invasive but unknown stage	1.0 (referent)			1.0 (referent)		
Delivery System						
radiation oncologist availability	0.926	(0.442, 1.938)	0.838	1.945**	(1.306, 2.896)	0.001
Inpatient service accessibility	1.059	(0.765, 1.468)	0.728	1.042	(0.921, 1.178)	0.515
Nurse Staffing Level	0.809	(0.384, 1.706)	0.578	1.068	(0.806, 1.416)	0.645
Nursing Skill Mix	0.993	(0.943, 1.047)	0.799	1.021	(0.996, 1.046)	0.102
Quality						
Low Quality	1.0 (referent)			1.0 (referent)		
Mid Quality	2.177	(1.008, 4.703)	0.048	1.138	(0.793, 1.633)	0.483
High Quality	2.372	(0.982, 5.734)	0.055	1.578	(1.024, 2.432)	0.039
Control Variables:						
Ownership						
For Profit	1.0 (referent)			1.0 (referent)		
Not for profit	1.083	(0.484, 2.425)	0.846	0.955	(0.634, 1.438)	0.826
Government	1.303	(0.401, 4.230)	0.659	0.850	(0.466, 1.548)	0.595
Network						
No Chain Mem	1.0 (referent)			1.0 (referent)		
Chain Membership	1.408	(0.642, 3.089)	0.393	1.049	(0.742, 1.484)	0.785
Payer Mix						
Percent Medicare	1.027	(0.972, 1.085)	0.338	1.021	(0.993, 1.049)	0.151
Percent Medicaid	1.012	(0.982, 1.042)	0.451	1.018	(1.002, 1.034)	0.029

**p<0.002; * p<0.01

Table 7c. Logistic Regression Model – Pain Management and Hospice Care

Independent Variables	Pain Management			Hospice Care		
	Odds Ratio	95%CI	p	Odds Ratio	95%CI	P
Health Policy						
PPS phase in BBA	0.696	(0.275, 1.764)	0.445	1.542	(0.536, 4.439)	0.422
Before BBA	1.0 (referent)			1.0 (referent)		
After BBA	1.934*	(1.268, 2.950)	0.002	1.024	(0.672, 1.560)	0.911

Table 7c (continued)

Independent Variables	Pain Management Odds Ratio	95%CI	p	Hospice Care Odds Ratio	95%CI	P
BBRA						
Before BBRA	1.0 (referent)			1.0 (referent)		
After BBRA	1.266	(0.692, 2.318)	0.444	2.042	(1.076, 3.875)	0.029
Predisposing						
Age						
65-69	1.699	(0.843, 3.426)	0.138	0.939	(0.458, 1.924)	0.863
70-74	1.149	(0.722, 1.828)	0.558	0.799	(0.479, 1.330)	0.387
75-79	1.433	(0.932, 2.203)	0.101	1.001	(0.654, 1.532)	0.998
80-84	1.162	(0.771, 1.750)	0.473	0.851	(0.586, 1.237)	0.398
>=85	1.0 (referent)			1.0 (referent)		
Sex						
Male	1.0 (referent)			1.0 (referent)		
Female	1.301	(0.878, 1.929)	0.190	1.647*	(1.151, 2.358)	0.006
Race						
White	1.0 (referent)			1.0 (referent)		
Non-white	0.497**	(0.327, 0.756)	0.001	1.282	(0.878, 1.872)	0.198
Comorbidity						
No comorbidity	1.0 (referent)			1.0 (referent)		
Alzheimer only	1.460	(0.685, 3.111)	0.327	0.511	(0.246, 1.061)	0.072
Alz + Other conditions	0.638	(0.403, 1.008)	0.054	0.907	(0.590, 1.393)	0.655
Other Comorbidity	1.066	(0.695, 1.634)	0.770	0.702	(0.462, 1.067)	0.098
Length of stay						
Long-Stay	1.0 (referent)			1.0 (referent)		
Short-Stay	1.123	(0.628, 2.010)	0.695	0.929	(0.534, 1.615)	0.793
Need						
Cancer site						
Breast	1.186	(0.721, 1.952)	0.502	1.267	(0.787, 2.040)	0.330
Colorectal	0.568	(0.353, 0.915)	0.020	0.877	(0.572, 1.344)	0.547
Lung	0.856	(0.540, 1.355)	0.507	1.006	(0.652, 1.553)	0.978
Prostate	0.795	(0.380, 1.663)	0.542	1.114	(0.578, 2.146)	0.748
Other GI	0.746	(0.355, 1.568)	0.439	1.034	(0.482, 2.215)	0.932
Pancreas	1.258	(0.644, 2.457)	0.502	1.031	(0.528, 2.013)	0.928
Bladder	1.465	(0.482, 4.455)	0.501	1.796	(0.854, 3.775)	0.123
Leukemia	0.479	(0.186, 1.234)	0.128	0.293	(0.075, 1.144)	0.077
Other	1.0 (referent)			1.0 (referent)		
Cancer Stage						
In situ				0.946	(0.390, 2.292)	0.902
Local				0.884	(0.596, 1.312)	0.540
Regional	1.135	(0.783, 1.646)	0.504	1.281	(0.833, 1.972)	0.260
Distant	1.384	(0.931, 2.059)	0.109	1.158	(0.771, 1.738)	0.480
Invasive but unknown stage	1.0 (referent)			1.0 (referent)		
Delivery System						
Physician accessibility	0.990	(0.981, 0.999)	0.030	1.015**	(1.007, 1.023)	0.000
Inpatient service accessibility	1.085	(0.946, 1.245)	0.245	0.897	(0.773, 1.041)	0.152
Nurse Staffing Level	0.902	(0.704, 1.155)	0.413	1.121	(0.880, 1.427)	0.356
Nursing Skill Mix	0.994	(0.966, 1.023)	0.677	0.996	(0.971, 1.021)	0.738

Table 7c (continued)

Independent Variables	Pain Management Odds Ratio	95%CI	p	Hospice Care Odds Ratio	95%CI	P
Quality						
Low Quality	1.0 (referent)			1.0 (referent)		
Mid Quality	0.924	(0.640, 1.333)	0.671	0.774	(0.547, 1.094)	0.147
High Quality	0.986	(0.632, 1.539)	0.952	0.509*	(0.325, 0.796)	0.003
Control Variables:						
Ownership						
For Profit	1.0 (referent)			1.0 (referent)		
Not for profit	0.889	(0.610, 1.295)	0.539	0.920	(0.639, 1.323)	0.652
Government	1.321	(0.772, 2.259)	0.309	0.672	(0.362, 1.250)	0.210
Network						
No Chain	1.0 (referent)			1.0 (referent)		
Members						
Chain Membership	0.986	(0.692, 1.405)	0.939	1.169	(0.834, 1.638)	0.365
Payer Mix						
Percent Medicare	1.001	(0.974, 1.028)	0.962	1.021	(0.996, 1.046)	0.106
Percent Medicaid	0.980*	(0.965, 0.995)	0.009	1.002	(0.988, 1.016)	0.815

**p<0.002; * p<0.01

provides estimates of the marginal effects as a part of the text. The following sections present the results for each model component.

