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Provision of Hospital-based Palliative Care and the Impact on Organizational and Patient Outcomes

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Provision of Hospital-based Palliative Care and the Impact on Organizational and Patient Outcomes

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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List of Abbreviations

AAMC	Association of American Medical Colleges
ABMS	American Board of Medical Specialties
ACD	Acute Cerebrovascular Disease
ACGME	Accreditation Council of Graduate Medical Education
ACS	American College of Surgeons
AIDS	Acquired Immunodeficiency Syndrome
AHA	American Hospital Association
AHRF	Area Health Resources File
AHRQ	Agency for Healthcare Cost and Quality
AMI	Acute Myocardial Infarction
ANCC	American Nurses Credentialing Center
AOA	American Osteopathic Association
APICC	All-payer Inpatient Cost-to-charge Ratio
APR-DRG	All-patient Refined Diagnosis-related Group
APRN	Advanced Practice Registered Nurse
AZ	Arizona
CA	California
CAPC	Center to Advance Palliative Care
CCI	Charlson-Comorbidity Index

CCR	Cost-to-charge Ratio
CCS	Clinical Classification Software
CHF	Congestive Heart Failure
CMI	Case-mix Index
CMO	Comfort Measures Only
CMS	Centers for Medicare and Medicaid Services
COPD	Chronic Obstructive Pulmonary Disease
COTH	Council of Teaching Hospitals
CPR	Cardiopulmonary Resuscitation
CPT	Current Procedural Terminology
DNR	Do not Resuscitate
DRG	Diagnosis-related Group
DV	Dependent Variable
DX	Diagnosis
EOL	End-of-life
EPEC	Education for Physicians on End-of-life Care
FIPS	Federal Information Processing Standard
FL	Florida
GAPICC	Group-average All-payer Inpatient Cost-to-charge Ratio
GCI	Global Cerebral Ischemia
HCF	Healthcare Facility
HCFA	Health Care Financing Administration
HCRIS	Healthcare Cost Report Information System

HCUP	Healthcare Cost and Utilization Project
HGLM	Hierarchical Generalized Linear Modeling
HH	Household
HHC	Home-health Care
HHI	Herfindahl-Hirschman Index
HIV	Human Immunodeficiency Virus
HLM	Hierarchical Linear Modeling
HMO	Health Maintenance Organization
HOSPC	Hospice Program
HPM	Hospice and Palliative Medicine
HQA	Hospital Quality Alliance
HRSA	Health Resources and Services Administration
ICC	Intra-class Correlation Coefficient
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
ICD-10-CM	International Classification of Diseases, 10th Revision, Clinical Modification
ICU	Intensive Care Unit
IDT	Interdisciplinary Team
IOM	Institute of Medicine
IPAL	Inpatient Palliative Care Unit
IPPS	Inpatient Prospective Payment System
IRR	Incidence Rate Ratio
IT	Institutional Theory
IWG	International Work Group in Death, Dying, and Bereavement

JCAHO	Joint Commission on Accreditation of Healthcare Organizations
JV	Joint Venture
LOS	Length of Stay
MD	Maryland
MICU	Medical Intensive Care Unit
MOSF	Multi-organ System Failure
MHB	Medicare Hospice Benefit
N/A	Not Available
NCHWA	National Center for Health Workforce Analysis
NCP	National Consensus Project for Quality Palliative Care
NHPCO	National Hospice and Palliative Care Organization
NHO	National Hospice Organization
NIH	National Institutes of Health
NJ	New Jersey
NQF	National Quality Forum
NY	New York
PA	Pennsylvania
PAL	Inpatient Palliative Care Consultation Service
PC	Palliative Care
PM	Pain Management
PPI	Producer-price Index
PPO	Preferred Provider Organization
PTSD	Post-traumatic Stress Disorder

RCT	Randomized Controlled Trial
RDT	Resource Dependence Theory
RN	Registered Nurse
SAS	Statistical Analytical System
SCP	Sole Community Provider
SD	Standard Deviation
SE	Standard Error
SICU	Surgical Intensive Care Unit
SID	State Inpatient Database
SNF	Skilled Nursing Facility
SPO	Structure-Process-Outcome
SUPPORT	Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment
TCE	Transaction Cost Economics
TEFRA	Tax Equity and Fiscal Responsibility Act
TJC	The Joint Commission
UC	Usual Care
UK	United Kingdom
US	United States
VA	Veterans Affairs
WHO	World Health Organization
WP	White Paper
ZIP	Zone Improvement Plan

Abstract

PROVISION OF HOSPITAL-BASED PALLIATIVE CARE AND THE IMPACT ON ORGANIZATIONAL AND PATIENT OUTCOMES

By Marisa L. Roczen, Ph.D., M.A.
A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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Hospital-based palliative care services aim to streamline medical care for patients with chronic and potentially life-limiting illnesses by focusing on individual patient needs, efficient use of hospital resources, and providing guidance for patients, patients' families and clinical providers toward making optimal decisions concerning a patient's care. This study examined the nature of palliative care provision in U.S. hospitals and its impact on selected organizational and patient outcomes, including hospital costs, length of stay, in-hospital mortality, and transfer to hospice. Hospital costs and length of stay are viewed as important economic indicators. Specifically, lower hospital costs may increase a hospital's profit margin and shorter lengths of stay can enable patient turnover and efficiency of care. Higher rates of hospice transfers and lower in-hospital mortality may be considered positive outcomes from a patient perspective, as the majority of patients prefer to die at home or outside of the hospital setting.

Several data sources were utilized to obtain information about patient, hospital, and county characteristics; patterns of hospitals' palliative care provision; and patients' hospital costs, length of stay, in-hospital mortality, and transfer to hospice (if a patient survived hospitalization). The study sample consisted of 3,763,339 patients; 348 urban, general, short-term, acute care, non-federal hospitals; and 111 counties located in six states over a 5-year study (2007-2011). Hospital-based palliative care provision was measured by the presence of three palliative care services, including inpatient palliative care consultation services (PAL), inpatient palliative care units (IPAL), and hospice programs (HOSPC). Derived from Institutional Theory, Resource Dependence Theory, and Donabedian's Structure Process-Outcome framework, 13 hypotheses were tested using a hierarchical (generalized) linear modeling approach.

The study findings suggested that hospital size was associated with a higher probability of hospital-based palliative care provision. Conversely, the presence of palliative care services through a hospital's health system, network, or joint venture was associated with a lower probability of hospital-based palliative care provision. The study findings also indicated that hospitals with an IPAL or HOSPC incurred lower hospital costs, whereas hospitals with PAL incurred higher hospital costs. The presence of PAL, IPAL, and HOSPC was generally associated with a lower probability of in-hospital mortality and transfer to hospice. Finally, the effects of hospital-based palliative care services on length of stay were mixed, and further research is needed to understand this relationship.

Chapter 1: Introduction

This chapter is divided into six sections. The first two sections summarize the study problem and research questions examined in this study. The third section provides an overview of the theoretical framework used to address the research questions, followed by a description of the analytical approach applied to test the study hypotheses. The significance of the study is highlighted in the fifth section. The chapter concludes with a summary of the remaining chapters.

The Study Problem

The chronically ill population with serious, potentially life-limiting diseases has been growing rapidly over the last two decades. In 2010, seven of the top ten leading causes of death in the United States were chronic diseases, with cancer and heart disease accounting for almost 50% of all deaths (Murphy, Xu, & Kochanek, 2013). While 37% of U.S. adults had at least one chronic illness in 1987, this number rose to about 60% in 2005 (Hoffman, Rice, & Sung, 1996; Machlin, Cohen, & Beauregard, 2008). This percentage is significantly higher for older adults, with the fraction ranging from 36.4% of persons aged between 18 and 34 to 91.5% of adults aged 65 and over (Machlin et al., 2008). These numbers are alarming considering the aging U.S. population. According to the Administration on Aging (AoA), Americans aged 65 and over constituted 13.3% of the overall population in 2011 (Administration on Aging, n.d.). This percentage is expected to increase to 21% in 2040. Similarly, the 85+ population is projected to nearly triple between 2011 and 2040, from 5.7 million in 2011 to a projected 14.1 million in 2040. With a population that currently has a life expectancy of 78.7 years, the U.S. health care system must prepare to serve an aging population that lives longer but most likely with serious, chronic illnesses or conditions that require long-term, often costly specialized care (Center to Advance Palliative Care, 2008).

One service explicitly tailored toward caring for individuals with serious, chronic, and potentially life-limiting illnesses is palliative care. Palliative care has the potential to help clinicians address the needs of such patients and generate cost savings. This study’s focus is on exploring the associations between hospital and environmental factors and the provision of hospital-based palliative care services and on examining how hospital-based palliative care services and hospitals’ experience in providing such services are associated with hospital costs, hospital length of stay, in-hospital mortality, and care transition to hospice.

Palliative care is a specialized, interdisciplinary, and holistic approach to medical care tailored toward patients with a serious, chronic and/or worsening illness. This type of care emphasizes the identification, prevention, assessment, alleviation, and management of suffering caused by a life-limiting disease or condition (Adolph, Frier, Stawicki, Gerlach, & Papadimos, 2011). Suffering can include physical pain and symptoms or other psychological, psychosocial, emotional, and spiritual distress (White & Coyne, 2011). Palliative care is typically provided by an interdisciplinary health care team, including specialist physicians, nurses, social workers, and chaplains, who focus on the complex needs of patients and their families with the goal to optimize quality of life across the continuum of a patient’s disease (National Quality Forum, 2011; World Health Organization, 2016). This type of care is appropriate at any age or stage of illness and can be provided along with life-prolonging or curative treatments.

The hospice and palliative care movement is rooted in Europe, where Dame Cicely Saunders first started to raise awareness of inadequate pain and symptom management at the end of life and advocate for better care for terminally-ill patients in the mid-20th century. Her efforts to establish the first modern hospice in 1967 in London is considered a vital milestone in the history of palliative care. Seven years later, the first U.S. hospice was founded in Connecticut preceded by rigorous collaborative efforts of Dame Cicely Saunders and hospice and palliative care advocates in the United States. However, it was not until the early to mid-1980s that U.S. policy makers began taking tangible action to facilitate access to palliative care for individuals at the end of life, including the establishment of the Medicare Hospice Benefit in 1983. During that time, hospice and palliative care was primarily considered most appropriate for terminal patients subsequent to curative treatment. But over the succeeding decades, this type of care started to be acknowledged as a fundamental part of medical care for all patients suffering from a serious and life-limiting illness.

While palliative care is provided in a variety of health care settings (e.g., long-term care facilities, hospitals, hospice, at home), the hospital setting remains a central source of end-of-life or palliative care for a large proportion of seriously ill patients. That is, while most patients with serious illnesses prefer to die at home, almost one in three Medicare beneficiaries with a cancer diagnosis or a chronic disease died in the hospital in 2007 (Goodman, Esty, Fisher, & Chang, 2011). The importance of hospital-based palliative care has been recognized since the late 1980s when concerns about patients' extended periods of suffering before death first started to take shape. A substantial misalignment between patient preferences and actual care provided at the end of life was first demonstrated in the mid-1990s, when the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment (SUPPORT) documented a lack of communication about end-of-life preferences between physicians and their patients. The two-year observational study of 4,301 patients revealed that 47% of physicians were unaware of their patients' preference to withhold cardiopulmonary resuscitation (CPR). Further, according to family members, 50% of patients who died in the hospital experienced moderate to severe pain at least 50% of the time during their last three days of life (The SUPPORT Principal Investigators, 1995). The second phase of the study was a two-year controlled clinical trial with 4,804 patients designed to improve end-of-life decision-making by facilitating information sharing between patients and their physicians. The results of this study phase revealed that patient preferences for end-of-life care did not have a significant effect on care processes, costs, or patient outcomes. A follow-up study showed that almost 82% of patients who had expressed a preference for dying at home, in fact, died in the hospital (Pritchard et al., 2008). In 1997, the Institute of Medicine (IOM) published its report "Approaching death: Improving care at the end-of-life," in which the need for action to improve care at the end of life was stressed (Institute of Medicine, 1997).

Since the turn of the 21st century, palliative care has been one of the fastest growing health care trends in the United States. The number of inpatient palliative care consultation services in hospitals increased from 24.5% in 2000 to 65.7% of hospitals with at least 50 beds in 2010 (Center to Advance Palliative Care, 2012). These numbers include inpatient palliative care consultation services provided by the hospital, health system, network, or a joint venture within the local community. Moreover, various palliative care initiatives, such as the National Consensus Project for Quality Palliative Care (NCP), the Center to Advance Palliative Care (CAPC), and the National Hospice and Palliative Care Organization (NHPCO) have been established, which focus on increasing the quality and availability of palliative care for individuals with serious, life-limiting health conditions.

As quality of life for critically ill patients has received greater attention and palliative care options have expanded, some research suggests that patients' preferences and end-of-life care have become more closely aligned (Cosgriff, Pisani, Bradley, O'Leary, & Fried, 2007; Wright et al., 2010). Numerous studies conducted in critical care settings have identified successful palliative care interventions with significant improvements in quality of care through the reduction of ineffective curative treatments when death is inevitable (Mosenthal et al., 2012). Untreated suffering has been shown to be associated with low patient and family satisfaction, amplified symptoms of post-traumatic stress disorder (PTSD) among family members, extended time in the intensive care unit (ICU) without observable patient benefits, decreased quality of life, and increased risk of mortality (Adolph, 2011; Andersson, 2009; Katz, 2002). Palliative care consultations have been found to improve symptoms of ICU cancer patients, such as pain, fatigue, nausea, constipation, dyspnea, sleep, depression, loss of appetite, drowsiness, and anxiety (Delgado-Guay, Parsons, Li, Palmer, & Bruera, 2009). Another study revealed that symptoms of PTSD, anxiety, and depression among family members of ICU patients were significantly improved following the implementation of a palliative care communication conference and bereavement brochure (Lautrette et al., 2007).

Hospital-based palliative care services aim to streamline patient care at the end of life with a specific focus on individual patient needs and efficient use of hospital resources. Access to palliative care in the hospital setting has the potential to guide patients, patients’ families and clinical providers toward making optimal decisions concerning a patient’s care, such as timely transitioning to other health care settings if appropriate. Avoiding prolonged hospital stays may be more in line with patients’ preferences for end-of-life care and may reduce the cost of patient care if medically unnecessary. The proposed study thus aims to explore the nature of palliative care provision in the hospital setting and the capability of palliative care services to facilitate care transitions to hospice, shorten length of stay, and reduce hospital costs and risk of mortality.

Research Questions

This research study has two main objectives. The first is to evaluate organizational and environmental factors associated with the likelihood of providing palliative care services among urban, non-federal, short-term, and acute care hospitals in the United States. The second objective is to examine potential associations between hospital-based palliative care services and subsequent organizational and patient outcomes in urban, non-federal, short-term, and acute care hospitals for patients who are most likely to benefit from and utilize palliative care services. The outcomes of interest are hospital costs per patient, hospital length of stay per patient, in-hospital mortality, and care transition to hospice. The following research questions are examined to explore the nature of hospital-based palliative care services and the association of hospital-based palliative care services with organizational and patient outcomes.

1) Which organizational and environmental forces are associated with the provision of hospital-based palliative care services?
2) Do hospitals that provide palliative care services have improved organizational and patient outcomes compared to those not providing such services?
3) Is a hospital's experience in providing palliative care services associated with improved organizational and patient outcomes?

Theoretical Framework

The underlying theoretical framework for this study is based on organizational theories and frameworks that have been used by other health services researchers to explain the nature of hospital service adoption and how such adoption potentially influences hospital performance. Five propositions and hypotheses that correspond to research question one are derived from Resource Dependence Theory (Pfeffer & Salancik, 1978) and Institutional Theory (DiMaggio &

Powell, 1983; Meyer & Rowan, 1977). Donabedian's Structure-Process-Outcome (SPO) framework for quality assessment (Donabedian, 1980) is applied to derive one proposition and four hypotheses corresponding to research questions two and three, respectively. Besides the key explanatory variables to test the study's 13 hypotheses, additional patient, hospital, and country control variables are included to account for factors potentially affecting the association between the key explanatory variables and the dependent variables.