Health Policy

PPS Phase In

PPS phase in was constructed to measure the effect of the Balanced Budget Act, which changed the Medicare reimbursement rate and reduced nursing home resources, on the probability of utilizing cancer-related medical services among nursing home residents. The results in Tables 7a, 7b, and 7c shown that the probability of utilizing cancer-directed surgery, chemotherapy or radiation therapy, oncologist visit, pain management and hospice care was not significantly different for residents of nursing homes with a greater versus lower percentage of PPS adjustment in Medicare payment rate.

BBA

Given that the Balance Budget Act of 1997 reduced the Medicare physician service reimbursement rate and gave the State government flexibility in paying the Medicaid co-

insurance, the studies expected the BBA implementation might affect the accessibility of needed health care services, and hence, decrease the probability of utilizing cancer-related treatments among Medicare and Medicaid dually eligible residents. The results in Table 7c show that after BBA implementation, residents with late stage cancer were significantly more likely to receive opioid pain medicine (OR=1.934; 95%CI=1.268 to 2.950; p=.002).

BBRA

In order to reduce the effect of payment reduction by the Balance Budget Act, BBRA increased the payment rate for nursing homes. The results showed that there was no significantly different usage pattern in cancer-related medical services.

Population Characteristics

Predisposing

Residents aged 65 to 69 with breast, colorectal, lung, prostate, and bladder cancer at local, regional, distant and invasive but unknown stage had greater likelihood of utilizing chemotherapy or radiation therapy (OR=8.726; 95%CI=2.687 to 28.343; p=.000) than residents aged 85 and older. For oncologist visits, residents aged 65 to 69 who survived 60 days and longer were more likely to visit an oncologist during 1996 to 2000 than residents aged 85 and older (OR=2.929; 95%CI=1.504 to 5.706; p=.002) (Table 7.b).

As can be seen in Table 7c, female residents who died before the end of 2000 were significantly more likely to receive hospice care than male residents (OR=1.647; 95%CI=1.151 to 2.358; p=.006). Non-white residents with late stage cancer were significantly less likely to receive opioid pain medicine than white residents (OR=0.497; 95%CI=0.327 to 0.756; p=.001).

Residents with Alzheimer's disease and other health condition(s) or comorbid conditions other than Alzheimer's disease were more likely to receive visit an oncologist than residents with

no comorbidity (OR=2.625; 95%CI=1.606 to 4.292; p=.000; OR=2.604; 95%CI=1.601 to 4.235; p=.000) (Table 7b). There is no significantly different utilization pattern in any cancer-related medical services between short stay and long stay residents.

Need

Residents with breast or colorectal cancer had a decreased likelihood of utilizing chemotherapy or radiation therapy than residents with bladder cancer (OR=0.118; 95%CI=0.029 to 0.485; p=.003; OR=0.064; 95%CI=0.014 to 0.307; p=.001, respectively). For visiting an oncologist after diagnosis of cancer, residents with prostate or bladder cancer were significantly more likely to visit an oncologist (OR=2.942; 95%CI=1.499 to 5.774; p=.002; OR=4.001; 95%CI=1.605 to 9.975; p=.003, respectively) than residents with other cancer sites.

Residents of breast, colorectal, lung, prostate and bladder cancer with regional cancer stage had a greater likelihood than residents with invasive but unknown stage in utilizing chemotherapy or radiation therapy (OR=5.412; 95%CI=2.118 to 13.825; p=.000). In addition, residents with local, regional or distant cancer stage were significantly more likely to visit an oncologist (p<.01) than residents with invasive but unknown stage (as shown in Table 7b).

Delivery System – Community Resources

Residents in a county having one or more radiation oncology specialists were almost as twice as likely to visit an oncologist after diagnosis of cancer than residents in a county having no radiation oncology specialist (OR=1.945; 95%CI=1.306 to 2.896; p=.001). On the other hand, residents who died before the end of 2000 in a county having greater general internal medicine physician accessibility were significantly more likely to utilize hospice care than residents in counties with lower physician accessibility. The odds ratio is 1.015 indicating that coefficient is .014702 and the marginal effect is .0031533. Marginal effect means change in probability per

unit change in the regressor. For each additional general internal medicine physician in the county per 100,000 population, there was a 0.003 increase in probability of utilizing hospice care. There is no significantly different utilization pattern in any cancer-related medical service among residents in a county with different level of inpatient accessibility.

Delivery System – Nursing Home Organizational Characteristics

Nurse Staffing Level

Hypothesis 1 predicts that residents of nursing homes with higher nurse staffing levels will utilize more cancer-related medical services than residents of nursing homes with lower nurse staffing levels while holding other variables constant. The results show that for those who survived more than 60 days with breast, colorectal, prostate and bladder cancer at in situ, local and regional stage (n=296), the probability of utilizing cancer-directed surgery was not significantly different for residents of nursing homes with higher or lower nurse staffing levels (p=.941) (Table 7a). For those who survived more than 60 days with breast, colorectal, lung, prostate and bladder cancer at local, regional, distant or unknown stage, nurse staffing level was not associated with chemotherapy or radiation therapy utilization (p=.578) (Table 7b). For those who survived more than 60 days, there was no significantly different utilization pattern in oncologists visits among residents of nursing homes with higher or lower nurse staffing level (p=.645) (Table 7b). Late stage cancer residents of nursing homes with higher nurse staffing levels did not have a significantly different pattern in receiving opioid pain medicine (p=.413) (Table 7c). For those who died before the end of 2000, there was no significant association detected between nurse staffing level and utilization of hospice care (p=.356) (Table 7c). Therefore, Hypothesis 1 was not supported.