Analytical Approach

To test the study's hypotheses, longitudinal data between 2007 and 2011 from six states, namely Arizona, California, Florida, Maryland, New Jersey, and New York are used. This study utilizes data from the following databases: Healthcare Cost and Utilization Project (HCUP) state inpatient databases, American Hospital Association (AHA) Annual Survey of Hospitals, Area Health Resources Files (AHRF), the Centers for Medicare & Medicaid Services (CMS) Healthcare Cost Report Information System (HCRIS), the HealthLeader-Interstudy databases, and the website of the American Nurses Credentialing Center (ANCC). A two-level hierarchical generalized linear model (HGLM) is used to analyze the proposed hypotheses under research question one, where hospitals are nested within markets (i.e., counties). Four three-level HGLM and hierarchical linear models (HLM) are employed to test the proposed hypotheses under research questions two and three, with patients nested within hospitals nested within markets.

Significance of the Study

This study is significant for several reasons. First, the U.S. health care system serves an aging population with increasing life expectancy and serious chronic or terminal illnesses that require specialized care (Center to Advance Palliative Care, 2008). Palliative care services are uniquely equipped to care for this type of patient population.

Second, hospital settings remain the primary source of palliative care for the majority of seriously ill patients. Thus, it is important to gain a broader understanding of the nature and effects of hospital-based palliative care.

Third, palliative care may play a significant role in implementing goals articulated by the Affordable Care Act (2010). Specifically, Fletcher and Panke (2012) reviewed the opportunities and challenges of palliative care in light of the Affordable Care Act and highlighted that palliative care may be the answer to rising healthcare costs and deficiencies in quality of care. The authors concluded with a call for evidence-based research efforts linking palliative care to improvement in quality of care and cost reduction. Despite the increased prevalence of hospital-based palliative care services, the necessity to improve care for patients with serious medical conditions remains (Weissmann & Meier, 2011). Existing studies primarily focus on evaluating the effects of palliative care provision on patient and organizational outcomes in single hospitals or a small number of hospitals within a hospital system. However, these effects are potentially hospital- or hospital system-specific and may therefore not be generalizable to all U.S. hospitals. An examination of palliative care services in a larger set of hospitals, as conducted in this study, may provide the basis for more generalizable conclusions regarding the impact of palliative care services on selected patient and organizational outcomes.

Summary of Remaining Chapters

This manuscript is divided into six chapters. This chapter introduced the study's thematic focus; defined the study problem, research questions, significance of this study; and summarized the theoretical framework and the analytical methodology applied in this study.

Chapter 2 provides detailed background information and reviews relevant literature related to the study's research questions. Chapter 3 describes the Structure-Process-Outcome framework, Institutional Theory, and Resource Dependence Theory to derive seven propositions and the corresponding 13 testable hypotheses. A detailed description of the study's data, methodology, research design, and empirical implementation is provided in Chapter 4. Chapter 5 summarizes the study findings, including descriptive statistics, regression models, and supplemental sensitivity analyses. Finally, Chapter 6 discusses and reflects on the study's findings with regard to the propositions and hypotheses and closes with outlining the study's limitations and implications for theory, health care policy, and practice.

Chapter 2: Literature Review

This chapter is divided into eight sections. The first section sets the stage by defining palliative care and related concepts. The second section outlines the evolution of palliative care in the U.S. health care system, including the historical development of conceptual models of palliative care. The third and fourth sections present the major delivery models of palliative care and their diffusion across hospitals nationwide and in the study sample. The fifth section discusses the study's dependent variables and why they are important from a hospital performance perspective. The sixth and seventh sections illustrate how studies have empirically explored the provision of hospital-based palliative care and hospital performance in regard to the study's selected organizational and patient outcomes. The last section concludes this chapter by summarizing the potential contribution of this study to the current literature exploring similar research questions.

Defining Palliative Care

Several terminologies exist to describe palliative care and related concepts, such as end-of-life care, palliative care, and hospice care. Recognizing their differences and commonalities is necessary to understand the evolution, nature, and goals of palliative care. The term "hospice" originates from the Latin word for hospitality (i.e., hospitium); the term "palliative" is derived from the Latin word for cloaked or covered (i.e., palliativus) and refers to the act of "relieving pain or alleviating a problem without dealing with the underlying cause" (Oxford Dictionaries, 2015). While palliative care is appropriate for seriously ill patients at the time of diagnosis and concurrent with curative treatment, hospice care typically starts after or independent of life-prolonging treatments and when the patient is not expected to live longer than six months. Consequently, hospice care may be viewed as a specific subset of palliative care, which is provided at the end of life when death is inevitable. Finally, end-of-life (EOL) care is often used as a synonym for palliative care despite its deceptive and limited view of palliative care. Rather, EOL care is more closely aligned with hospice care, as it focuses on providing care to patients with terminal diagnoses. Several leading health care initiatives have developed definitions of palliative care. Table 1 provides an overview of these definitions.

Table 1

Organizational Definitions of Palliative Care

Organization	Definition
WHO	Palliative care is an approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual. (WHO, 2016)
NQF	Palliative care refers to patient- and family-centered care that optimizes quality of life by anticipating, preventing, and treating suffering. Palliative care throughout the continuum of illness involves addressing physical, intellectual, emotional, social, and spiritual needs and facilitating patient autonomy, access to information, and choice. (NQF, 2006)
CAPC	Palliative care, also known as palliative medicine, is specialized medical care for people living with serious illness. It focuses on providing relief from the symptoms and stress of a serious illness – whatever the diagnosis. The goal is to improve quality of life for both the patient and the family. (CAPC, n.d.)
NCP	The goal of palliative care is to prevent and relieve suffering and to support the best possible quality of life for patients and their families, regardless of the stage of the disease or the need for other therapies. Palliative care is both a philosophy of care and an organized, highly structured system for delivering care. Palliative care expands traditional disease-model medical treatments to include the goals of enhancing quality of life for patient and family, optimizing function, helping with decision making, and providing opportunities for personal growth. As such, it can be delivered concurrently with life-prolonging care or as the main focus of care. (NCP, 2013)

Note. CAPC=Center to Advance Palliative Care. NCP=National Consensus Project for Quality Palliative Care. NQF=National Quality Forum. WHO=World Health Organization.

The NQF's definition is among the most widely used description of palliative care in the United States. Both the National Hospice and Palliative Care Organization (NHPCO) and the Centers for Medicare and Medicaid Services (CMS) officially refer to this definition in the context of palliative care. There are several notable commonalities between the definitions presented in Table 1, including the focus on quality of life, relief of disease-related suffering, and care that is centered on the patient and their families. Several definitions mention the multi-dimensionality of palliative care, including addressing physical, psychological, social, and spiritual needs of patients and their families.

In 2004, the NCP developed a set of eight domains covering the full spectrum of palliative care services. Each domain is associated with guidelines, which outline best palliative care practices, as presented in Table 2.

A review of the guidelines in Table 2 illustrates that high-quality palliative care should be provided by an interdisciplinary team that carefully assesses and manages various aspects of patients' and families' needs from the time of diagnosis to bereavement support after the patient's death. The domains and corresponding guidelines also highlight the importance of care-that emphasizes quality of life and is based on goals of care that reflect patients' and families' preferences and values. To assure that patients' and families' needs are met, palliative care draws from the expertise of a wide spectrum of clinical specialists, including physicians, nurses, chaplains, social workers, psychologists, and other disciplines. Finally, palliative care distinguishes itself from other types of medical care by not only attending to medical needs (i.e., pain and symptom management), but also addressing other aspects of life affected by the patient's illness, including bereavement support for family members after the patient's death.

Table 2

Palliative Care Domains and Corresponding Guidelines

Domain	Guideline
1. Structure/Processes	1. A comprehensive and timely interdisciplinary assessment of patient and family forms the basis of the plan of care. 2. The care plan is based on the identified and expressed preferences, values, goals, and needs of the patient and family and is developed with professional guidance and support for patient-family decision making. *Family* is defined by the patient. 3. An interdisciplinary team (IDT) provides services to the patient and family consistent with the care plan. In addition to chaplains, nurses, physicians, and social workers, other therapeutic disciplines who provide palliative care services to patients and families may include: child-life specialists, nursing assistants, nutritionists, occupational therapists, recreational therapists, respiratory therapists, pharmacists, physical therapists, massage, art, and music therapists, psychologists, and speech and language pathologists. 4. The palliative care program is encouraged to use appropriately trained and supervised volunteers to the extent feasible. 5. Support for education, training, and professional development is available to the interdisciplinary team. 6. In its commitment to quality assessment and performance improvement, the palliative care program develops, implements, and maintains an ongoing data driven process that reflects the complexity of the organization and focuses on palliative care outcomes. 7. The palliative care program recognizes the emotional impact of the provision of palliative care on the team providing care to patients with serious or life-threatening illnesses and their families. 8. Community resources ensure continuity of the highest quality palliative care across the care continuum. 9. The physical environment in which care is provided meets the preferences, needs and circumstances of the patient and family, to the extent possible.

Table 2 (continued)

Domain	Guideline
2. Physical	1. The interdisciplinary team assesses and manages pain and/or other symptoms and their subsequent effects based upon the best available evidence. 2. The assessment and management of symptoms and side effects are contextualized to the disease status.
3. Psychological/Psychiatric	1. The interdisciplinary team assesses and addresses psychological and psychiatric aspects of care based upon the best available evidence to maximize patient and family coping and quality of life. 2. A core component of the palliative care program is a grief and bereavement program available to patients and families, based on assessment of need.
4. Social	1. The interdisciplinary team assesses and addresses the social aspects of care to meet patient-family needs, promote patient-family goals, and maximize patient-family strengths and well-being. 2. A comprehensive, person-centered interdisciplinary assessment (as described in Domain 1, Guideline 1.1) identifies the social strengths, needs, and goals of each patient and family.
5. Spiritual/Religious/Existential	1. The interdisciplinary team assesses and addresses spiritual, religious, and existential dimensions of care. 2. A spiritual assessment process, including a spiritual screening, history questions, and a full spiritual assessment as indicated, is performed, The assessment identifies religious or spiritual/existential background, preferences, and related beliefs, rituals, and practices of the patient and family; as well as symptoms, such as spiritual distress and/or pain, guilt, resentment, despair, and hopelessness. 3. The palliative care service facilitates religious, spiritual, and cultural rituals or practices as desired by patient and family, especially at and after the time of death.
6. Cultural	1. The palliative care program serves each patient, family, and community in a culturally and linguistically appropriate manner. 2. The palliative care program strives to enhance its cultural and linguistic competence.

Table 2 (continued)

Domain	Guideline
7. End-of-Life	1. The interdisciplinary team identifies, communicates, and manages the signs and symptoms of patients at the end of life to meet the physical, psychosocial, spiritual, social, and cultural needs of patients and families. 2. The interdisciplinary team assesses and, in collaboration with the patient and family, develops, documents, and implements a care plan to address preventative and immediate treatment of actual or potential symptoms, patient and family preferences for site of care, attendance of family and/or community members at the bedside, and desire for other treatments and procedures. 3. Respectful postdeath care is delivered in a respectful manner that honors the patient and family culture and religious practices. 4. An immediate bereavement plan is activated postdeath.
8. Ethical/Legal	1. The patient or surrogate's goals, preferences, and choices are respected within the limits of applicable state and federal law, current accepted standards of medical care, and professional standards of practice. Person-centered goals, preferences, and choices form the basis for the plan of care. 2. The palliative care program identifies, acknowledges, and addresses the complex ethical issues arising in the care of people with serious or life-threatening illness. 3. The provision of palliative care occurs in accordance with professional, state and federal laws, regulations and current accepted standards of care.

Note. Adapted from "National Consensus Project for Quality Palliative Care. C. Dahlin, Ed. Clinical Practice Guidelines for Quality Palliative Care. 3rd ed. Pittsburgh, PA: National Consensus Project for Quality Palliative Care; 2013." Copyright 2013 by the National Consensus Project for Quality Palliative Care. Adapted with permission.

Evolution of Palliative Care

The evolution of palliative care in the U.S. healthcare system was highly influenced by historical changes in defining and conceptualizing the role of death and dying. This can be illustrated by the changing role of curative treatment and palliative care along the continuum of care or illness trajectory spanning from the time of diagnosis to death.

In Western societies, including the United States, changes in perceptions of death and dying have been accompanied and influenced by scientific, medical, pharmacological, and technological advancements. Until the mid-19th century, there was little medicine could do to prolong life or cure diseases. Dying often occurred with minimal medical involvement and was largely considered the responsibility of the family, community or religious institutions (Institute of Medicine, 1997). In addition, life expectancy was relatively low and most deaths occurred at home in the care of family members. While the first U.S. hospitals established in the 18th century functioned like hospices to provide care for the sick and dying and shelter for the poor, the preferred place of care for the upper and middle class was at home throughout most of the 19th century (Starr, 1982).

As medical practice advanced steadily and industrialization continued to evolve, health care became increasingly professionalized and institutionalized. By the early-20th century, hospitals had transformed into modern health care facilities with a focus on recovery and cure employing professional staff and medical technology and techniques, such as aseptic surgery and x-rays (Starr, 1982). In 1946, the Hospital Survey and Construction Act (or Hill-Burton Act), initiated considerable hospital growth by providing substantial financial support to expand community hospitals in the United States. In addition, the Public Health Service Act of 1944 shaped medical research in the post-World War II era by providing federal funds that triggered the expansion of the National Institutes of Health (NIH) and facilitated growth of medical knowledge and fostered scientific discovery. Scientific breakthroughs, particularly in medicine, generated a universal confidence and hopefulness toward medicine's ability to prolong life and conceivably defeat death (Byock, 2014). As more Americans died in institutional settings than in their own homes, the role of medicine and medical institutions at the end of life became increasingly prominent. The focus of medicine was primarily on curing diseases and postponing death in the early to mid-20th century. Death was largely viewed as the inability to cure a disease, which commonly led to inattention to patients' suffering, including pain at the end of life (Wheat, 2009). In addition, patients were typically not included in the medical decision-making process and little attention was paid to patients' preferences and values (Byock, 2014).

Medical advances also led to a steep decrease in infant mortality and a gradual increase in life expectancy (Institute of Medicine, 1997). Concerns about how to care for the elderly and terminally-ill arose among health care professionals and the public. During the early 1950s, Europeans began focusing their attention on end-of-life or hospice care. In particular, the modern use of the term hospice can be traced back to England (Clark, 2014). Considered among the most important landmarks of the modern hospice and palliative care movement is the establishment of the first modern hospice, St. Christopher's Hospice in 1967 in London, UK, by nurse, medical social worker, and physician Dame Cicely Saunders (Wheat, 2009). Saunders is considered one of the movement's pioneers, as she was among the first to identify and focus on the special needs of patients at the end of life (Richmond, 2005). The decade preceding the foundation of St. Christopher's played a crucial role in shaping and developing the modern idea of hospice and palliative care (Buck, 2011; Clark, 1998).

Saunders first discussed the idea of creating a home for the dying with one of her terminally-ill patients, a Polish Jewish refugee named David Tasma, during Saunders’s work as a medical social worker at Archway Hospital in Northern London in 1948 (Richmond, 2005). Hoping to expand her nursing work with terminally-ill patients, she was advised to become a physician to better influence the care provided to the dying. She started her medical training at St. Thomas Hospital shortly after, followed by a research scholarship to study pain management at St. Mary’s Hospital in London (Richmond, 2005). During that time, she also volunteered at St. Joseph’s Hospice between 1958 and 1965, a home for the dying poor run by nuns located in London, where she used her medical knowledge and research findings to improve quality of care (Saunders, 2001). Extensive anecdotal and empirical evidence of the use of pain and symptom management were collected at St. Joseph’s Hospice to reveal the inadequacies of care for the dying in the British welfare state and raise awareness for the idea of specialized care for the dying (Saunders, 2001).