Nursing Skill Mix

Residents in nursing homes with higher nursing skill mix are expected to utilize more cancer-related medical services than residents of nursing homes with lower nursing skill mix while holding other variables constant for Hypothesis 2. For those who survived more than 60 days with breast, colorectal, prostate and bladder cancer at in situ, local and regional stage (n=296), the probability of utilizing cancer-directed surgery was not significantly different for residents of nursing homes with higher or lower nursing skill mix (p=.286) (Table 7a). For those who survived more than 60 days with breast, colorectal, lung, prostate and bladder cancer at local, regional, distant or unknown stage, nursing skill mix was not associated with chemotherapy or radiation therapy utilization (p=.799) (Table 7b). For those who survived more than 60 days, there was no significant different utilization pattern in oncologist visits among residents of nursing homes with higher or lower nursing skill mix (p=.102) (Table 7b). Late stage cancer residents of nursing homes with higher nursing skill mix did not have a significantly different pattern in receiving opioid pain medicine (p=.677) (Table 7c). For those who died before the end of 2000, there was no significant association detected between nursing skill mix and utilization of hospice care (p=.738) (Table 7c). Therefore, Hypothesis 2 was not supported.

Quality Deficiencies

Residents of nursing homes with fewer quality deficiencies are expected to utilize more cancer-related medical services than residents of nursing homes with more quality deficiencies while holding other variables constant in Hypothesis 3. For those who survived more than 60 days with breast, colorectal, prostate and bladder cancer at in situ, local and regional stage (n=296), the probability of utilizing cancer-directed surgery was not significantly different for residents of nursing homes with higher versus lower quality (Table 7a). For those who survived

more than 60 days with breast, colorectal, lung, prostate and bladder cancer at local, regional, distant or unknown stage, quality were not significantly associated with chemotherapy or radiation therapy utilization (Table 7b). For those who survived more than 60 days, there was no significantly different utilization pattern in oncologist visits between residents of nursing homes with higher versus lower quality (Table 7b). Late stage cancer residents of nursing homes with higher quality did not have a significantly different pattern in receiving opioid pain medicine (Table 7c). For those who died before the end of 2000, residents of high quality nursing home have a decreased likelihood of utilizing hospice care than residents of low quality nursing homes (OR=0.509; 95%CI=0.325 to 0.796; p=.003) (Table 7c). However, the direction of this significant association between quality deficiencies and hospice care is not as expected. Hence, Hypothesis 3 is not supported by the results.

Control Variables

Late stage cancer residents of nursing homes with more Medicaid paid residents were less likely to receive any opioid pain medicine (OR=0.980; 95%CI=0.965 to 0.995; p=0.009). By increasing Medicaid paid residents by one percentage, the odds of receiving any opioid pain medicine decreased 0.005. There is no significantly different utilization pattern in any cancer-related medical services between residents of nursing homes with chain membership versus independent facilities. Nursing home ownership and percentage of Medicare paid residents were not significantly associated with any cancer-related medical services.

Sensitivity Analysis

The study grouped nursing home organizational characteristics into high, medium and low quality to examine their relationship to resident's utilization of cancer-directed medical services. Measures in Tables 7a to 7c used quartiles to define high, medium, and low quality. In

order to determine whether different cut-off points for this key variable impacts the utilization of cancer-related medical services, the study tested a set of values -- mean value, median value, 25%, 10%, and 25% as high while 25% to 75% as middle group -- to create categories. Since nursing homes with greater quality deficiencies have worse quality, the study defines high quality if quality deficiencies fell into the lowest quartile. Table 8 presents the test results. The study found that except for hospice care, no matter what type of measurement is used to define high quality, there was no significant association detected between high quality and cancer-related medical services. Thus, the principal findings of this study are robust and not affected by the method used to define nursing home quality.

Table 8. Sensitivity Test Results

	Chemo or Radiation	Oncology	CS	Pain	Hospice
Mean					
Median					
25%					Q(-)
10%					Q(-)
25%(HQ), 25-75% (MQ)					HQ(-)

Chemo: Chemotherapy
Radiation: Radiation Therapy
CS: Cancer-directed Surgery
Q: High Quality
HQ: 1st quartile High Quality Group
MQ: 2nd & 3rd quartile Quality Group
- : Negative Relationship
+: Positive Relationship

Summary

This chapter presents descriptive results of outcome and explanatory variables and reports results of multiple logistic regressions in examining the relationship between nursing home organizational characteristics and their residents' utilization of cancer-related medical services. The unit of analysis is the nursing home resident.

The main interest of the study is the association between nursing home organizational characteristics and utilization of cancer-related medical services. Nurse staffing level, nursing skill mix and quality deficiencies are the key variables while ownership, chain membership and payer mix are control variables. Nurse staffing level, nursing skill mix and quality deficiencies

were not strong predictors in the study. Nurse staffing level and nursing skill mix did not predict any cancer-related medical service utilization. Quality deficiencies only predicted the utilization patterns for hospice care but in opposite direction. Thus, none of the study hypotheses were supported. Among other nursing home organizational characteristics, residents of nursing homes with more Medicaid paid residents were less likely to receive opioid pain medicine.

In other parts of the model, largely, there is little association between health policy and utilization of cancer-related medical services. PPS phase in and BBRA were insignificant in predicting utilization of cancer-related medical services. Residents with late cancer stage were more likely to receive opioid pain medicine after BBA implementation.

Among predisposing characteristics, age has been a strong predictor in utilizing cancer-related medical services. Residents aged 65 to 69 with breast, colorectal, lung, prostate and bladder cancer at local, regional, distant and unknown stage were associated with an increased likelihood of utilizing chemotherapy or radiation therapy than residents aged 85 and older. For oncologist visits, residents aged 65 to 69 were also more likely to visit an oncologist than residents aged 85 and older.

Females were more likely than males to use hospice care. Non-white residents had a decreased likelihood of receiving opioid pain medicine than white residents. In addition, comorbidity is a strong predictor for oncology related health services. Residents with Alzheimer's disease and other comobid conditions were more likely to visit an oncologist than residents with no comorbidity. Short stay variable did not present strong prediction in utilizing any cancer-related medical services.