In 1959, Saunders had prepared a 10-page proposal outlining her concept for a terminal-care home, which she shared and later refined with support from key constituents in the clinical field in Britain and the United States (Clark, 1998; Saunders, 2001). Publishing papers became an important and effective medium for disseminating her ideas and connecting with constituents around the world (Clark, 1998). Her first paper in 1957, entitled “Dying of Cancer,” in which Saunders discussed many of the elements comprising the core elements of modern idea of hospice care, generated affirmative feedback and valuable connections with supporters and associates dedicated to her cause. But it took several years to evoke serious interest among professionals in the medical field (Clark, 1998).

As her professional network grew, Saunders developed an interest in exploring terminal care in the United States. She began lecturing about her work and research with terminally-ill patients at St. Joseph's Hospice in medical institutions in the United States in 1963 (Buck, 2011). Her approach to medical care was in stark contrast to the then pre-dominant emphasis on using medicine to cure diseases, such as cancer, rather than alleviate suffering caused by such diseases (Wheat, 2009). Her lectures made a profound impression on Florence Wald, then Dean of the School of Nursing at Yale University, who eventually invited her to become a visiting faculty member in the school in 1965 (National Hospice and Palliative Care Organization, 2015).

As awareness of the need for specialized care for terminally-ill patients rose steadily, numerous studies demonstrating inadequate pain management and lack of emotional, psychosocial, spiritual and psychological support for patients with terminal illnesses and their families in the United States were published (Buck, 2011). Specifically, several studies published in the 1950s and early 1960s played an important role in shifting the attention to suffering and poor care conditions among patients dying of cancer at home and in charitable homes (Clark, 2014; Saunders, 2001). For example, Elisabeth Kübler-Ross' book "On Death and Dying" published in 1969 became an international bestseller, in which the author introduced the five stages of grief based on numerous interviews with dying patients and emphasized the patient's right to participate in the end-of-life decision-making process (National Hospice and Palliative Care Organization, 2015).

While the medical mainstream remained largely reluctant, nursing educators began proposing and teaching alternative approaches to care for the dying, including strategies to address ethical, spiritual, and emotional issues related to end-of-life care (Buck, 2011). After the establishment of St. Christopher's Hospice in 1967 and sabbatical visits to study that hospice's care for terminally-ill patients, Wald founded the first modern hospice in North America, the Connecticut Hospice in Branford, Connecticut in 1974 (National Hospice and Palliative Care Organization, 2015; Saunders, 2001), shortly followed by the establishment of the International Work Group in Death, Dying, and Bereavement (IWG) (Buck, 2011).

In 1978, following a series of meetings of hospice advocates during the prior three years, the National Hospice Organization (NHO) was founded. This organization published the first *Standards of a Hospice Program of Care* in the following year (Connor, 2007). Concurrently, the IWG published the document *Assumptions and Principles Underlying Standards for Terminal Care* (1979). Both organizations were actively involved in developing and advocating for a guiding framework for hospice and palliative care (Buck, 2011).

National policy makers became increasingly aware of the potential benefits of hospice care for the elderly population. The Centers for Medicare and Medicaid Services (CMS), formerly known as the Health Care Financing Administration (HCFA), initiated 26 demonstration programs in hospices nationwide to assess their care delivery models, structure, and cost effectiveness in an effort to facilitate a federal reimbursement system for hospice care. As a result, the Medicare Hospice Benefit (MHB), established in 1983 and made permanent in 1985, was included in the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 to cover end-of-life services to eligible individuals aged 65 and older. During this time, The Joint Commission (TJC), formerly known as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), started developing standards for hospice accreditation. While the nursing profession had long accepted and promoted hospice and palliative care for terminal patients, the medical profession began to follow suit (Connor, 2007). Although palliative care began to be recognized as a critical part of health care delivery, it remained largely separate from curative and life-prolonging therapies. Palliative care was primarily considered end-of-life care and thus largely provided through hospice programs to actively dying patients after life-prolonging or curative treatments had been exhausted, as displayed in Figure 1 (Meier & McCormick, 2015).

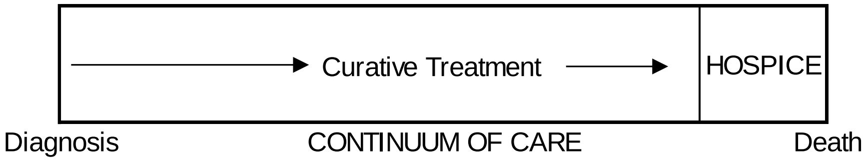

Figure 1. Paradigm of Medical Care with Hospice Care
Adapted from "Living Well at the End of Life: Adapting Health Care to Serious Chronic Illness in Old Age," by J. Lynn, D. M. Adamson, 2003, RAND Health White Paper WP-137, p. 10. Copyright 2003 by RAND Corporation. Adapted with permission.

The definition and application of palliative care began to broaden in the 1990s, when the focus was on the integration of palliative care and curative treatment. The 1995 SUPPORT study jump-started this paradigm shift by demonstrating a substantial lack of such integration. Specifically, the study revealed that the majority of hospital patients experienced untreated physical pain at the end of life, that physicians lacked awareness of patients' preferences of care and that patients' preferences (when known) did not significantly impact processes of care. Additionally, two reports published by the Institute of Medicine (IOM) reports, *Approaching Death* (1997) and *Crossing the Quality Chasm* (2001), emphasized the need to combine the traditional model of medical care and palliative care into a comprehensive approach to care focused on increasing the quality of life for patients with serious illnesses and regardless of disease progression. Sepulveda et al. (2002) suggested that "this change in thinking emerged from a new understanding that problems at the end of life have their origins at an earlier time of the trajectory of disease" (p. 92)

Palliative care became increasingly recognized as an integral part of high-quality health care delivery appropriate and potentially beneficial to patients at the time of diagnosis, not only to patients at the end of life through the channel of hospice care. This paradigm shift was evident through a variety of developments in health care delivery, practice and research. For example, in 2000, the NHO changed its name to the National Hospice and Palliative Care Organization (NHPCO) in recognition of the need to expand the application of palliative care. Also, the World Health Organization's (WHO) definition of palliative care was considerably modified in 2002. The WHO initially regarded palliative care as an approach to care that is focused on pain relief and targeted toward cancer patients who do not respond to curative or life-prolonging treatments. The updated definition, however, emphasized that palliative care may not be limited to patients at the end of life, but instead, may be appropriate and beneficial for all patients with serious or life-threatening illnesses and at any stage of the illness trajectory (World Health Organization, 2002). The new definition broadened its focus to consider the treatment of all disease-related symptoms, such as physical, social, psychological, and spiritual needs, and attend to the patient's family members' well-being and health both during the patient's illness and after the patient's death by means of bereavement support (Sepulveda et al., 2002).

In 2001, palliative care leaders met at a conference organized by the Center to Advance Palliative Care (CAPC) to discuss the current state of palliative care in the United States, which eventually led to the foundation of the National Consensus Project for Quality Palliative Care (NCP) (NCP, 2013). The NCP first published its *Clinical Guidelines for Quality Palliative Care* in 2004, which included the core concepts and structures of quality palliative care and eight domains of practice, as presented in the previous section. In the 2006 report *A National Framework and Preferred Practices for Palliative and Hospice Care Quality*, the National

Quality Forum (NQF) endorsed and included NCP's clinical guidelines and domains of practice, which were used as a foundation to develop a set of preferred practices developed to improve palliative care. The guidelines have been updated in 2009 and 2013 to reflect the current state of research and practice. The modern paradigm of medical care that recognized the need to integrate palliative care early in the illness trajectory is presented in Figure 2.

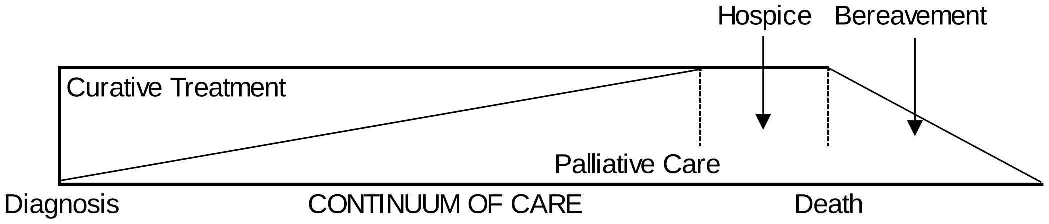

Figure 2. Paradigm of Medical Care with Palliative Care, Hospice Care, and Bereavement
Adapted from "Living Well at the End of Life: Adapting Health Care to Serious Chronic Illness in Old Age," by J. Lynn, D. M. Adamson, 2003, RAND Health White Paper WP-137, p. 10. Copyright 2003 by RAND Corporation. Adapted with permission.

Recognizing the need to provide access to palliative care to patients regardless of age, stage of illness, and health care setting has translated into a wide-variety of quality-improvement projects, which are concerned with improving palliative care in hospital settings (e.g., ICUs, emergency rooms), in other health care settings (e.g., ambulatory clinics, home health), and for certain patient populations (e.g., neonatal/pediatric patients, AIDS/HIV patients). The following section defines and describes the different delivery models of palliative care relevant to this study's research focus.

Delivery Models of Palliative Care

Palliative care is provided in a range of health care settings, including hospitals, the patient's home (e.g., the patient's residence, nursing homes, or assisted-living facilities), hospices, and ambulatory or outpatient clinics (e.g., physician's offices, transitional care facilities, or cancer centers). In the United States, palliative care is predominately delivered at home, in hospices, and in the hospital setting. This study centers on the provision of palliative care in the hospital setting.

There are four major delivery models for hospital-based palliative care, including integrative models, inpatient palliative care consultation services, inpatient palliative care units, and hospice programs. Integrative models, or primary palliative care, focus on incorporating palliative care principles into the daily practices of hospital care (Nelson et al., 2010). The primary goal is to educate clinical staff involved in the patient's routine care on how to address basic palliative care needs. Conversely, inpatient palliative care consultation services, inpatient palliative care units, and hospice programs may be classified as specialty palliative care provided by palliative care experts who are trained to manage patients with complex symptoms, family dynamics, and care decisions (Meier, 2011; von Gunten, 2002).

The diffusion of hospital-based integrative models is difficult to examine due to data limitations. The focus of this study is therefore on specialty palliative care, which is described in the following paragraphs.

Inpatient palliative care consultation services.

Inpatient palliative care consultation services, the prevailing model of palliative care delivery in the hospital setting, provide palliative care consultations to patients and families within the hospital. Such services typically involve an advanced practice registered nurse (APRN) or physician as the primary provider who is trained in palliative care and has access to a palliative care-trained interdisciplinary team comprising nurse practitioners, pharmacists, psychologists, chaplains, social workers, therapists, and volunteers (Nelson et al., 2010; Wiencek & Coyne, 2014). The goal is to provide support to the referring physician to address the needs of patients and their families through recommendations relating to pain and symptom management, goals of care, and coordination of care, while the referring physician typically holds the primary responsibility for the patient (Meier & McCormick, 2015). The AHA Annual Survey of Hospitals defines inpatient palliative care consultation services (also referred to as palliative care programs) as “an organized program providing specialized medical care, drugs, or therapies for the management of acute or chronic pain and/or the control of symptoms administered by specially trained physicians and other clinicians; and supportive care services, such as counseling on advanced [sic] directives, spiritual care, and social services, to patients with advanced disease and their families.”

Inpatient palliative care units.

Inpatient palliative care units are designated units or clusters of beds where specialized medical care with an emphasis on comfort, symptom control, and quality of life is provided. Such units distinguish themselves by centralized palliative care expertise, a family-patient-focused setting, and expert care and support for patients at the end of life and their families (Wiencek & Coyne, 2014). Inpatient palliative care units typically care for patients who have complex symptoms, are imminently dying, and/or cannot be treated in other hospital settings in an optimal manner. These units serve not only these patients but also their family members. The referring physician may transfer the patient’s primary care responsibility to the unit’s palliative care clinicians or keep it after the patient’s transfer to the unit (Meier & McCormick, 2015). Inpatient palliative care units may provide both curative treatment and palliative care, although the focus is primarily on comfort care. The AHA Annual Survey of Hospitals defines palliative care inpatient units as “a physically discreet, inpatient nursing unit where the focus is palliative care. The patient care focus is on symptom relief for complex patients who may be continuing to undergo curative treatment. Care is provided by palliative medicine specialists.”

Hospice programs.

Another form of specialty palliative care includes hospice units and programs, designed to care for patients with terminal illnesses and a life expectancy of six months or less who chose to forgo life-prolonging treatments. The AHA Survey of Hospitals does not distinguish between designated hospice units and hospice consultation services. Instead, it describes hospice programs as “a recognized clinical program with specific eligibility criteria that provides palliative medical care focused on relief of pain and symptom control and other services that address the emotional, social, financial, and spiritual needs of terminally ill patients and their families.”

Diffusion of Palliative Care Delivery Models

Figure 3 demonstrates the diffusion of palliative care services based on inpatient palliative care consultation services (PAL), inpatient palliative care units (IPAL), hospice programs (HOSPC) and NONE (i.e., no PAL, IPAL, or HOSPC present) for urban, non-federal, short-term, and acute care hospitals nationwide and across the study sample for the time period 2007-2011. Note that the study sample includes hospitals located in Arizona, California, Florida, Maryland, New Jersey, and New York, which were in operation throughout the study period and had complete information for the study’s key and control variables (n=348). The national sample consisted of all hospitals present in the 2007-2011 AHA Annual Hospital Survey data (n=1,687). According to Figure 3, the national sample suggests an increase of palliative care in hospitals nationwide, with 54.2% of hospitals having at least one of the three palliative care services in place in 2007 compared to 57.9% of hospitals in 2011. Additionally, while the prevalence of PAL and IPAL rose between 2007 and 2011, the presence of HOSPC decreased over the study period.

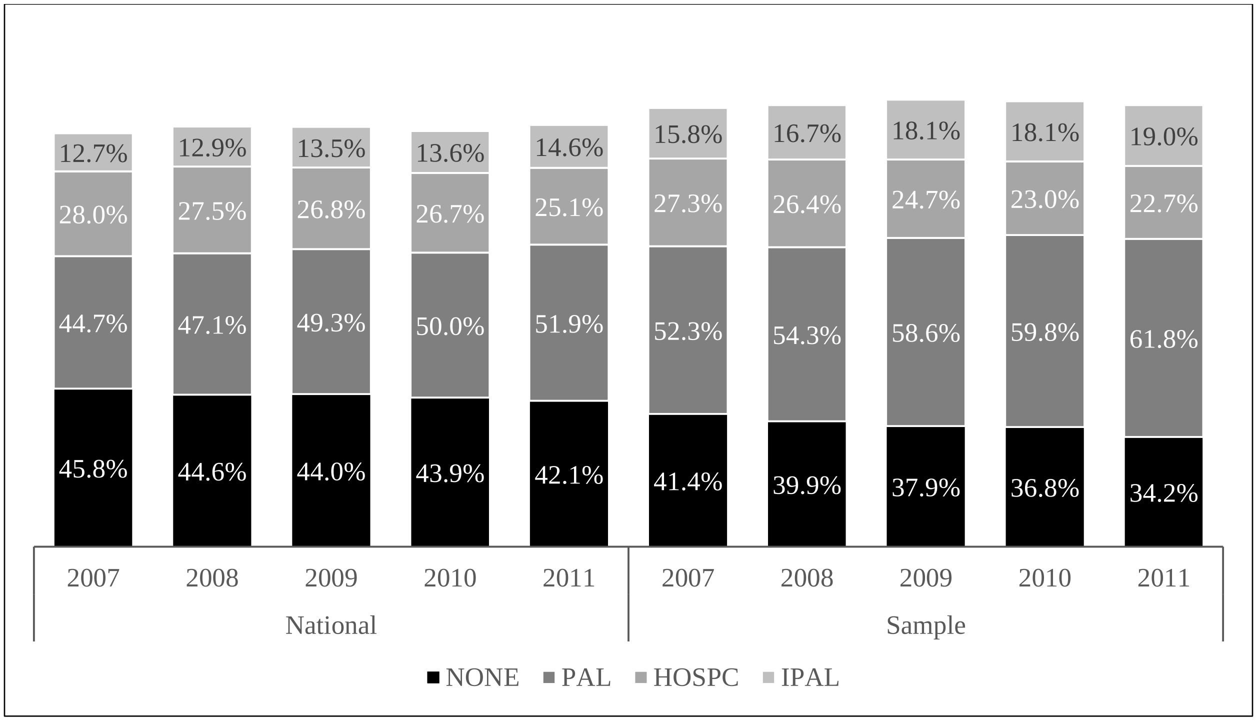

Figure 3. Comparison of Hospital-based Palliative Care in National and Study Sample
Note. Categories do not add up to 100% as hospitals may have multiple palliative care services in place. IPAL=Inpatient palliative care units. HOSPC=Hospice programs. NONE= no PAL, IPAL, or HOSPC present. PAL=Inpatient palliative care consultation services.