Perceived need was measured by cancer site and cancer stage. Residents with breast or colorectal cancer had a decreased likelihood to utilize chemotherapy or radiation therapy than

residents with bladder cancer. In addition, residents with prostate or bladder cancer were more likely to visit an oncologist than residents with other cancer sites. Residents with breast, colorectal, lung, prostate and bladder cancer at regional stage were more likely to use chemotherapy or radiation therapy than residents with invasive but unknown stage. Residents with local, regional or distant cancer stage had a greater likelihood of visiting an oncologist than residents with invasive but unknown stage.

The delivery system includes community resources and nursing home organizational characteristics. Community resources were operationalized by the number of physicians or specialists per 100,000 residents and short term general hospital beds per 1,000 residents. Residents in a county having one or more radiation oncology specialists were more likely to visit an oncologist after diagnosis of cancer than residents in a county having no radiation oncology specialist available. Residents in a county that had greater number of general internal medicine physicians were significantly more likely to utilize hospice care than residents in a county with lower number of general internal medicine physicians.

Overall, this study used multiple logistic regression and revealed little association between nursing home organizational characteristics and utilization of cancer-related medical services. The next chapter discusses the interpretation of the results in light of the study's hypotheses, the study limitations, policy implications and areas for future research.

CHAPTER 6: DISCUSSION

The purpose of this study was to examine the association between nursing home organizational characteristics and receipt of cancer-related medical services. In this chapter, the results of hypotheses tests will be discussed as well as the results of other model components. The study limitations, policy implications and future research areas will also be discussed in this chapter.

Summary and Interpretation of the Hypotheses Tests

The first study hypothesis looks at the association of nurse staffing level in the facilities and the utilization of cancer-related medical services among residents. The hypothesis predicts that residents of nursing homes with higher nurse staffing levels are more likely to utilize cancer-related medical services than residents of nursing homes with lower nurse staffing levels while holding other variables constant. This hypothesis was not supported for any cancer-related medical services.

Previous studies indicate that residents of nursing homes with higher nurse staffing level received more direct personal care and have better health outcomes (Konetzka et al., 2008), and hence, may have greater opportunity to receive cancer-related medical services. In addition, utilizing cancer treatments usually involves many trips to clinics or hospitals. For example, radiation therapy treatment requires patients to go to a hospital or an outpatient clinic five days a week and lasts a period of weeks or months. Residents need assistance to arrange transportation, move from their beds to the vehicle, and rearrange their daily care schedule accordingly. Higher

nurse staffing levels provide more support to residents and may encourage residents to proceed with their treatments. Also, undergoing surgery, chemotherapy or radiation therapy requires some intensive recovery care and can result in some serious side effects (Longman, Braden, & Mishel, 1997). Higher nurse staffing levels that deliver more direct personal care may boost residents' confidence that they are able to handle the treatments.

However, cancer care may be associated with patient characteristics, such as age, comorbidity, cancer site or cancer stage (Owonikoko et al., 2007; Prout et al., 2005; Bradley et al., 2008; Du & Gor, 2007), which are usually taken into consideration when physicians suggest treatment options (Krzyzanowska et al., 2009; Frey et al., 2005; Lee et al., 2009; Keating et al., 2008). Because elderly patients are often excluded from clinical trials, physicians often do not have sufficient medical literature support or evidence about treating the elderly (Kutner et al., 2000; Protiere et al., 2009). Even though patient preferences for treatment may affect physician's decision (Krzyzanowska et al., 2009), patients are likely to follow physician opinions (Kutner et al., 2000). Hence, even though nursing homes with higher nurse staffing level may provide better quality of care and support for their residents, the probability that residents utilize cancer-related medical services is not significantly higher may be for this reason.

In addition, study hypotheses suggest that when residents receive more direct care, they will have more opportunity to express their pain to nurses and thus, will be more likely to receive opioid pain medicines for their late stage cancer. However, studies have shown that physicians or oncologists may not have sufficient knowledge to prescribe opioid pain medicine for late stage cancer patients (Jacobsen et al., 2007; Larue et al., 1995; Eftekhar et al., 2007; Mercadante et al., 2008). On the other hand, study hypotheses suggest that early recognition of terminally-ill conditions would occur for residents receiving more direct care resulting in arrangement of

hospice care. However, patients require a physician's evaluation to access hospice care. Therefore, access to physician services may have a more substantial effect than nurse staffing on utilization of hospice care.

The second study hypothesis examines at the association of nursing skill mix in the facilities and the utilization of cancer-related medical services among residents. The hypothesis predicts that residents of nursing homes with higher nursing skill mix are more likely to utilize cancer-related medical services than residents of nursing homes with lower nursing skill mix holding other variables constant. This hypothesis was not supported for any cancer-related medical services.

Previous studies indicate that residents of nursing homes with higher nursing skill mix received better supervised care that increased the chance of recognizing symptoms (Intrator & Mor, 2004) and received guideline-recommended treatment (Hutt et al., 2008). Hence, residents of nursing homes with higher nursing skill mix were expected to have greater opportunity to receive cancer-related medical services. In addition, skilled nurses are often well-trained in managing residents' medical conditions. For example, RNs have better skills in managing complications and have better recovery outcomes (Decker, 2008c). They can interpret residents' symptoms better, provide better care or communicate with physicians more clearly. Higher nursing skill mix results in better support to residents which may encourage residents to proceed with their treatments. However, when physicians suggest cancer treatments, they have to consider survival benefit these patients could have compared to the physical suffering and costs of therapy these patients must bear. Given that nursing home elderly residents are often very old and have other health conditions that require long-term institutional care, physicians may recommend treatment based on residents' characteristics. In addition, the majority of patients

have little involvement in cancer treatment decision making (Hawley et al., 2007) and more than 70% of cancer patients follow the physician's decision (Kutner et al., 2000). Therefore, these factors may explain why use of cancer-related medical services did not differ among nursing homes with different nursing skill mix.

On the other hand, study hypotheses suggests that when residents received higher nursing skill mix care, their pain or terminally-ill condition will be more readily detected and as a result, greater utilization of opioid pain medicines or hospice care would result. However, physicians and patients may have concerns in utilizing opioid pain medicines and physicians may be hesitant to prescribe them (Reid, Gooberman-Hill, & Hanks; 2008; Gallagher, Hawley & Yeomans, 2004). Healthcare professionals have become increasingly informed about utilizing opioid pain medicine in relieving late stage cancer pain in recent years (Gilson, Maurer, & Joranson, 2007). Therefore, even if nurse noticed their residents to be in great pain, residents may not have received such relieve until more recent years.

The third study hypothesis concerns the association of quality deficiencies in the facilities and the utilization of cancer-related medical services among residents. The expectation is that residents of nursing homes with fewer quality deficiencies are more likely to utilize cancer-related medical services than residents of nursing homes with greater quality deficiencies while holding other variables constant. This hypothesis was not supported for any cancer-directed medical services. Ironically, the result was statistically significant for hospice care but in the opposite direction than was predicted. It indicated that residents of nursing homes with fewer quality deficiencies are less likely to use hospice care.

Given that quality deficiencies measure the process of care in the nursing homes including facility safety issues, previous studies found that residents of nursing homes with fewer

quality deficiencies received better care, had better health outcomes (Dellefield, 2006; Stevenson, 2005; Mukamel, 1997), and hence, may have had greater opportunity to receive cancer-related medical services. However, cancer care seems more related to patient characteristics. Physicians used patient's age, comorbidity, cancer site or cancer stage (Krzyzanowska et al., 2009; Frey et al., 2005; Lee et al., 2009; Keating et al., 2008) and results from medical literature (Kutner et al., 2000; Protiere et al., 2009) to make treatment decisions. Even though residents of nursing homes with fewer quality deficiencies are more likely to be in better health than their counterparts, physicians consider all comorbidities of nursing home residents (Vrakking et al., 2005). Therefore, better nursing home quality of care may not increase the probability of residents in receiving cancer-related medical services.

Study hypotheses suggests that late stage cancer residents from nursing homes providing higher quality of care are more likely to get better pain management than residents from nursing homes with lower quality of care. However, use of opioid pain medicines in managing late stage cancer has been better understood in more recent years according to surveys from state medical board members in 1991, 1997, and 2004 (Gilson, Maurer & Joranson, 2007). Therefore, the association between nursing home quality of care and pain management could not be detected.

Interestingly, the study found that residents of nursing homes with fewer quality deficiencies had a decreased likelihood of utilizing hospice care. This study originally hypothesized that nursing homes with higher quality would have more residents adopting hospice care to improve their quality of end-of-life. The finding did not support the hypothesis. Perhaps residents in high quality nursing homes want to stay and do not want to go potentially a new facility or unit for their final few months. On the other hand, residents or their family

members who were not satisfied with the quality of care in their facilities may be motivated to use hospice care. In addition, nursing homes that could not provide good quality of care may persuade their terminally-ill residents or their family members to enroll into hospice care instead of using up their limited resources.

Summary and Interpretation of other Model Components

Health Policy

PPS Phase-in

The BBA implementation decreased nursing home revenues resulting in lower nurse staffing levels, RNs working times, and higher quality deficiencies (Chen & Shea, 2002; Konetzka, Norton, Sloane, Kilpatrick, & Stearns, 2006; Konetzka et al., 2006; Konetzka, Yi, Norton, & Kilpatrick, 2004). Hence, it should lead to less likelihood of utilizing cancer-related medical services. However, the results did not show any significant relationship to receiving cancer treatment.

BBA

The BBA reduced the Medicare reimbursement rate for physician services and provided state government flexibility in paying the Medicaid co-payments for physician services. In Michigan, the Medicaid payment for physician services was significantly decreased after the BBA (Mitchell & Haber, 2004). As a result, the BBA implementation may reduce the utilization of cancer-related medical services. Interestingly, the finding was opposite to that hypothesized. Residents who were diagnosed after the BBA implementation were more likely to receive opioid pain medicines. The pain management findings could be due to improved knowledge in managing the pain over time and more physician confidence in prescribing opioid medicines for

cancer pain in later years of the study (Williams, Sampson, Kalilani, Wurzelmann, & Janning, 2008).

BBRA

The Balance Budget Refinement Act of 1999 (BBRA) was passed to reduce the payment reduction impact of the BBA of 1997. The study expected the implementation of the BBRA to increase the utilization of cancer-related medical services. However, the results did not show any significant relationship to receiving cancer treatment.

Population Characteristics

Age

Age has shown to be a strong predictor in receiving cancer treatment (Bradley et al., 2008; Janssen-Heijnen et al., 2005; Litvak & Arora, 2006; Owonikoko et al., 2007; Townsley et al., 2003; Warren et al., 2008). The results of this study were consistent with previous studies. Older residents had a statistically significant decreased likelihood of utilizing chemotherapy, radiation therapy and oncology visit than younger residents.

Race

Studies have reported that non-white Americans suffered treatment disparities due to their race (Ayanian et al., 2003; Esnaola, Stewart, Feig, Skibber, & Rodriguez-Bigas, 2008; Morris et al., 2008; Murphy et al., 2009). This was true in this study for pain management. Non-white residents with late stage cancer were significantly less likely to receive opioid pain medicine than white residents.

Comorbidity

Multiple pre-existing health problems, or comorbidity, decrease the likelihood of utilizing cancer treatment (Baldwin et al., 2005; Kutner et al., 2000; Prout et al., 2005). In contrast, the

study shows that residents with comorbidity were more likely to visit an oncology specialist than residents with no comorbidity. The study identified physicians who practice three or more cancer-related chemotherapy or radiation therapy during 1996 to 2000 as oncologists. Many oncologists may also provide other medical services in addition to oncology services. The study found that 32.38% of residents with no comorbidity, 75.41% of residents with Alzheimer's disease only, 93.33% of residents with Alzheimer's disease and other conditions; and 80.98% of residents with health conditions other than Alzheimer's disease had consulted with oncologists before their cancer diagnosis for non-cancer medical conditions. Therefore, residents with comorbidities are more likely to visit an oncologist after their cancer diagnosis.

Sex

Bernabei et al. (1998) found that male patients were less likely to ask for pain medicine or less likely to have it prescribed and utilize hospice care than female patients. This study found that female residents were more likely to utilize hospice care, but were not significantly more likely to receive opioid medicine.