This development suggests a gradual shift away from HOSPC toward IPAL and PAL. This development may be in part explained by the similarities between these services and by the fact that IPAL may provide services to a broader patient population, including hospice patients.

Although similar patterns are present among the hospitals in the study sample, several differences are noteworthy. First, hospitals with PAL in the study sample are more prevalent throughout the study period compared to the national sample. While 52.3% and 61.8% of hospitals in the study sample had a PAL in place in 2007 and 2011 respectively, 44.7% and 51.9% of hospitals nationwide had this service in place, respectively. The prevalence of hospitals with IPAL is also higher in the study sample throughout the study period compared to the prevalence of this service in hospitals nationwide. Among hospitals in the study sample, 15.8% and 19% had an IPAL in place in 2007 and 2011, respectively. Among hospitals nationwide, only 12.7% and 14.6% of hospitals had this service in place in 2007 and 2011, respectively. It follows that the study sample has fewer hospitals without any palliative care services (i.e., NONE) compared to the national sample throughout the study period. In other words, the study sample over-represents hospitals with palliative care services. The study's sample selection approach is described in more detail in Chapter 4.

Relevance of Key Variables

Palliative care services have expanded because of the perceived need for these types of services and empirical evidence that they are linked to hospital performance. This study focuses on determining the benefits to hospitals and patients, including lower hospital costs, shorter hospital stays, lower in-hospital mortality, and higher rates of hospice transfers.

From a hospital perspective, providing a service-mix that optimizes both economic viability and quality of care is an important management strategy. Specifically, hospital costs and hospital length of stay are considered key economic indicators of hospital performance. Whereas lower hospital costs may increase hospitals' profit margins, shorter lengths of stay can facilitate patient turnover and care efficiency. From a patient perspective, lower in-hospital mortality and higher rates of hospice transfers may be viewed as positive outcomes, as most patients prefer to die at home or at least outside of the hospital setting.

The following paragraphs discuss in more detail the relevance of hospital costs, hospital length of stay, in-hospital mortality, and transfer to hospice in the context of hospital performance.

Dependent variable hospital cost.

In 2010, 5% of Medicare beneficiaries generated 39% of Medicare spending. These "costly" beneficiaries include patients with multiple chronic conditions, who utilize inpatient hospital services, and who are at the end of life. Palliative care programs, particularly those that are based in hospitals, target this patient population and are thus uniquely qualified to reduce health care spending due to over- or misuse of health care services and inefficient care coordination. Prior research has shown that palliative care programs can prevent health care costs associated with expensive and preventable hospital services, such as hospital readmissions, prolonged ICU stays, emergency department visits, and futile use of hospital resources (Meier, 2011). In particular, May et al. (2014) systematically reviewed empirical evidence regarding the financial impact of hospital-based palliative care and identified consistent savings in hospital costs, ranging from 9% to 25%. Morrison et al. (2011) examined the effect of palliative care consultations on hospital costs among Medicaid enrollees and found that patients who received a palliative care consultation incurred, on average, $6,900 less in hospital costs, spent less time in the ICU, were less likely to die in the ICU, and were more likely to receive hospice referrals than patients who received usual care.

Dependent variable length of stay.

Hospital length of stay (LOS) typically describes the number of days a patient was hospitalized in an inpatient facility. Inpatient days are calculated by subtracting the day of admission from the day of discharge. In health services research, hospital LOS is a widely used indicator of hospital performance. While many factors influence LOS in the hospital (Gruenberg et al., 2006), hospital LOS also provides insight into a hospital’s use of resources, and thus may function as a proxy for efficiency concerning costs, capacity, and quality of care (Kroch, Duan, Silow-Carroll, & Meyer, 2007).

Hospital LOS is a main determinant of hospital costs; that is, cost efficiency is often equated with shorter hospital LOS, holding patient diagnosis and primary treatments constant.

Medicare’s inpatient prospective payment system (IPPS), implemented in 1984, and many commercial insurers have mechanisms in place to incentivize shorter hospital LOS (Cassel, Kerr, Pantilat, & Smith, 2010b). Specifically, under Medicare’s IPPS, hospitals receive a fixed payment per patient admission (Feder, Hadley, & Zuckerman, 1987). For each patient admission within a given diagnosis-related group (DRG), the hospital payment is based on a historically-determined average of hospital costs of all patients within that particular DRG (Averill et al., 2009). While hospitals typically expect to remain in close proximity to the average costs across all patients within a given DRG, mechanisms to improve cost efficiency (i.e., to reduce hospital LOS) without compromising quality of care are generally in the best interest of a hospital’s financial performance.

Minimizing hospital LOS is also viewed as a central approach to improve a hospital’s capacity management and patient flow. Hospitals operating at or close to maximum capacity are likely to consider hospital LOS as an essential tool to avoid patient diversion to other hospitals (Bazzoli, Brewster, Liu, & Kuo, 2003; Cassel et al., 2010b). If a hospital deviates from its optimal capacity due to changes in demand, it is likely to adjust its supply of services to maintain economic viability (Bazzoli et al., 2006). A hospital may also consider changing its management of patient flow by streamlining the care continuum from admission to discharge of a patient.

Prior research has also linked quality of care with hospital LOS. However, the relationship between hospital LOS and quality of care is complex. It is influenced by a variety of factors, including factors related to “organisational culture and hospital bed availability, through availability of ‘step down’ or intermediate care services, to the customs and cultures of the local populace” (Clarke, 2002, p. 209). In addition, the various dimensions of quality of care complicate a simple relational depiction. A widely used measure to capture quality of care in the hospital setting is hospital readmission rates. Hospital readmissions may happen due to insufficient planning of discharge, severe illness progression, or inadequate allocation of follow-up care (Jencks, Williams, & Coleman, 2009). Despite inconclusive findings on the relationship between hospital LOS and hospital readmissions, strategies have been employed to reduce hospital readmission rates and hospital LOS simultaneously. Accordingly, hospital-based palliative care may be a means to avoid unplanned hospital readmissions and reduce hospital LOS by offering a systematic approach to determine patient-centered goals of care based on diagnosis, prognosis, available treatments, and patient preferences and to facilitate efficient patient flow and timely transitions to the most appropriate care settings (Fine, 2004).

Dependent variable in-hospital mortality.

Hospital mortality rates have been a widely used indicator of quality of care and patient safety among hospitals in the United States. For a given hospital, the hospital mortality rate is typically defined as the proportion of patients who die during hospitalization (i.e., in-hospital mortality) or shortly after hospital discharge (i.e., 30-day mortality) (Borzecki, Christiansen, Chew, Loveland, & Rosen, 2010). These types of hospital mortality rates may be reported for the entire patient population (i.e., all-cause hospital mortality) or for patients with specific medical conditions (i.e., condition-specific hospital mortality). If variation in hospital mortality is due to variation in hospitals’ structural or procedural environments, lower hospital mortality rates may indicate higher quality of care (Goodacre, Campbell, & Carter, 2015). More precisely, it may provide evidence of clinical advances in diagnosing and treating patients, changes in discharge patterns, and which structural or procedural characteristics of care can circumvent or minimize preventable patient deaths (Kroch et al., 2007; Tourangeau, Cranley, & Jeffs, 2006). However, variation in hospital mortality is also driven by variation in patient population; that is, higher mortality rates may be associated with a higher proportion of more complex or sicker patients for a given hospital (Goodacre et al., 2015). Risk-adjustment also needs to take into account how diagnoses and comorbidities are coded and how hospital readmissions are handled (Goodacre et al., 2015; Nicholl, 2007). Given appropriate and sufficient risk-adjustment, variation in hospital mortality rates are assumed to be attributable to suboptimal care (Girling et al., 2012).

A variety of national quality improvement efforts have focused on hospital mortality rates, including public reporting and pay-for-performance (P4P) efforts. For example, the Centers for Medicare and Medicaid Services (CMS) and the Hospital Quality Alliance (HQA) started publicly reporting 30-day risk-standardized mortality rates for three common medical conditions, namely for acute myocardial infarction and congestive heart failure in 2007 and for pneumonia in 2008 (Centers for Medicare and Medicaid Services, 2015c). Nonetheless, the practicality of mortality rates to reflect quality of care has been a matter of debate. Cassel et al. (2010a) challenge the use of hospital mortality as a quality of care measure, as it equates patient deaths with medical failure. Patient-specific factors, such as goals of care, are important confounders of mortality for patients with serious chronic illnesses or at the end of life (Cassel et al., 2010a). Hence, if death is inevitable and focus on comfort care is part of the patient’s treatment plan, patient death is an unpreventable and expected outcome for that patient. While hospitals with a greater proportion of such patients may experience higher risk-adjusted mortality rates, they may not necessarily provide inferior quality of care. The use of risk-adjusted mortality rates as a quality measure is based on the assumption that this measure includes a sufficiently large proportion of *preventable* deaths to explain variation in risk-adjusted hospital mortality (Goodacre et al., 2015). Yet recent studies have found weak associations between risk-adjusted hospital mortality rates and preventable mortality rates, deeming risk-adjusted hospital mortality rates poor indicators of quality of care (Girling et al., 2012; Hogan et al., 2015). Hogan et al. (2015) suggest that instead of relying on risk-adjusted mortality rates to assess a hospital's quality of care, "reviews of individual deaths should focus on identifying ways of improving the quality of care, whereas the use of standardized mortality ratios should be restricted to assessing the quality of care for conditions with high case fatality for which good quality clinical data exist." (p. 1) That is, risk-adjusted mortality measures may not be suitable for hospitals with a large proportion of patients with serious, chronic, and terminal illnesses – patients who would greatly benefit from palliative care.

Despite arguable evidence, it is unlikely that mortality rates will vanish from outcomes-related quality domains (Cassel et al., 2010a; Reed, 2010). Cassel et al. (2010a) discusses several approaches to adjust for palliative care-specific circumstances, such as mandating hospitals to publish all diagnoses assigned to a patient. That is, palliative care involvement is typically listed low among secondary diagnoses and, depending on the amount of secondary diagnoses, may not appear at all. Finally, the authors propose to limit mortality analyses to patients undergoing high-risk procedures and patients with acute illnesses. If information on goals of care is not available or not considered, a focus on acute illnesses and high-risk procedures may be an appropriate way to recognize differences in hospital's patient population and corresponding quality of care. While this approach may support the notion that patients with non-acute illnesses (e.g., cancer) are expected to die and patients with acute illnesses (e.g., pneumonia) are expected to live (Holloway & Quill, 2007), objective comparison of mortality rates across hospitals are only fair if differences in goals of care are sufficiently recognized.

In summary, the controversial application of hospital mortality to measure quality of care emphasizes two important issues to consider when using mortality rates in such context. First, it is crucial to control for all relevant patient-level factors influencing mortality, including goals of care (if available). This does not necessarily mean excluding all patients who receive palliative care. While end-of-life or hospice care focuses on patients with a terminal illness, palliative care is appropriate for all patients with a serious illness, regardless of acuity level. Nevertheless, certain patient populations are more likely to have palliative care needs (e.g., cancer patients, older patients) than others, which emphasizes the need to control for such confounding factors. Second, attending to structure and process of care measures when analyzing a hospital's quality of care is essential. Besides difficulties in discriminating between hospitals based on hospital mortality rate alone, the level of mortality rates does not suggest any practical improvement activities (Shih & Schoenbaum, 2007). Hence, hospitals with palliative care services in place may indicate a commitment to high-quality care with the patient's well-being at its core. In addition, palliative care services with appropriate structural and procedural formats are designed to facilitate patient-centered care planning by determining a patient's preference concerning life-prolonging treatment and palliative care, including developing appropriate discharge planning plans, supporting efficiency of care, and avoiding unnecessary hospital readmissions.

Dependent variable transfer to hospice.

The facilitation of hospice transfers may have positive associations with both patient and organizational outcomes. Specifically, for patients at the end of life, a transfer to hospice care may be a more appropriate and desirable alternative to prolonged hospitalization or in-hospital death. Place of death has been proposed as a quality indicator for end-of-life care based on the concept and empirical evidence that most patients prefer to die at home or at least outside of the hospital setting (Bell, Somogyi-Zalud, & Masaki, 2009; Higginson & Sen-Gupta, 2000). In 2013, the majority of patients who received hospice care (66.6%) died in their place of residence (i.e.., private residence, nursing home, and residential facility). The remaining hospice patients died in hospice inpatient facilities (26.4%), and acute care hospitals (7%) (National Hospice and Palliative Care Organization, 2014). Thus, patient preferences to die at home may be realized under hospice care for most patients at the end of life.

Moreover, discharge management, including the facilitation of hospice transfers, may also influence hospital utilization at the end of life with noteworthy implications for quality of care, resource utilization, and health care spending. In particular, there is evidence that hospice enrollment at the end of life among nursing home residents is linked to better pain management, fewer physical restriction, and improved family satisfaction compared to nursing home residents without hospice enrollment (Mukamel et al., 2012). In addition, inpatient care, particularly in the critical care setting, is costly, often perceived as futile, and does not align with all patient and family preferences at the end of life (Barrett, Smith, Elixhauser, Honigman, & Pines, 2014; Huynh et al., 2013; Stricker, Rothen, & Takala, 2003). Still, one in three patients aged 65 and older dies in the hospital, despite a steady decline in hospital inpatient deaths between 1989 and 2007 (Health, 2011). Teno et al. (2013) examined changes in sites of death, places of care, and health care transitions for Medicare decedents in 2000, 2005, and 2009. The researchers found that, while more Medicare patients died at home in 2009 compared to 2005, roughly 10% more patients were admitted to the hospital in the last 90 days prior to death (69.3%) and about 20% more patients were admitted to the ICU in the last 30 days (29.2%) during this period.

In summary, strategies to facilitate care transitions to other health care settings, such as home hospice services or hospice medical facilities, promise to improve both organizational and patient outcomes. Hospital-based palliative care may provide a unique opportunity for hospitals to determine optimal patient-centered tools to assist care transitions, which align with a patient's goals of care, optimize resource use, and reduce unnecessary health care spending by minimizing ineffective treatment strategies.

Hospital Adoption of Palliative Care

Existing studies exploring the adoption of hospital-based palliative care services usually focused on describing organizational and environmental factors that may be related to the adoption of such services. A summary of their findings is provided in Table 3.

Nine studies, published between 2001 and 2015, examined the relationship between market or hospital characteristics and the adoption of hospital-based palliative care services. The studies vary by focus, empirical approach, and sample selection, definition of palliative care services, theory application, and data structure.

The majority of studies (*n*=6) focused on hospital-based inpatient palliative care consultation services. One study examined organizational and market factors associated with hospital-based hospice programs (Harrison et al. 2005). Pan et al. (2001) focused on the two palliative care-related services that were introduced into the AHA Survey of Hospitals in 1998, namely hospital-based end-of-life services and pain management. White, Cochran, and Patel (2002) created an end-of-life care index, ranging from 0 to 3 representing the presence of no to all of three palliative care services, including end-of-life, hospice, or pain management services. The authors examined the association between hospital and market characteristics on the number of palliative care services provided by the hospital, hospital system, network, or joint venture.