Cancer site

Treatments vary dramatically for each cancer site. Residents with breast or colorectal cancer at local, regional, distant or unknown stage were found to be less likely to receive chemotherapy or radiation therapy than residents with bladder cancer in this study. Even though adjuvant radiotherapy after breast-conserving surgery or mastectomy significantly reduces the incidence of 10-year local recurrence (Kunkler, Prescott, Williams, & King, 2006; Olmi, Fallai, Cerrotta, Lozza, & Badii, 2003; Truong, Wong, Bernstein, Berthelet, & Kader, 2004), many residents in the study were older than 85 years old and might not have 10 years life expectancy to consider the need of recurrence-preventing therapy. For more than a decade, surgery and

chemotherapy were used as systemic treatments colorectal cancer (Kim, Lee, Yu, & Yang, 2000; Wolpin & Mayer, 2008). However, physicians may not prescribe chemotherapy for these residents considering their age.

Residents with prostate or bladder cancer were found to be more likely to visit an oncologist than residents with other cancer sites. A 10-year clinical trial comparing radical prostatectomy with watchful waiting in the management of early prostate cancer among elderly men was unable to demonstrate a strong survival benefit for surgery relative to non-surgical conservative treatments (Bill-Axelson et al., 2005). Instead, studies found that chemotherapy could be used to improve quality of life and reduced pain among elderly men with prostate cancer (Arianayagam, Chang, & Rashid, 2007; Khan & Partin, 2004). Therefore, residents with a prostate cancer may have higher opportunity to visit an oncologist to consult regarding utilizing chemotherapy.

Cancer stage

Other than cancer sites, treatments also differ based on cancer stage. The study found that residents with regional or distant cancer stage were more likely to utilize chemotherapy or radiation therapy than residents with unknown stage.

Delivery System

Physician accessibility

Greater physician availability in a county where the nursing home is located translated into better accessibility to physician services and hence, could result in residents using more cancer-related medical services. This was found to be true. When nursing homes were located in a county that had one or more radiation oncology specialist available, residents were more likely to visit an oncologist. Also, when nursing homes located in the county that has more

general internal medicine physicians, residents were more likely to utilize hospice care.

Inpatient care accessibility

A greater number of short-term general hospital beds available in a county indicates better accessibility to inpatient services and therefore, could be more capable in adopting latest expensive medical equipment and cancer treatments. However, this study did not find any significant association between inpatient care accessibility and utilization of cancer-related medical services.

Ownership

Nursing home ownership may affect the quality of care provided to their residents. However, this study did not find any significant association between ownership and utilization of cancer-related medical services.

Payer Mix

Previous research shows that nursing homes with higher percentage of Medicare revenue were more likely to provide higher quality of care while facilities with higher percentage of Medicaid revenue were less likely to deliver high quality of care (Carter & Porell, 2003). This study found nursing homes with a higher percentage of Medicaid payment may have fewer resources to provide needed care for residents. Hence, residents were less likely to receive opioid medicine. This result is consistent with the finding in Clement, Bradley and Lin (2009).

Limitations

This study has several limitations. First, only Medicare and Medicaid dually insured residents were included in the study. There was no complete data source available to identify private-pay nursing home residents. If private-pay residents were included, the study could have given a more comprehensive picture of treatment patterns among different nursing homes. In

addition, nursing homes may deliver better care to their cancer patients if they have a high-volume cancer patients residing in their facilities. If the study were able to include all residents with different insurance statuses, the study could adjust for the number of cancer cases diagnosed in each nursing home.

Second, the data was extracted from one state, Michigan. Thus, the results may not be generalizable to other states.

Third, the study did not have information on resident or family member and physician preference for treatments. Jasen, Otten, and Stiggelbout (2004) suggested that patient's preference in cancer treatments cannot be entirely explained by patient and clinical characteristics. In addition, the specialist's treatment recommendation affects treatment decision substantially (Penman et al., 1984; Smitt & Heltzel, 1997). Hence, if residents or physician's preference of treatments were known, the study could more clearly identify factors influencing utilization patterns for cancer treatments. This limitation could be overcome in future studies by interviewing or surveying residents, their family members or caregivers, and physicians.

Fourth, the study cannot separate time trend effects from health policy effects. Given that the study used resident's cancer diagnosis date and nursing home fiscal year start date to define the health policy measures, there existed near perfect collinearity between health policy variables and time dummy variables. One way to overcome this limitation would be by administering surveys to physicians regarding factors that they consider while making treatment decisions.

Fifth, the study used physician specialty codes and oncology practice experiences to identify oncologists. Even though this method has been used in many previous studies (Davidoff et al., 2009; Morris et al., 2008; Murphy et al., 2009; Bradley et al., 2008), the study found that many residents consulted with these oncologists for non-cancer medical conditions. A better

definition of oncologists may be needed for future study.

Sixth, the study did not have enough sample size to detect significance. Based on the PASS software suggestion, this study need at least 1000 observations to achieve 90% power at an alpha level of .01 to detect significant difference. This limitation could be overcome if the study can include other state dataset or use nationwide dataset to increase sample size.

Policy Implications

This study provides several significant contributions to the long-term care and cancer treatment literature with associated policy implications. This study is the first in literature that examines the association between nursing home organizational characteristics and utilization patterns of cancer-related medical services, including curative and palliative care, among elderly residents who were diagnosed with cancer after admission to nursing homes.

For decades, researchers and policy makers have used nurse staffing level, nursing skill mix and quality deficiencies among nursing home organizational characteristics as proxy variables for quality of care in nursing homes. This study did not find a positive association between nurse staffing level, nursing skill mix, or quality and utilization of cancer-related medical services. Instead, the findings suggest that many residents did not get cancer treatment because of their age. Existing studies have shown that many physicians are reluctant to recommend cancer treatment to their elderly patients due to lack of evidence based on medical literature or evidence from clinical trials (Lee et al., 2009; Kutner et al., 2000). Therefore, policy makers or research foundations should encourage inclusion of elderly patients in the pool in future cancer clinical trials.

Ironically, residents of nursing homes with fewer quality deficiencies showed a decreased likelihood of utilizing hospice care. This suggests that residents may not feel the need to enroll

into hospice care if they already have good quality of care available in the facilities. Furthermore, nursing homes may gain some financial benefit by keeping their residents in facilities (HHS, 2000) and hence, nursing homes may play a passive role in recommending their residents to use hospice care. Since majority of hospice enrollment occurred after being admitted to nursing homes (HHS, 2000), researchers and policy makers should conduct further studies to explore the role nursing homes play in hospice care enrollment.

In summary, given that average life expectancy of people is increasing, more and more elderly are likely to be diagnosed with cancer. The study recommends that research foundations or policy makers should encourage inclusion of higher proportion of elderly patients in the sample pool in future cancer clinical trials to obtain clearer guidelines for treating the elderly.

Future Research

This study also opens avenues for several areas for future research. This study relied entirely on secondary, quantitative, administrative dataset. Given that the Andersen model suggests perceived need will also impact utilization of health services while the study only used evaluated need, namely a cancer diagnosis, to predict utilization, a qualitative study of patient preferences versus physician perception in treatment would enhance our understanding of factors affecting utilization of cancer-related medical services. Additionally, individual patient charts could be reviewed to find out the treatment suggestions made by physicians.

Secondly, a qualitative study analyzing the decision process for choice of treatment of residents or their family or caregivers would be extremely insightful to understand the factors that are considered in making treatment decisions. This would be crucial in determining the extent to which nursing home organizational characteristics play a role in utilizing cancer-related medical services.

Thirdly, private pay residents were not included in this study, which limited the ability to generalize the results. Future studies could include private-pay resident information to analyze the treatment patterns. Furthermore, physician characteristics and hospice care provider characteristics should also be included in future studies.

Finally, the data was only from Michigan. It would be interesting to include different state data to determine the association between nursing homes organizational characteristics and cancer treatment utilization and provide generalizable results.

In conclusion, there is a large gap in knowledge concerning cancer treatment of elderly nursing home residents. Many elderly nursing home residents are undertreated. Since residents rely heavily on their nursing facilities, nursing homes might influence them in their treatment decisions. However, very few studies are focused on this issue. Even though this study did not successfully find that higher nurse staffing level, higher nursing skill mix or higher quality of care are associated with greater use of cancer-related medical services, this study was successful in laying out an empirically sound base framework to analyze this association. Future research can incorporate other states or nationwide data to re-examine this relationship using this study as a base model.

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APPENDICES

Appendix A.1 Correlation Table

	age_1	age_2	age_3	age_4	non_wh~e	female	alz_only
age_1	1						
age_2	-0.0912	1					
age_3	-0.1117	-0.1752	1				
age_4	-0.1318	-0.2066	-0.2531	1			
non_white	0.0103	-0.0047	0.028	0.0379	1		
female	-0.1125	-0.0898	-0.0668	0.0205	-0.072	1	
alz_only	-0.0227	-0.0073	-0.0078	0.027	0.0462	0.0111	1
alz_comorbid	-0.0497	-0.0532	0.0628	0.0168	0.0696	0.0083	-0.1876
other_como~d	0.011	0.0531	-0.0273	0.0051	-0.133	0.0231	-0.1817
bba_phase	-0.0214	-0.0118	0.0108	0.0171	0.0196	0.021	-0.0622
bba	-0.0229	0.0093	0.0202	-0.0025	0.0456	0.0095	-0.0944
bbra	-0.0206	-0.0103	-0.01	0.0288	0.03	0.0265	-0.0476
breast	-0.0226	0.0051	-0.0539	-0.0153	-0.0855	0.3058	0.0568
colorectal	-0.0471	-0.044	0.0033	0.0063	-0.0353	0.0054	-0.0315
lung	0.0308	0.0866	0.0789	0.0176	0.0919	-0.1303	0.0277
prostate	-0.0045	0.0081	0.007	0.0051	0.0577	-0.4221	-0.014
gi	0.0243	0.024	0.0038	0.0074	0.0184	-0.0327	0.0283
pancreas	-0.0496	-0.0389	-0.0279	-0.0106	0.0005	0.0457	0.0102
bladder	0.0047	-0.0159	-0.0202	-0.005	-0.0241	-0.0918	-0.03
leuk	-0.0153	-0.0122	0.0099	-0.0498	-0.0365	-0.0112	-0.0376
in_situ	0.0437	-0.0224	-0.0305	-0.0032	0.0092	0.0002	-0.0191
local_stage	0.0368	-0.0405	0.0121	0.0735	-0.013	-0.0535	-0.0032
regional_s~e	0.0175	0.1093	-0.0488	-0.0275	-0.0203	0.0906	-0.0172
distant_st~e	-0.0242	0.0258	0.0469	0.0102	0.0755	-0.0809	0.0223
s_stay	-0.0066	0.032	0.0266	0.0289	-0.0132	-0.0361	-0.0434
rad_sp1	0.0224	0.0113	0.08	-0.0141	0.3028	0.007	0.0462
new_md	0.0134	-0.0424	0.0419	0.0106	0.1987	0.0067	0.0478
sur_md	0.0097	-0.0505	0.0311	0.0025	0.089	0.0155	0.0405
st_b	0.0036	-0.0068	0.0054	0.0388	0.0713	-0.0224	0.0017
nurse_pppd	0.0174	-0.0003	-0.0187	-0.019	-0.0876	0.0348	0.0058
skill_mix	0.0284	0.038	-0.008	-0.0055	-0.1042	-0.0213	-0.0104
high_quali~3	-0.0134	0.0182	0.0126	-0.0275	-0.0303	0.0351	0.0219
mid_quality3	0.0583	-0.0508	-0.0052	-0.0256	-0.1024	-0.0096	-0.0401
multi	-0.0348	0.008	0.0527	0.041	0.0008	0.0562	-0.0587
non_profit	-0.0158	-0.0478	0.0419	-0.0291	0.006	0.0299	0.0102
government	0.0331	0.0294	-0.0434	0.0056	-0.1534	0.0042	-0.0336
pctmcare	-0.047	0.0249	0.0074	0.0281	-0.1145	0.0499	-0.0277
pctmcaid	0.0476	0.0327	-0.0034	0.0261	0.3416	-0.1227	0.0045