In addition, most studies used cross-sectional hospital samples consisting of U.S. non-federal acute care hospitals. Billings and Pantilat (2001) limited their study sample to a 100 randomly selected academic U.S. hospitals in operation in 1999. Morrison, Maroney-Galin, Kralovec, and Meier (2005) studied the growth of hospital-based inpatient palliative care

Table 3

Summary of Palliative Care Adoption Studies

Study	Study Sample	Research Method	DV(s)	Key Findings
Dumanovsky et al. (2015) United States	2293 hospitals for 2013	Descriptive Statistics, multivariate logistic regression	Binary variable: Presence of PAL (hospital-based, provided by health system/network/joint venture)	Hospitals with more beds are more likely to provide PC; public, Catholic Church-operated, and not-for-profit hospitals are more likely to provide PC than for-profit hospitals; SCP hospitals are less likely to provide PC; Hospitals with ACGME accreditation, ACS-approved cancer program, hospice affiliation, and AAMC membership are more likely to provide PC; hospitals with higher mean % in county graduating from 4-year college are more likely to provide PC; hospitals located in the East South Central and West South Central are less likely to provide PC than hospitals located in the Mid-Atlantic; hospitals located in the Pacific region are more likely to provide PC than hospitals located in the Mid-Atlantic region.
Morrison et al. (2011) United States	2,489 hospitals for 2009	Descriptive Statistics	Binary variable: Presence of PAL (hospital-based, provided by health system/network/joint venture)	No statistical analysis employed/reported.
Goldsmith et al. (2008) United States	2,452 hospitals for 2006	Descriptive Statistics Multivariate logistic regression	Binary variable: Presence of PAL (hospital-based, or provided by health system, network, or joint venture)	For-profit and public hospitals are less likely to provide PC than not-for-profit hospitals; SCP hospitals, hospitals with hospice affiliation and ACS-approved cancer program are more likely to provide PC; hospitals located in counties with higher % of bachelor's degree are more likely to provide PC; Hospitals located in the Midwest and West are more likely to provide PC than hospitals located in the Northeast.

Table 3 (continued)

Study	Study Sample	Research Method	DV(s)	Key Findings
Harrison et al. (2005) United States	4,032 hospitals for 2001	Descriptive Statistics Correlation Analysis Multivariate logistic regression	Binary variable: Presence of hospital-based HOSPC	Hospitals with more services and operating expense per patient discharge are more likely to offer HOSPC; hospitals located in counties with higher per capita income and percentage of residents 65 and older are more likely to offer HOSPC; hospitals located in counties with higher unemployment rate and HMO penetration are less likely to offer HOSPC.
Morrison et al. (2005) United States	4,156 hospitals for 2000; 4,064 for 2001 4,163 for 2002 4,226 for 2003	Descriptive Statistics (2000-2003) Multivariate logistic regression (using 2003 data)	Binary variable: Presence of hospital-based PAL	Hospitals with more beds, critical care beds are more likely to provide PC; public, for-profit, and federal/non-VA hospitals are less likely to provide PC than not-for-profit hospitals; VA hospitals are more likely to provide PC than not-for-profit hospitals; hospitals with ACS-approved cancer program, AAMC membership, and hospice affiliation are more likely to provide PC; hospitals located in the census regions Middle Atlantic, South Atlantic, East North Central, West North Central, West South Central, and Pacific are less likely to provide PC than hospitals located in census region New England.
Stover (2005) United States	4,616 hospitals for 2000	Descriptive Statistics Correlation Analysis Multivariate Logistic regression	Binary variable: Presence of hospital-based PAL	Hospitals with ACS-approved cancer program, health system/network membership, more beds, higher percentage of Medicare patients, and COTH membership are more likely to provide PC; for-profit hospitals are less likely to provide PC than not-for-profit hospitals; catholic hospitals are more likely to provide PC than not-for-profit hospitals.

Table 3 (continued)

Study	Study Sample	Research Method	DV(s)	Key Findings
White et al. (2002) United States	3,939 hospitals for 1998	Descriptive Statistics	EOL care index ranging between 0 and 3 based on presence of EOL services, PM, and/or hospice services (hospital-based, or provided by health system, network, or joint venture); 0=no service present,1=1 service present, 2=2 services present; 3=3 services present	Catholic hospitals provide more EOL services than hospitals with other ownerships; hospitals with more beds offer more EOL services; hospitals located in the census regions South Atlantic, East South Central, West South Central, and Pacific provide fewer EOL services than hospitals located in New England.
Billings & Pantilat (2001) United States	100 hospitals for 1999	Descriptive Statistics	Binary variable: Presence of hospital-based PAL, IPAL, HOSPC, and PM	No statistical analysis employed/reported.
Pan et al. (2001) United States	1,120 hospitals for 1998/1999	Descriptive Statistics T-Tests	Binary variable: Presence of hospital-based EOL services and PM	The average hospital with PC had more beds, critical care beds, admissions, Medicare discharges, but less full-time residents.

Note. AAMC=American Association of Medical Colleges. ACGME=Accreditation Council of Graduate Medical Education. ACS=American College of Surgeons. COTH=Council of Teaching Hospitals. DV=Dependent variable. EOL=End-of-life. HMO=Health maintenance organization. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. PC=Palliative care. PM=Pain management. SCP=Sole community provider. VA=Veterans Affairs.

consultation services in federal and non-federal acute care U.S. hospitals between 2000 and 2003. Pan et al. (2001) included all U.S. hospitals in their study sample. Three studies focused on the associations between hospital-based palliative care provision and hospital characteristics (Billings & Pantilat, 2001; Morrison et al. 2005; Pan et al., 2001), while the remaining six studies examined the impact of hospital and market characteristics on hospital-based palliative care provision. “Markets” in these cases were typically defined as counties within a given state.

Most studies (*n*=6) employed multivariate logistic regressions models, while the remaining three studies reported descriptive statistics only (Billings et al., 2001; Morrison et al., 2005; Pan et al., 2001). However, only one study acknowledged and accounted for heteroscedasticity bias at the county-level by clustering standard errors by county (Stover, 2005). Additionally, one study Morrison et al. (2011) reported the variation in the number of board-certified palliative care physicians by Medicare deaths in a given state to indicate a lack of access to palliative care. Most studies (*n*=6) also included controls for nine census regions (i.e., Mid-Atlantic, New England, South Atlantic, East-North Central, East-South Central, West-North Central, West-South Central, Mountain, and Pacific) in their descriptive statistics or multivariate logistic regression models to control for regional variation in palliative care provision.

The primary datasets used in the studies were the Area Health Resources Files (AHRF) to collect market characteristics and the AHA Annual Survey of Hospitals to identify hospitals with or without palliative care services and gather additional hospital characteristics, such as bed size, ownership type, and teaching status. Billings et al. (2001)’s study was the only study that randomly selected and surveyed hospitals in the Council of Teaching Hospitals (COTH) directory to collect such information. This is likely due to the fact that the AHA Annual Survey of Hospitals first inquired about hospital-based palliative care services in 2000 (Stover, 2005).

One of the nine studies applied organizational theories to derive specific research questions and hypotheses (Stover, 2005). The remaining eight studies focused largely on providing a general overview of the prevalence of hospital-based palliative care services and describing the organizational and environmental differences between hospitals with and without palliative care services rather than using a theoretical or conceptual framework to explain why such differences exist. Five of the nine studies belong to a series of reports published in five-year intervals to give an account on the state of hospital-based palliative care programs in non-federal acute care hospitals in the United States (Dumanovsky et al., 2015; Morrison et al., 2011; Goldsmith, Dietrich, Du, & Morrison, 2008; Morrison et al., 2005; Pan et al., 2001). Several of the nine studies found significant relationships between hospital-based palliative care services and hospital or environmental characteristics. Hospital characteristics, including teaching status, hospital size, hospice affiliation, and not-for-profit ownership had a positive association with the probability of hospital provision of palliative care services. Environmental characteristics, including educational level in a county and census region, were typically good predictors of hospital-based palliative care services.

Hospital Performance Effects of Palliative Care

Fifty-six studies evaluating the effect of hospital-based palliative care on the study's four dependent variables, published between 1988 and 2015, have been reviewed in this study. A summary of the empirical findings is presented in Table 4.

Note that several published reviews have previously summarized the empirical evidence on the association between palliative care services and this study's dependent variables. Specifically, ten reviews synthesized empirical findings regarding the relationship between palliative care services and hospital and ICU costs (Higginson et al., 2002; Douglas et al., 2003;

Table 4

Summary of Outcome Evaluation Studies

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Ahrens et al. (2003) United States	Type: PAL	Setting: ICU Sample: 43 PC 108 UC	Single-center, Non-RCT, prospective, cohort study	Hospital charges; ICU LOS; Hospital LOS; In-hospital mortality	Lower (~35%) mean hospital variable direct charge per patient (*p* = .01), lower (~37%) hospital variable indirect charges per patient (*p* = .007), lower (~37%) fixed charges per patient (*p* = .006) for PC than UC; Lower (~31%) hospital LOS (*p* = .03), lower (~36%) ICU LOS (*p* = .09) for PC than UC; in-hospital mortality not statistically different.
Albanese et al. (2013) United States	Type: IPAL	Setting: IPAL Sample: 209 PC 55 UC	Single-center, Observational	Hospital costs	Lower (~69%) mean daily direct costs for IPAL who died in IPAL than UC (*p* not reported).
Andereck et al. (2014) United States	Type: PAL	Setting: ICU Sample: 240 PC 238 UC	Single-center, RCT	Hospital costs; Hospital LOS; ICU LOS;	*Live discharges:* ICU LOS, hospital LOS, and mean hospital costs not statistically different. *Decedents:* ICU LOS, hospital LOS, and mean hospital costs not statistically different.
Azoulay et al. (2002) France	Type: Integration	Setting: ICU Sample: 87 PC 88 UC	Multi-center, Cluster RCT, prospective blinded	ICU LOS; ICU mortality	ICU LOS and ICU mortality not statistically different.

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Back et al. (2005) United States	Type: PAL	Setting: Mixed Sample: 82 PC 183 UC	Single-center, Observational	Hospital LOS; In-hospital mortality	Lower (~24%) mean hospital LOS for PC than UC ($p < .05$); Fewer PC patients (21%) died in acute care setting than UC patients (64%) ($p < .05$).
Bakitas et al. (2009) United States	Type: PAL	Setting: Mixed Sample: 161 PC 161 UC	Single-center, RCT	Hospital LOS; ICU LOS; Hospice transfer; In-hospital mortality	Mean hospital LOS, ICU LOS, referrals to hospice, and survival not statistically different between PC and UC patients.
Bendaly et al. (2008) United States	Type: PAL	Setting: Mixed Sample: 61 PC 55 UC	Single-center, Observational	Hospital charges; Hospital LOS	Lower (~16%) median total charges for PC than UC ($p = .001$); Mean hospital LOS not significantly different.
Binney et al. (2014) United States	Type: HOSPC	Setting: Hospice Sample: 167 PC (died) 99 UC (died)	Multi-center, Observational	Hospital costs; Hospital LOS; ICU LOS;	Mean LOS in HOSPC of 3.5 days translates into 585 ICU days avoided and $1,384,110 saved (2011 currency); Lower mean hospital LOS for HOSPC (10.3 days) than ICU patients (13.6 days) ($p < .05$), higher mean ICU LOS for HOSPC (9.8 days) than ICU patients (7.2 days) ($p < .05$).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Campbell et al. (2003) United States	Type: PAL	Setting: ICU Sample: *Multi-organ system failure (MOSF):* 21 PC 22 UC *Global cerebral ischemia (GCI):* 20 PC 18 UC	Single-center Observational, historical controls	Hospital costs; Hospital LOS; ICU LOS	*MOSF patients:* Higher (~113%) mean daily cost savings after DNR order for PC patients than UC if CMO elected ($p < .05$); Lower (~27%) mean hospital LOS for PC patients than UC, mean ICU LOS not statistically different. *GCI patients:* Difference in mean daily cost savings after DNR order not statistically different; Lower (~45%) mean hospital LOS ($p < .001$) and lower (~48%) ICU LOS ($p < .01$) for PC patients than UC.
Campbell et al. (2004) United States	Type: PAL	Setting: ICU Sample: 26 PC 26 UC	Single-center, Observational, historical controls	Hospital LOS; ICU LOS; In-hospital mortality	Lower (~39%) mean hospital LOS ($p < .007$), lower (~49%) mean ICU LOS ($p < .004$) for PC than UC; Mean in-hospital mortality not statistically different.
Carlson et al. (1988) United States	Type: PAL	Setting: ICU Sample: 93 patients	Single-center, Observational, pre-post	Hospital charges; Hospital LOS; ICU LOS; In-hospital mortality;	Lower (~31-64%) mean hospital charges for PC than UC ($p < .05$); lower (~33-70%) mean hospital LOS for PC than UC ($p < .05$); ICU LOS and in-hospital mortality not statistically different.