Appendix A.2

	alz_co~d	other_~d	bba_ph~e	bba	bbra	breast	colore~l
alz_comorbid	1						
other_como~d	-0.6272	1					
bba_phase	0.2627	-0.0804	1				
bba	0.3518	-0.0873	0.6597	1			
bbra	0.1555	-0.0571	0.495	0.2994	1		
breast	-0.0195	-0.0109	-0.0767	-0.0662	-0.0516	1	
colorectal	-0.0124	0.0203	0.0381	0.0312	0.0527	-0.1919	1
lung	-0.0026	-0.0134	-0.0334	0.0453	-0.0589	-0.1842	-0.1894
prostate	0.0118	-0.0613	-0.0112	-0.0395	-0.0069	-0.1291	-0.1328
gi	-0.0196	0.013	0.0407	0.0775	0.0792	-0.0898	-0.0923
pancreas	0.0363	-0.0277	0.0236	0.0132	-0.0042	-0.0888	-0.0914
bladder	0.0116	-0.0251	-0.0163	-0.0368	-0.0064	-0.0907	-0.0933
leuk	0.0133	-0.0037	-0.0201	-0.0369	-0.0434	-0.0697	-0.0717
in_situ	-0.0217	0.0142	0.016	-0.001	-0.0281	0.0181	-0.0124
local_stage	-0.0094	0.0103	-0.008	-0.0403	-0.0059	0.139	0.0275
regional_s~e	-0.0166	0.0446	0.0199	0.0437	0.0402	0.0293	0.1385
distant_st~e	-0.0052	-0.0182	0.0056	0.0024	0.0076	-0.1514	-0.0684
s_stay	0.0354	0.0327	0.0725	0.069	0.0876	-0.0311	-0.004
rad_sp1	0.0734	-0.0984	-0.064	0.0036	-0.0048	-0.0474	-0.0082
new_md	0.0301	-0.0466	-0.0178	0.0253	-0.0214	-0.0305	0.0117
sur_md	-0.0003	-0.0136	-0.0382	0	-0.0209	-0.029	0.0107
st_b	-0.0005	0.0217	-0.0201	0.0654	-0.0386	-0.0365	0.0163
nurse_pppd	-0.0156	0.0236	0.0013	0.0734	0.0335	0.0177	0.021
skill_mix	0.0246	-0.0046	0.0219	-0.0022	-0.0005	-0.0144	-0.0055
high_quali~3	-0.0365	0.0094	-0.042	-0.0288	-0.0231	0.0251	0.0191
mid_quality3	-0.0203	0.069	0.0276	-0.0155	0.0246	-0.0007	-0.0158
multi	0.042	0.0146	0.0569	0.0134	-0.0016	0.0485	-0.0049
non_profit	-0.0452	0.0292	-0.0042	0.0048	0.0041	0.0201	0.0347
government	-0.0689	0.0861	0.0084	0.0131	0.0444	-0.0044	0.061
pctmcare	0.0525	-0.0066	0.0596	-0.0281	0.032	0.0289	-0.0027
pctmcaid	0.0523	-0.0732	-0.0413	-0.0024	-0.0077	-0.0516	-0.0055

Appendix A.3i

	local_~e	region~e	distan~e	s_stay	rad_sp1	new_md	sur_md
local_stage	1						
regional_s~e	-0.2735	1					
distant_st~e	-0.2924	-0.2007	1				
s_stay	0.0237	0.0266	-0.0531	1			
rad_sp1	-0.0547	0.0902	0.0703	-0.0434	1		
new_md	-0.0481	0.0217	0.0449	-0.0127	0.5652	1	
sur_md	-0.0487	0.0184	0.0108	-0.0092	0.5178	0.9249	1
st_b	0.0002	0.051	-0.0394	-0.021	0.1515	0.2808	0.3267
nurse_pppd	0.0051	0.0292	-0.0286	0.0282	-0.0481	-0.0856	-0.0451
skill_mix	-0.0613	0.0005	-0.0089	0.0386	0.0455	0.1106	0.1601
high_quali~3	0.0216	0.0015	0.0126	0.0123	-0.1265	-0.112	-0.105
mid_quality3	-0.0094	0.0203	-0.0274	0.0187	-0.0127	-0.0281	0.0013
multi	-0.0131	0.0137	-0.0404	0.0225	0.037	0.0834	0.1074
non_profit	0.0391	-0.0406	-0.0252	0.0754	0.0712	-0.0075	0.0214
government	0.022	-0.0274	-0.0434	0.009	-0.2584	-0.2204	-0.181
pctmcare	-0.0392	-0.031	-0.0031	0.055	0.0636	0.0567	0.0795
pctmcaid	0.0145	0.0164	0.0535	-0.0663	0.033	-0.0348	-0.122

Appendix A.4

	st_b	nurse_~d	skill_~x	High_q~3	mid_qu~3	multi	non_pr~t
st_b	1						
nurse_pppd	-0.0204	1					
skill_mix	-0.0685	-0.094	1				
high_quali~3	-0.0275	0.0545	-0.0388	1			
mid_quality3	0.0051	0.0593	0.0368	-0.5142	1		
multi	0.004	-0.1696	-0.0251	-0.2184	0.0772	1	
non_profit	-0.0387	0.1531	-0.0988	0.0176	0.0235	-0.0428	1
government	0.0528	0.2332	0.0156	0.1861	-0.042	-0.3388	-0.2002
pctmcare	-0.0823	0.1281	0.2151	-0.1276	0.0773	0.2382	0.0383
pctmcaid	0.0852	-0.1633	-0.1293	0.0623	-0.089	-0.1345	-0.2285

Appendix A.5

	govern~t	pctmcare	pctmcaid
government	1		
pctmcare	-0.0586	1	
pctmcaid	0.0857	-0.5726	1

VITA

Chun-Chieh Lin (Anna Lin) was born on December 11, 1972 in Taoyuan, Taiwan. In 1995, she graduated from National Taiwan University with a B.A., majoring in Business Administration and received a Master of Business Administration concentrated in Marketing and Information System, at Georgia State University in 1998. She joined Johnson & Johnson Ethicon as a Territory Assistant in Houston, TX for a year before relocating back to Taiwan to work for Johnson & Johnson Medical Taiwan as a Senior Marketing Executive until 2002. In 2003, she moved to Japan and joined Microsoft as a Software tester. In 2004, she worked for Hudson as an associate consultant for six months and then enrolled in the Department of Health Administration's doctoral program at Virginia Commonwealth University. She completed the requirements for the Ph.D. degree in May, 2010.