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Cassel et al. (2010c) United States	Type: PAL	Setting: Mixed Sample: 91 PC patients 20 PC patients	Single-center Observational, before-and-after study	Hospital charges; Hospice transfers; In-hospital mortality	Lower (~25%) mean hospital charges for PC than UC (*p* not reported); More transfers to hospice for PC than UC (*p* not reported); No increase in-hospital mortality (*p* not reported).
Cheung et al. (2010) United States	Type: PAL	Setting: ICU Sample: 10 PC patients 10 UC patients	Single-center, RCT	Hospital LOS; ICU LOS; In-hospital mortality	Median hospital LOS, median ICU LOS, hospital and ICU mortality not statistically different.
Ciemins et al. (2007) United States	Type: PAL	Setting: Mixed Sample: 27 PC patients 128 UC patients	Single-center, observational, interrupted time-series, matched cohort design	Hospital costs; Hospital LOS	Lower (~13%) mean daily costs for PC than UC (*p* < .01); lower (~16%) mean costs per admission for PC than UC (*p* < .00001); Mean/Median hospital LOS not significantly different.
Cowan (2004) United States	Type: PAL	Setting: Mixed Sample:164 PC patients 152 UC patients	Single-center, observational, cohort study	Hospital charges;	Lower (~6%) mean daily charges for PC than UC (*p* = .006); PC reduces hospital LOS for patients with hospital LOS ≥ 7 (0.55–3.55 days).
Curtis et al. (2008) United States	Type: Integration	Setting: ICU Sample: 337 PC patient (post-PAL) 253 UC patients (pre-PAL)	Single-center, observational, pre-post study	Hospital LOS; ICU LOS;	Lower (~19%) mean ICU LOS for PC (post-PAL) than UC (pre-PAL) (*p* = .01), lower (~20%) mean hospital ICU for PC (post-PAL) than UC (pre-PAL) (*p* = .02).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Curtis et al. (2011) United States	Type: Integration	Setting: ICU Sample: 669 PC patients 570 UC patients	Multi-center, RCT	ICU LOS	ICU LOS not statistically different.
Daly et al. (2010) United States	Type: Integration	Setting: ICU Sample: 354 PC patients 135 UC patients	Multi-center, observational, pre-post study	Hospital LOS; ICU LOS; In-hospital mortality	Mean hospital LOS, ICU LOS, hospital mortality, and ICU mortality not statistically different.
Davis et al. (2005) United States	IPAL	N/A	Multi-center, observational	Hospital charges	Higher (~9%) mean total charges in IPAL than national mean charges (no *p* reported), Lower (~33%) mean pharmacy and laboratory charges in IPAL than national mean charges (no *p* reported).
Detering et al. (2010) Australia	Type: PAL	Setting: Mixed Sample: 154 PC patients 155 UC patients	Single-center, RCT	In-hospital mortality	Lower ICU mortality for PC (0%) than UC (15%) (*p* = .03); hospital mortality not statistically different.
Digwood et al. (2011) United States	Type: IPAL	Setting: ICU Sample: 2,319 (pre-IPAL) 2,716 (post-IPAL)	Single-center, observational, pre-post	ICU LOS; ICU mortality;	Lower mean ICU LOS after IPAL opening (4 days) than before (4.6 days) (*p* = .014); Lower (~24%) ICU mortality after IPAL opening than prior to opening (*p* = .003).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Dowdy et al. (1998) United States	Type: PAL	Setting: Mixed Sample: 31 PC patients 68 UC patients	Single-center, non-RCT	Hospital charges; ICU LOS In-hospital mortality	In-hospital mortality and hospital charges not statistically different. *Live discharges:* Lower ICU LOS for PC than UC (*p* not reported). *Decedents:* Lower (minus 13 days) ICU LOS for PC than UC (no *p* reported).
Elsayem et al. (2004) United States	Type: IPAL	Setting: IPAL in cancer center Sample: 320 IPAL patients	Single-center, observational	Hospital charges; In-hospital mortality;	In-hospital mortality between before and after IPAL opening not different (no *p* reported); Lower (~38%) mean daily charges in IPAL than in entire hospital (no *p* reported)
Elsayem et al. (2006) United States	Type: IPAL	Setting: IPAL Sample: N/A	Single-center, observational, longitudinal (1999-2004), IPAL established in 1999	In-hospital mortality; ICU mortality	In-hospital mortality remained constant over time ($p > .2$); ICU mortality decreased from 38% (1999) to 28% (2004).
Field et al. (1989) United States	Type: PAL	Setting: ICU Sample: 20 patients (pre consult) 20 patients (post-consult)	Single-center, observational, pre-post	In-hospital mortality; Hospital LOS; ICU LOS;	In-hospital mortality and hospital LOS not statistically different (no *p* reported); Lower ICU LOS after intervention (6 days) than before (12 days) ($p < .01$).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Foreman et al. (2015) Canada	Type: PAL	Setting: Mixed Sample: 65 PC patients 35 UC patients	Single-center, observational	Hospital costs;	Lower (~80%) medical-imaging costs ($p =.01$), lower (~36%) laboratory costs ($p = .024$), lower (~48%) total healthcare costs ($p = .001$), and higher (~28%) physician costs ($p = .05$) for PC than UC.
Gade et al. (2008) United States	Type: PAL	Setting: Mixed Sample: 275 PC patients 237 UC patients	Multi-center, RCT	Total health care costs; Hospital LOS; In-hospital mortality; Hospice transfers	Lower (~31%) mean total healthcare costs for PC than UC ($p = .001$); Mean hospital LOS not statistically significant; Higher (~114%) in-hospital mortality for PC than UC ($p = .002$); Patients admitted to hospice not statistically significant.
Hall et al. (2004) Canada	Type: Integration	Setting: ICU Sample: 138 patients (pre PC) 168 patients (post PC)	Single-center, observational, pre-post	Hospital LOS; ICU LOS;	Reduced hospital LOS (16.4 to 10.5 days) ($p = .005$) ICU LOS not statistically different.
Hanson et al. (2008) United States	Type: PAL	Setting: Mixed Sample: 104 PC patients 1,813 UC patients	Single-center, observational	Hospital costs; ICU mortality	Lower (~11%) daily variable costs for PC than UC ($p = .03$); more (~20%) cost savings if PC for more than 50% of hospital LOS
Holloran et al. (1995) United States	Type: Integration	Setting: ICU Sample: N/A	Single-center, observational, pre-post	ICU LOS	Decreased LOS for SICU patients ($p < .05$).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Hsu-Kim et al. (2014) United States	Type: PAL	Setting: ICU Sample: 41 PC patients 80 UC patients	Single-center, observational	Hospital costs; Hospital LOS; ICU LOS; In-hospital mortality	Mean daily costs not statistically different; Higher (~73%) hospital LOS, higher (~100%) ICU LOS, and higher (~414%) in-hospital mortality (*p* < .01) for PC than UC.
Jung et al. (2012) South Korea	Type: IPAL	Setting: IPAL Sample: 126 IPAL patients 461 UC patients	Single-center, observational	Hospital costs	Lower (~27%) total medical costs for IPAL than UC (*p* < .001); increasingly lower (~33%) medical costs 1-2 months prior to death for PC than UC (*p* = .001).
Lamba et al. (2012) United States	Type: PAL	Setting: ICU Sample: *Live discharges* 58 Pre PC 73 Post PC *Decedents* 21 Pre PC 31 (post PC)	Single-center, observational, pre-post	Hospital LOS; ICU LOS	*Decedents:* Mean ICU LOS and mean hospital LOS Not statistically different
Lautrette et al. (2007) France	Type: Integration	Setting: ICU Sample: 63 PC patients 63 UC patients	Multi-center, RCT	Hospital LOS; ICU LOS	Mean hospital and ICU LOS not statistically different.

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Lilly et al. (2000,’03) United States	Type: Integration	Setting: ICU Sample: 396 Post PC 134 Pre PC (2,361 PC patients in 4-year follow-up)	Single-center, observational, pre-post	ICU LOS; ICU mortality	Lower median ICU LOS for PC (3 days) than UC (4 days) (*p* =.01); ICU LOS remains 3 days for PC patients in follow-up period. *Decedents:* Lower median ICU LOS for PC patients with highest risk of mortality (3 days) than UC patients with highest risk of mortality (5 days) (*p* = .02); Lower ICU mortality for PC (22.7%) than UC (31.3%) (*p* = .01), lower ICU mortality for PC in follow-up period (18%).
Lo et al. (2002) Taiwan	Type: HOSPC	Setting: N/A Sample: 912 hospice patients 25,544 UC patients	Observational (based on insurance claims data)	Healthcare costs	Lower total healthcare costs for PC than UC patients (*p* = .01).
Lustbader et al. (2011) United States	Type: PAL	Setting: ICU Sample: *Decedents* 693 PC patients 515 UC patients	Single-center, observational, historical controls	Hospital LOS; ICU LOS; ICU mortality	Shorter median hospital LOS for PC (11 days) than UC (12 days) (*p* < .0106); ICU LOS not statistically different; Lower (~34%) ICU mortality for PC than UC (*p* < .0005).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Morrison et al. (2008) United States	Type: PAL	Setting: Mixed Sample: *Live discharges* 2,630 PC patients 18,427 UC patients *Decedents:* 2,278 PC patients 2,124 UC patients	Multi-center, observational	Hospital costs	*Live discharges:* Lower (~14%) total costs (*p* = .02), lower (~19%) daily total costs (*p* < .001), lower (~15%) direct costs per admission (*p* = .004), lower (~21%) daily direct costs (*p* < .001), lower (~35%) laboratory costs, lower (~73%) ICU costs (*p* < .001) for PC than UC *Decedents:* Lower (~18%) total costs (*p* = .001), lower (~22%) daily total costs (*p* < .001), lower (~22%) direct costs per admission (*p* = .003), lower (~45%) daily direct costs (*p* < .001), lower (~34%) laboratory costs, lower (~27%) pharmacy costs, lower (~45%) ICU costs (*p* < .001) for PC than UC.
Morrison et al. (2011) United States	Type: PAL	Setting: Mixed Sample: *Live discharges:* 290 PC patients 1,427 UC patients *Decedents:* 185 PC patients 149 UC patients	Multi-center, observational	Hospital costs; ICU costs, ICU LOS; Hospice transfer ICU mortality	*Live discharges:* Lower (~11%) mean total costs per admission (*p* < .05), lower (~18%) mean daily costs (*p* < .001), and lower ICU costs (*p* < .001) for PC than UC; More PC patients (30%) than UC patients (1%) were discharged to hospice (*p* < .001); Mean ICU LOS not statistically different. *Decedents:* Lower mean (~11%) total costs per admission (*p* < .05), lower (~9%) mean daily costs (*p* < .01), lower (~21%) mean pharmacy costs (*p* < .05); Mean ICU LOS shorter (~26%) for PC than UC (*p* < .05); Fewer PC patients (34%) than UC patients (58%) died in the ICU (*p* < .05).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Mosenthal et al. (2008) United States	Type: Integration	Setting: ICU Sample: *Live discharges* 244 Pre PC 321 Post PC *Decedents* 42 Pre PC 46 Post PC	Single-center, observational, pre-post	Hospital LOS; ICU LOS; In-hospital mortality	*Decedents:* Shorter mean ICU LOS for PC (6.1 days) than UC (7.6 days) (no *p* reported), shorter mean hospital LOS for PC (6.5 days) than UC (14.4 days) (no *p* reported); Lower in-hospital mortality for PC (14%) than UC (15%) (no *p* reported).
Norton et al. (2007) United States	Type: PAL	Setting: ICU Sample: 126 PC patients 65 UC patients	Single-center, quasi-experimental	Hospital LOS; ICU LOS In-hospital mortality;	Mean hospital LOS not statistically different, lower (~45%) ICU LOS for PC patients than UC patients (*p* = .0001); Mean ICU mortality not statistically different, PC patients who died in the ICU had significantly shorter ICU LOS.
O’Mahony et al. (2005) United States	Type: PAL	Setting: Mixed Sample: 77 PC patients (post PC) 77 UC patients (pre PC)	Single-center, observational, pre-post	Hospital charges; Hospital LOS;	Lower median number of ventilator charges for patients post PC (n=4) than patients prior to PC (n=0) (*p* < .0001), lower (~63%) median total ventilator charges (*p* < .0001); Lower median LOS for patients transferred to hospice after PC (9 days) than prior to PC (12 days) (*p* < .05).
Penrod et al. (2006) United States	Type: Integration	Setting: Mixed Sample: 82 PC patients 232 UC patients	Multi-center, observational	Hospital costs; Hospital LOS; ICU LOS	Lower (~31%) daily direct costs for PC than UC (*p* = .0001); Mean hospital LOS not significantly different between PC and UC (*p* = .44); Mean ICU LOS shorter (~57%) for PC patients than UC patients (*p* = .007).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Penrod et al. (2010) United States	Type: Integration	Setting: Mixed Sample: 606 PC patients 2,715 UC patients	Multi-center, observational	Hospital costs; Hospital LOS; ICU LOS;	Lower daily direct hospital costs, nursing, radiology, pharmacy, and laboratory costs for PC than UC; Mean hospital LOS higher (~79%) for PC than UC; mean ICU LOS higher (~94%) for PC than UC; PC less likely (~44%) to be admitted to ICU than UC (no *p* reported).
Quenot et al. (2011) France	Type: Integration	Setting: ICU Sample: 678 expired (pre PC) 823 expired (post PC)	Single-center, observational, pre-post	In-hospital LOS; ICU LOS	Among patients who withheld or withdrew life-prolonging therapy, fewer median ICU days after intervention (7 days) than before (13 days) ($p < .05$) until death in ICU, fewer median hospital days after intervention (10 days) than before intervention (14 days) until death in hospital ($p < .05$).
Schneiderman et al. (2000) United States	Type: PAL	Setting: ICU Sample: 35 PC patients 35 UC patients	Single-center, RCT, Prospective	ICU LOS; In-hospital mortality	In-hospital mortality not statistically different. *Decedents:* Lower (~68%) mean ICU LOS for ethics patients than UC ($p = .03$).
Schneiderman et al. (2003) United States	Type: PAL	Setting: ICU Sample: 276 PC patients 270 UC patients	Multi-center, RCT, Prospective	Hospital LOS; ICU LOS; In-hospital mortality	In-hospital mortality not statistically different. *Decedents:* Lower (~25%) mean hospital LOS for ethics patients than UC ($p = .01$) and lower (~18%) mean ICU LOS for PC than UC ($p = .03$).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Shelton et al. (2010) United States	Type: PAL	Setting: ICU Sample: 187 PC patients (post PC) 190 UC patients (pre PC)	Single-center, observational, pre-post	Hospital costs; Hospital LOS	Mean costs and hospital LOS not statistically different.
Simoens et al. (2010a) Belgium	Type: PAL	Setting: Mixed Sample: 88 PC patients 53 UC patients	Multi-center, observational	Hospital costs	Higher (~24%) mean daily costs for PC than UC (*p* = .002); Lower (~17%) mean daily costs for PC patients in ICU than UC patients (*p* = .025).
Smith et al. (2003) United States	Type: IPAL	Setting: IPAL Sample: 38 PC patients (died in IPAL) 38 UC patients (died in UC)	Single-center, observational	Hospital costs; ICU LOS	Lower mean direct costs (*p* = .004) and lower mean total costs (*p* = .0009) for PC than UC; ICU LOS not statistically different between PC and UC.
Stover (2005) United States	Type: PAL	Setting: Mixed Sample: 555,521 patients	Multi-center, observational	Hospital charges; In-hospital mortality	Hospitals with PAL do not have statistically lower hospital charges or in-hospital mortality.

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
The SUPPORT Principal investigators (1995) United States	Type: PAL	Setting: Mixed Sample: 2,652 PC patients 2,152 UC patients	Multi-center, cluster RCT	Hospital charges; In-hospital mortality; ICU mortality	For alive discharges, no difference in resource use (in US$1993) (no *p* reported); Lower median hospital charges for PC ($27,000) than UC ($33,000) (no *p* reported); Mean hospital and ICU mortality not different (no *p* reported).
Treece et al. (2004) United States	Type: Integration	Setting: ICU Sample: 41 UC patients (pre PC) 76 PC patients (post PC)	Single-center, observational, Pre-post	Hospital LOS; ICU LOS	Median hospital LOS and median ICU LOS not statistically different.
Weckmann et al. (2013) United States	Type: HOSPC	Setting: Mixed Sample: 7 hospice patients 202 UC patients	Single-center, observational	Hospital costs; Hospital LOS;	*Decedents:* Lower hospital costs for HOSPC patients than UC ($p < .001$); Lower hospital LOS for HOSPC patients than UC ($p = .02$); Lower (~28%) costs for patients who received PC consult than patients who did not ($p < .04$).
White et al. (2006) United States	Type: IPAL	Setting: IPAL Sample: 1,774 PC patients (died in IPAL) 520 UC patients (died in UC)	Single-center, observational	Hospital costs	Lower (~72%) mean direct costs for PC patients than UC patients in the ICU (*p* not reported), lower (~30%) mean direct costs for PC patients than UC patients in other settings (no *p* reported).

Table 4 (continued)

Study	PC Type	Setting/Sample	Research Design/Method	Relevant Outcomes	Key Findings
Whitford et al. (2014) United States	Type: PAL	Setting: Mixed Sample: *Live discharges* 1,177 PC patients 3,531 UC patients *Decedents* 300 PC patients 900 UC patients	Multi-center, observational	Hospital costs; Hospital LOS; Hospice transfers	More hospice transfers for PC (31%) than UC (1%); hospital LOS not statistically different. *Live discharges:* Lower (~5%) mean total hospital costs for PC than UC ($p < .05$); Higher procedure costs, evaluation and management, image costs, and pharmacy costs for PC than UC (no % or p reported). *Decedents:* Lower (~31%) mean total hospital costs ($p < .05$); lower procedure, evaluation and management, image, pharmacy costs for PC than UC (no % or p reported).

Note. CMO=Comfort measures only. DNR=Do not resuscitate. GCI=Global cerebral ischemia. HOSPC=Hospice program. ICU=Intensive care unit. IPAL=Inpatient palliative care unit. LOS=Length of stay. MOSF=Multi-organ system failure. N/A=Not available. PAL=Inpatient palliative care consultation service. PC=Palliative care. RCT=Random controlled trial. SICU=Surgical intensive care unit. UC=Usual care.

Higginson et al., 2003; Zimmermann et al., 2008; Smith & Cassel, 2009; Higginson & Evans, 2010; Simoens et al., 2010b; El-Jawahri et al., 2011; Smith, Brick, O'Hara, & Normand, 2014; May et al., 2014). Three reviews focused on synthesizing empirical evidence regarding the association between palliative care services and hospital and/or ICU LOS (Cassel et al., 2010b; Aslakson et al., 2014; Khandelwal et al., 2015).

Overall, most studies (*n*=32) evaluated inpatient palliative care consultation services, of which approximately half (*n*=15) took place in ICUs. The remaining studies assessed the effects of integrative models (i.e., primary palliative care) (*n*=13), inpatient palliative care units (*n*=8), and hospice programs (*n*=3). The majority of integrative models embedded palliative care in the ICU setting (*n*=11), while only two embedded palliative care in mixed hospital units (Penrod et al., 2006; Penrod et al., 2010). Finally, the vast majority (*n*=46) were retrospective or prospective observational cohort studies, ten studies applied a randomized controlled trial (RCT) design (e.g., Andereck et al., 2014; Bakitas et al., 2009).

Of 32 studies that evaluated hospital costs, charges or healthcare costs, most studies (*n*=26) identified significantly fewer hospital costs, charges or healthcare costs for patients who received palliative care compared to patients who did not. Six studies did not find any significant differences between patients who received palliative care and patients who did not receive palliative care (Andereck et al., 2014; Dowdy et al., 1998; Hsu-Kim et al., 2015; Shelton et al., 2010; Stover, 2005; The SUPPORT Principal Investigators, 1995). Four studies reported mixed findings regarding hospital costs (Foreman et al., 2015; Simoens et al., 2010a; Whitford et al., 2014; Davis et al., 2005). More than a third of the studies (*n*=11) used hospital charges to evaluate the economic impact of palliative care, although hospital charges are viewed as inadequate proxies for hospital expenditures. In particular, hospital charges are merely the amount the hospital bills to the insurer or patient, not the actual costs the hospital incurred for a certain procedure or service. Hospital charges also vary widely by hospital and are therefore not suitable for comparing results across hospitals. The majority of studies (*n*=21) evaluated hospital costs, a more accurate representation of hospital expenditures. Of those 21 studies, the majority used the hospital's cost-accounting system to retrieve cost measures. Two studies applied cost-to-charge ratios (CCR) to convert hospital charges into costs (Andereck et al., 2014; Whitford et al., 2014). Two studies used alternative measures of costs (Gade et al., 2008; Lo, 2002). In particular, Gade et al. (2008) examined all healthcare costs incurred within the six months after hospitalization, while Lo (2002) used insurance payments from the Taiwanese National Health Insurance claims database as a proxy for healthcare expenditures within one year prior to the patient's death. Overall, the results show that palliative care reduces hospitalization costs, which is consistent with conclusions of similar recent reviews (May et al., 2014; Simoens et al., 2010b; Smith et al., 2014). However, heterogeneous patient populations, particularly in non-RCT studies, may result in selection bias and thus hinder the ability to compare the economic impact of palliative care across studies.

More than half of the reviewed studies (*n*=30) examined hospital LOS. While 13 studies were unable to find a difference in hospital LOS between palliative care and usual care patients (e.g., Ciemins et al., 2007; Lamba et al., 2012; Penrod et al., 2006), 15 studies identified lower hospital LOS for patients who received palliative care compared to patients who received usual care (e.g., Carlson et al., 1988; Lustbader et al., 2011; Mosenthal et al., 2008). The remaining two studies reported higher hospital LOS (Hsu-Kim et al., 2015; Penrod et al., 2010). Similarly, 31 studies measured ICU LOS, 14 of which found shorter ICU LOS (e.g., Penrod et al., 2006), 14 found no difference (e.g., Carlson et al., 1988), and two reported higher ICU LOS (Binney et al., 2014; Hsu-Kim et al., 2015) for patients who received palliative care than patients who received usual care. Overall, empirical evidence on hospital and ICU LOS is inconclusive. The variability in findings may be explained by multiple factors, including the use of research designs. Cassel et al. (2010b) discussed many of these studies in regard to the relationship between inpatient palliative care consultation services and hospital LOS in their literature review. The researchers found that studies that revealed reduced hospital LOS were quasi-experimental designs or randomized controlled trials, which focused on ICU-based palliative care consultations and primarily examined hospital LOS of deceased patients (Cassel et al., 2010b). Particularly in observational studies, the ability to detect differences in hospital LOS may also be influenced by the fact that palliative care consultations often occur relatively late in the hospitalization period, which may result in Type II errors (Cassel et al., 2010b). Similarly, concerns regarding simultaneity bias or reverse causation arise, as prolonged hospital/ICU LOS may result in initiation of palliative care consultations. Cassel et al. (2010b) suggested employing proactive palliative care consultations on a predetermined day of hospitalization or at the time of hospital admission may mitigate these problems. Furthermore, the authors recommended analyzing and reporting the effect of palliative care services on LOS for living and deceased patients separately due to substantial interpretive and consequential differences of reduced LOS for those two patient groups. Another systematic review that summarized studies published between 1995 and March 2014 found more consistent evidence of reduced ICU LOS (Khandelwal et al., 2015). Specifically, 11 of 16 studies reported reduced ICU LOS, while five demonstrated no significant change. Two of the studies without significant changes in ICU LOS examined the effect of a system-level palliative care interventions (e.g., addition of a family support coordinator to the surgical ICU). Khandelwal and her colleagues (2015) concluded in their systematic review that effects may be easier to detect if palliative care interventions take place at the patient level, because the effective palliative care consultations hinge on adapting care plans to the needs of an individual patient. The mean reduction in ICU LOS across all studies estimating ICU LOS was 26% with a standard deviation of 23% (Khandelwal et al., 2015). Similar to Cassel et al. (2010b)'s supposition, the researchers attributed the observed variability in ICU LOS partially to the distinction between alive and deceased patients in their study sample.

Twenty-six studies evaluated in-hospital mortality, including hospital and ICU mortality. Most of the studies (*n*=19) found no significant difference in hospital mortality between patients who received palliative care and patients who received usual care. However, the studies demonstrated consistently lower ICU mortality for patients who received palliative care compared to patients who received usual care (e.g., Digwood et al., 2011; Lilly et al., 2000; Lilly et al., 2003). These results suggest that palliative care facilitates the transition to lower levels of care, which may also be reflected in lower hospital costs. Finally, a small number of studies (*n*=4) evaluated the effects of hospital-based palliative care on hospice transfers (Cassel et al., 2010c; Gade et al., 2008; Morrison et al., 2011; Whitford et al., 2014), three of which demonstrated more transfers or referrals to hospice care for patients who received palliative care compared to patients who received usual care (Cassel et al., 2010c; Morrison et al., 2011; Whitford et al., 2014) and one found no significant difference in hospice transfers between patients who received palliative care and patients who received usual care (Gade et al., 2008).

Study Contribution

This study aims to contribute to prior literature by using multiple measures of hospital-based palliative care and robust analytical methodology. Specifically, this study takes a more comprehensive look at the nature of palliative care services and their effects on selected outcomes than previous work by focusing on the provision of three types of hospital-based specialty palliative care services, namely inpatient palliative care consultation services, inpatient palliative care units, and hospice programs. All of these services are focused on providing end-of-life care. The service descriptions, as identified in this chapter, emphasize symptom and pain management and supportive care to address emotional, psychological, spiritual, financial, legal, and social needs of seriously ill patients and their families.

While the definitions highlight the similarities of the nature of these services, there are also two noteworthy differences. First, while hospice programs serve patients with certain eligibility criteria only (i.e., patients with a terminal illness, life expectancy of six months or less, and willingness to forgo curative treatment), inpatient palliative care consultation services and inpatient palliative care units typically provide services to all patients with serious illnesses regardless of stage of illness, prognosis, and continuation of curative treatments. Second, an inpatient palliative care unit distinguishes itself from the other two services by being a "physically discreet" ward. Conversely, hospice programs provide their services in the hospital, at home, or in other freestanding care facilities. An inpatient palliative care consultation service typically focuses on providing palliative care in the hospital, such as in general wards, ICUs, or other specialized care units.

The similarities between these three services justify the assumption that the factors causing a hospital to provide one type of palliative care service are the same as the factors causing a hospital to offer the other two types of palliative care services; that is, this study models the provision of each of these services jointly in research question one.

On the other hand, each of these services may have a different impact on patient and organizational outcomes. Therefore, this study examines the effect of each of these services on selected outcomes separately in research questions two and three. For example, from a hospital's perspective, it may be critical to know if having an inpatient palliative care unit has a greater impact on economic viability and quality of care compared to the other two palliative care services. Answers to questions, such as “Is an inpatient palliative care unit positively associated with selected outcomes in the presence of a palliative care program and/or a hospice program?” may be useful to hospital managers when deciding to expand, reduce, or modify end-of-life care-related service mixes.

This study also distinguishes between and accounts for the *source* of palliative care services; that is, whether palliative care services are hospital-based or not-hospital-based. Hospital-based palliative care services are owned/provided by the hospital or its subsidiary. Palliative care services that are provided by a health system, network, or joint venture in a hospital’s local community are considered not-hospital-based in this study. The first research question focuses on the provision of at least one of the three hospital-based palliative care services as a dependent variable, and the corresponding analytical model controls for whether not-hospital-based palliative care services are available to hospitals. The availability of not-hospital-based palliative care services is viewed as an important predictor of hospital-based palliative care services. Similarly, for research questions two and three, in addition to three binary variables indicating the presence of hospital-based palliative care services, a control variable for whether a not-hospital-based palliative care service is available is included in the analysis to account for its potential effect on organizational and patient outcomes.

Overall, this study aims to shed light on the differentiating effects of the *types* (i.e., inpatient palliative care consultation services, inpatient palliative care unit, and hospice program) and *sources* (hospital-based or not-hospital-based) of palliative care services on selected outcomes. A question of interest is “Do hospital-based palliative care services have significant effects on outcomes when not-hospital-based palliative care services are present?” If findings suggest otherwise, a hospital may not need to invest in hospital-based palliative care services and, instead, take advantage of resources available through their networks, health systems, or joint ventures in their local community.

In sum, although previous research has studied the nature and effect of hospital-based palliative care services, a broader and more inclusive analysis of hospital-based palliative care services is a natural extension of previous studies and is likely to carry more relevance in decision-making processes at the hospital administrative level. Furthermore, no research study has explored whether hospitals with more experience in providing palliative care services have improved organizational and patient outcomes, as this study attempts to answer under research question three.

This study also uses longitudinal data from several states, located in three of four census regions to assure geographic diversity, to predict the association of hospital and market characteristics with the provision of hospital-based palliative care. This study employs a longitudinal analysis using data on patients, hospitals, and counties from years 2007 through 2011. While cross-sectional designs are limited to estimating correlations between variables, longitudinal designs are able to account for hospital and market characteristics over time. Moreover, this study includes a more inclusive set of control and independent variables derived from organizational theory.

Additionally, hierarchical generalized linear models (HGLM) and hierarchical linear models (HLM) are employed to address this study's research questions and test the corresponding hypotheses. Although most research on health service organizations deals with some form of nested data (e.g., patients nested within hospitals nested within counties nested within states), the majority of studies on hospital adoption of health services and their effects on organizational and patient outcomes have not properly accounted for the complexity of hierarchical data. This study uses HGLM and HLM to estimate effects of variables measured at different levels (i.e., patient, hospital, and county) on a hospital-level outcome (i.e., research question one) and four patient-level outcomes (i.e., research questions two and three). In the context of hierarchical data, this statistical approach has several advantages compared to conventional estimation methods. Some conventional models ignore the hierarchical structure by analyzing higher- and lower-level predictors in the same way. For example, county- and hospital-level variables are included into the conventional, non-hierarchical, single-level model to predict an outcome at the hospital level. Alternatively, patient-, hospital-, and county-level variables are included in a single-level model to predict an outcome at the patient level. In these approaches, standard errors are generally too small since they do not take into account the clustering of the lower-level units within the higher-level units (Raudenbush & Bryk, 2002b). Hence, these models are likely to induce Type I errors. In this study, the hierarchical nature of the data is emphasized and modeled accordingly. Conversely, some studies aggregate lower level information to a higher-level and include the aggregated information with other higher level variables as predictor variables into the single-level model. For instance, patient-level information, such as age, gender, or primary diagnosis, is averaged at the hospital level and included as an explanatory variable. These models may suffer from inefficient regression estimates if the number of nested units within higher-level units varies significantly (Raudenbush & Bryk, 2002b).

Summary

This chapter began with a review of the concept of palliative care, its evolution, and delivery models. It continued with a description of the relevance of key variables in the context of hospital performance and outlined existing evidence on the effects of hospital and market characteristics on palliative care provision and the impact of hospital-based palliative care on hospital costs, hospital length of stay, in-hospital mortality, and transfer to hospice.

The following chapter provides an overview of the theoretical framework used in this study and develops propositions and corresponding hypotheses to address the study’s research questions.

Chapter 3: Theoretical Framework

The underlying conceptual framework for this study is based on organizational theories and frameworks that have been used by other health services researchers to explain the nature of hospital service adoption and how it potentially influences hospital performance. Five propositions and hypotheses are derived from Resource Dependence Theory (RDT) and Institutional Theory (IT) corresponding to research question one: which organizational and environmental forces are associated with the provision of hospital-based palliative care services? Donabedian's (1980) Structure-Process-Outcome framework for quality assessment is applied to derive one proposition and four hypotheses corresponding to research questions two and three, respectively: do hospitals that provide palliative care services have improved organizational and patient outcomes compared to those not providing such services?; and: Is a hospital's experience in providing palliative care services associated with improved organizational and patient outcomes?

This chapter is divided into two main sections. The first section provides an overview of Resource Dependence Theory (Pfeffer & Salancik, 1978), Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), and how Oliver's (1991) model of organizational responsiveness combines both theories. Five propositions and hypotheses from these conceptual perspectives are then developed to explain palliative care adoption in hospitals. The second section discusses Donabedian's (1980) Structure-Process-Outcome framework and establishes two propositions and eight corresponding hypotheses relating palliative care services with the study’s patient and organizational outcomes: hospital costs, length of stay, in-hospital mortality, and care transition to hospice. The last section concludes this chapter with a brief summary.

Hospital Adoption of Palliative Care

To address research question one, five propositions and corresponding hypotheses are derived based on the theoretical perspectives of Resource Dependence Theory (Pfeffer & Salancik, 1978) and Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977).

Resource Dependence Theory is an open-system approach to organizational behavior. According to this theory, a hospital’s survival is contingent on two major determinants: the availability of internal resources and the ability to acquire and maintain critical resources from the environment (Scott & Davis, 2007). Critical resources include economic resources, reputation, and knowledge. This theory posits that organizations are not self-sufficient and must therefore engage in exchanges with other organizations, stakeholders, and the environment to acquire the resources necessary for their survival (Pfeffer & Salancik, 1978). If a hospital is not entirely in control of all conditions or resources necessary to achieve a desired goal or outcome, a certain degree of dependence between actors arises (Casciaro & Piskorski, 2005; Pfeffer & Salancik, 1978). The act of exchanging resources creates power and dependence relations, which make hospitals vulnerable to the demands of resource providers. Dependence is a measure of how potent external constituents in a hospital’s environment are and to what degree they need to be taken into consideration in the decision-making process (Pfeffer & Salancik, 1978). Then, in order to secure a stable flow of critical resources, reduce dependence, and maximize autonomy, hospitals may choose between a variety of strategies and tactics to coordinate these relations (Scott & Davis, 2007).

Institutional Theory, like Resource Dependence Theory, is an open-natural approach to organizational behavior. This theory argues that organizations are shaped and constituted by their institutional environments and corresponding pressures (Scott & Davis, 2007). At the center of this theory lies the concept of institutionalization. Institutionalization has been defined as a means or process to infuse intrinsic value to organizational structures or activities to promote organizational self-maintenance (Scott, 1987). These organizational structures or activities are viewed as adaptive systems formed in response to internal participants and external demands (Selznick, 1996). Once these structures or activities become valued, they are replicated by other organizations over time and are assigned similar meaning within a given society – they become institutionalized (Scott, 1987). These institutional demands or pressures can be viewed as highly rationalized myths that are binding for some organizations.

Oliver's (1991) model of organizational responsiveness combines the theoretical views of Institutional Theory and Resource Dependence Theory (Oliver, 1991). Both theories have been used successfully in prior research studies to explain why, how, and when hospitals respond to external demands, pressures, and expectations (Campbell & Alexander, 2005; Proenca, Rosko, & Zinn, 2000; Zinn, Weech, & Brannon, 1998). The basic argument to justify this combined approach is that both these open-system approaches to organizational behavior focus on the organization's exchange with the environment (Scott & Davis, 2007). The theories assume that organizational strategic choice and response are restricted and shaped by multiple external demands, pressures, and expectations to which organizations must respond to secure survival, stability, and predictability (Oliver, 1991). Organizational responses to institutional pressures imposed by the environment may vary between complying with and resisting such demands. While RDT suggests that powerful constituents are those who control scarce resources, institutional theorists assume that power resides in those who shape and enforce institutional rules, norms, and beliefs, such as government agencies, interest groups, and public opinion (Oliver, 1991; Proenca et al., 2000). Organizational responsiveness to demands of external constituents then varies according to the different assumptions about the degree of choice, awareness of pressures, and self-interest. Resource Dependence Theory assumes an active role of management (i.e., that organizational change is intentional) and that organizations seek to maintain autonomy and obtain resources for survival. Institutional Theory adopts a more passive role of management. It posits that organizations seek legitimacy for survival by conforming to collective norms and beliefs. Yet institutional theorists started to acknowledge explicitly the role of agency, organizational interest, and strategic choice in explaining the variation in organizational responses to institutional environments (Goodrick & Salancik, 1996; Oliver, 1991; Pache & Santos, 2010; Scott, 1987). Research has suggested that organizational interest and discretion is greater when institutional rules are uncertain, unclear, conflicting, or inconsistent with technical requirements (Goodrick & Salancik, 1996; Pache & Santos, 2010). Conflicting institutional demands typically arise in environments where multiple, uncoordinated actors with different views on what is effective and legitimate coexist (i.e., fragmentation) and where these actors have the ability to enforce their demands (i.e., centralization) (Pache & Santos, 2010). The health care environment is indeed inherently complex, uncertain and highly dynamic, manifested by fragmented health care delivery, ambiguous policies and values, incompatible financial incentives, and multifaceted regulatory systems, (Proenca et al., 2000). This diverse environment is likely to pose different, potentially competing demands on hospitals, so that their responsiveness is likely to vary according to type, relative intensity of external pressures, and organizational goals and interests.

Hospitals are increasingly providing palliative care services to their patient population. The hospital’s environment may pose demands, expectations, and norms onto a hospital, to which it may respond through providing palliative care services. Both the internal (i.e., organizational factors) and external environment (i.e., market factors) determine how the hospital functions. According to RDT and IT, organizational and environmental factors may explain why hospitals decide to provide palliative care services. The combined approach by Oliver (1991) is appropriate to explain why hospitals decide for or against providing palliative care services. In this model, five drivers of strategic responses to institutional pressures to conform to norms, demands, or expectations are presented: cause, constituents, control, context, and content. These five categories will function as an overarching conceptual framework for the first five propositions and the corresponding hypotheses to address research question one.

The first antecedent of strategic responsiveness relates to the *cause* of institutional pressures, which refers to “the rationale, set of expectations, or intended objectives that underlie external pressures for conformity” (Oliver, 1991, p. 161). This factor refers to the reason that a focal hospital is pressured to conform to norms, demands, or expectations. A related factor is *control*, which relates to the method or means by which a hospital is pressured to conform to external pressures. Due to its similarity, control will not be discussed separately (Fareed, 2013). The decision to conform or not depends on how much a hospital agrees with and values the objectives and intentions of institutional constituents who try to pressure hospitals to be more economically and socially accountable. Integrating palliative care into the hospital’s service mix is said to improve quality of care and increase a hospital’s economic viability through cost-savings when provided to patients who are most likely to benefit from palliative care services (Center to Advance Palliative Care, 2014). In particular, the National Quality Forum (NQF) developed quantifiable quality indicators for palliative care in the hospital setting; the Joint Commission provides an advanced certification for palliative care; and the National Consensus Project for Quality Palliative Care (NCP) promotes evidence-based practices to optimize palliative care programs. An industry-wide emphasis on the importance of palliative care in providing high-quality care may be viewed as an institutional pressure, which, in turn, may influence a hospital with similar values and objectives to provide palliative care services in hope of reaching or maintaining legitimacy and economic health (Oliver, 1991; Proenca et al., 2000). This is particularly true for large hospitals, as their size increases their visibility and public exposure. From an economic perspective, a positive relationship between hospital size and palliative care provision may also imply the existence of economies of scope. Therefore, it is proposed,

Proposition 1: Hospital size is positively associated with the provision of palliative care services.

- Hypothesis 1: Hospitals with more staffed and set-up beds are more likely to provide palliative care services compared to hospitals with fewer staffed and set-up beds, *ceteris paribus*.

Another antecedent of strategic responsiveness relates to the environmental context, in which institutional pressures are exercised. According to RDT, the level of market competition is an essential external factor that influences organizational change (Zinn et al., 1998). Greater competition increases the demand on a shared pool of resources (Fareed & Mick, 2011; Zinn et al., 1998). Hospitals must compete for the same resources, which makes inputs scarcer and pressures hospitals to differentiate themselves from competitors (Kazley & Ozcan, 2007). Providing hospital-based palliative care services may be seen as a method to attract patients and manage organizational interdependence (Scott & Davis, 2007). In areas with a higher density of competitors, more hospitals compete for the same patient population (e.g., patient referrals). Providing hospital-based palliative care services may be a visible indicator of the hospital's effort to accommodate the internal and external stakeholders. In competitive markets, hospitals may argue that the provision of palliative care services makes them more attractive to potential patients, who have a wider variety of health care settings to choose from compared to less competitive markets (Kazley & Ozcan, 2007). Offering hospital-based palliative care services may establish a competitive advantage in securing the flow of resources needed for organizational success (Zinn et al., 1998). Thus,

Proposition 2: Market competition is positively associated with the provision of palliative care services.

- Hypothesis 2: Hospitals in more competitive markets (i.e., counties) are more likely to provide palliative care services compared to hospitals in less competitive markets (i.e., counties), *ceteris paribus*.

Interconnectedness is another context-related predictor of organizational conformity (Oliver, 1991). Organizations in highly interconnected environments are predicted to be more likely to comply with the values, norms, or expectations of the environment, facilitated by voluntary or regulatory diffusion of information and best-practice guidelines (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Pfeffer & Salancik, 1978). Hospitals affiliated with a health system typically have access to greater internal resources (e.g., capital to invest in palliative care services) to respond to environmental pressures (Banaszak-Holl, Zinn, & Mor, 1996). On the other hand, the availability of alternative sources for key resources may also moderate the need to comply with such pressures (Zinn, Weimer, Spector, & Mukamel, 2010).

That is, having access to palliative care services through a health system, network, or joint venture in the local community provides an alternative source of such services. Hospitals affiliated with a health system, network, or joint venture offering palliative care services at another location may be less likely to provide their own palliative care services. Therefore, it is proposed,

Proposition 3: The availability of alternative sources for palliative care services is negatively associated with the provision of palliative care services.

- Hypothesis 3: Hospitals that have access to palliative care services through a health system, network, and/or joint venture in their local community are less likely to provide palliative care services in-house, *ceteris paribus*.

Constituents are stakeholders who express expectations, norms, or demands, to which hospitals may feel pressured to conform (Oliver, 1991). Providing cost-effective care is one of the primary demands of public payers, such as Medicare. Palliative care practices in the hospital setting have been shown to contain hospital costs, reduce length of stay in the hospital and ICU, decrease the use of unnecessary treatments, and decrease 30-day hospital readmissions (Nelson, Chand, Sortais, Oloimooja, & Rembert, 2011). Providing hospital-based palliative care services may be viewed as a means to meet demands related to the provision of cost-effective care. In addition, Medicare patients are typically good candidates for palliative care services, as they are older and tend to spend an extended period of time in the hospital at the end of life. Hospitals with a greater Medicare share of inpatient days are more likely to depend on Medicare reimbursements for economic survival than hospitals with a lower proportion of Medicare patients. Thus, it is proposed, Proposition 4: Medicare dependence is positively associated with the provision of palliative care services.

- Hypothesis 4: Hospitals with a greater Medicare share of inpatient days are more likely to provide palliative care services compared to hospitals with a smaller Medicare share of inpatient days, *ceteris paribus*.

The final antecedent of strategic responsiveness, content, relates to which particular expectations, norms, or demands the hospital needs to conform. In other words, content refers to the nature of environmental pressures (Oliver, 1991). If such pressures are consistent with the hospital's internal goals, values, and mission, a hospital is more likely to conform. Hospital teaching status may reflect a hospital's internal goals, values, and mission. Teaching hospitals are dedicated to providing clinical care, conducting research, and teaching the future workforce. Teaching hospitals may view the provision of palliative care services as an important part of teaching and providing comprehensive care. Specifically, the education and training of medical students may be viewed as essential to provide quality palliative care to an aging population that increasingly deals with serious chronic illnesses, such as cancer. Therefore, it is proposed,

Proposition 5: Teaching status is positively associated with the provision of palliative care services.

- Hypothesis 5: Hospitals that are COTH (Council of Teaching Hospitals) members are more likely to provide palliative care services compared to hospitals that are non-COTH members, *ceteris paribus*.

Hospital Performance Effects of Palliative Care

To address research questions two and three, two propositions and eight corresponding hypotheses are derived based on Donabedian's (1980) Structure-Process-Outcome (SPO) framework for quality assessment. Donabedian identifies three categories of quality measures, namely structure, process, and outcomes of care. Structural characteristics affect the process of care, which, in turn, affect outcomes of care. Structure is described as “the attributes of the setting in which care occurs” (Donabedian, 1988, p. 1745). The main proposition of the structural component is that high-quality care can only occur in the “appropriate” setting. Structural attributes of a hospital setting may be described in terms of environmental, organizational, and patient characteristics. Process refers to the actual provision of care. Finally, outcome denotes “the effects of care on the health status of patients and populations” (Donabedian, 1988, p. 1745). This model provides a conceptual framework to test whether hospital-based palliative care services have an association with organizational and patient outcomes.

This study views palliative care services as a structural component of care, as palliative care services provide hospitals with a “systematic approach” to coordinate and manage care for complex patients and assist with appropriate transitioning between health care settings (Center to Advance Palliative Care, 2014). Studies have found that palliative care services lead to cost containment due to decreased hospital and ICU length of stay (Campbell & Guzman, 2003; 2004), and more appropriate utilization of health care services, such as laboratory tests, and radiological tests (Lautrette et al., 2007; O'Mahony et al., 2010).

In this study, it is proposed that hospitals that provide palliative care services produce improved organizational and patient outcomes compared to hospitals that do not provide palliative care services. Furthermore, hospitals that are more experienced in providing palliative care services have better outcomes than hospitals that are less experienced in providing palliative care services. The two propositions and their corresponding hypotheses related to organizational patient outcomes are formally stated as follows:

Proposition 6: The provision of palliative care services is associated with improved patient and organizational outcomes.

- Hypothesis 6a: Patients treated in hospitals that provide palliative care services incur lower hospital costs than patients treated in hospitals that do not provide such services, *ceteris paribus*.
- Hypothesis 6b: Patients treated in hospitals that provide palliative care services have shorter hospital LOS than patients treated in hospitals that do not provide such services, *ceteris paribus*.
- Hypothesis 6c: Patients treated in hospitals that provide palliative care services are less likely to die during hospitalization than patients treated in hospitals that do not provide such services, *ceteris paribus*.
- Hypothesis 6d: Patients treated in hospitals that provide palliative care services are more likely to transfer to hospice than patients treated in hospitals that do not provide such services, *ceteris paribus*.

Proposition 7: Greater experience in providing palliative care is associated with improved patient and organizational outcomes.

- Hypothesis 7a: Patients treated in hospitals that are more experienced in providing palliative care services incur lower hospital costs than patients treated in hospitals that are less experienced, *ceteris paribus*.

- Hypothesis 7b: Patients treated in hospitals that are more experienced in providing palliative care services have shorter hospital LOS than patients treated in hospitals that are less experienced, *ceteris paribus*.
- Hypothesis 7c: Patients treated in hospitals that are more experienced in providing palliative care services are less likely to die during hospitalization than patients treated in hospitals that are less experienced, *ceteris paribus*.
- Hypothesis 7d: Patients treated in hospitals that are more experienced in providing palliative care services are more likely to be transferred to hospice than patients treated in hospitals that are less experienced, *ceteris paribus*.

Summary

This chapter established a theoretical framework by drawing on Institutional Theory, Resource Dependence Theory, and Donabedian's Structure-Process-Outcome framework to explain the impact of hospital and market factors on palliative care provision and the effects of palliative care services on patient and organizational outcomes. Based on the theoretical framework, seven propositions and 13 corresponding hypotheses were derived. The next chapter describes this study's research methodology, including research design, data sources, study sample, variable measurement, empirical methodology, and sensitivity analyses.

Chapter 4: Methodology

This chapter explains the research methods used to explore the nature of hospital-based palliative care provision and the relationship between hospital-based palliative care provision and hospital costs, hospital length of stay, in-hospital mortality, and transfer to hospice.

The first section identifies the research design; the next four sections describe the data sources, study sample, variable measurement, and the empirical methodology employed to investigate the study's research questions. The last section outlines the set of sensitivity analyses used to evaluate the robustness of the empirical results. The chapter concludes with a summary.

Research Design

This study, observational and retrospective in nature, aims to examine the relationship between hospital and market characteristics and hospital-based palliative care provision (research question one) and the association between hospital-based palliative care provision and patient and organizational outcomes (research questions two and three).

To test the seven propositions and 13 hypotheses presented in the previous section, this study analyzes a longitudinal data set, which encompasses a five-year (2007-2011) time frame and six U.S. states (Arizona, California, Florida, Maryland, New Jersey, and New York). A two-level hierarchical generalized linear model (HGLM) is used to analyze the five hypotheses proposed under research question one. Four three-level HGLM or hierarchical linear models (HLM) are estimated to test the hypotheses proposed under research questions two and three.

General, short-term, acute care, non-federal, and urban hospitals in the U.S. are units of analysis nested within counties for research question one. Hospital *i* is the lower level unit nested within the higher level unit county *j* (i.e., level-2 unit). Independent and control variables were obtained or constructed at the hospital or county level. For research questions two and three, the lowest level units of analysis are hospital visits of patients aged 18 and older with one of eight primary diagnoses deemed most likely to benefit from palliative care. Further detail is provided in a later section of this chapter. Patient *i* is a level-1 unit nested within hospital *j* (i.e., level-2 unit) nested within county *k* (i.e., level-3 unit). Independent and control variables were obtained or constructed at the patient, hospital, or county level.

Two additional empirical specifications are noteworthy. First, all analytical models in this study are estimated using a balanced sample of hospitals; that is, hospitals that consistently provided hospital information across the five-year study period. A balanced panel was used to facilitate the construction of palliative care adoption patterns for hospitals across the study period. Finally, years (i.e., time points) are not modelled as an additional hierarchical level in any of the analytical models outlined in the previous paragraph. Specifically, for research question one, level-1 units consist of hospitals with five observations for the years 2007 through 2011. For research questions two and three, level-2 units constitute hospitals with five observations for the years 2007 through 2011.

Data Sources

Administrative data are obtained and merged from a variety of sources to acquire wide-ranging information about market and hospital characteristics, hospitals' patterns of palliative care provision, and measures of hospital performance. The two primary data sources for this study are the AHA Annual Survey of Hospitals and State Inpatient Databases (SID) for Arizona, California, Florida, Maryland, New Jersey, and New York from 2007 to 2011. The AHA Annual Survey of Hospitals is conducted on a yearly basis by the American Hospital Association and collects information from over 6,400 hospitals nationwide with an annual response rate of more than 75%. Participating hospitals respond to approximately 1,000 questions spanning a variety of categories, including organizational structure, demographics, staffing, service utilization, facilities and services, and managed care affiliations (American Hospital Association, 2014).

The SID are assembled by the Healthcare Cost and Utilization Project (HCUP), which is sponsored by the Agency for Healthcare Research and Quality (AHRQ). A wide range of clinical and non-clinical data elements are available for each inpatient discharge record, including patient demographics, primary and secondary diagnoses, hospital length of stay, payer source, hospital charges, and disposition at discharge (Agency for Healthcare Research and Quality, 2015).

The study also includes data from four supplemental administrative databases: the Area Health Resources Files (AHRF), the HealthLeader-Interstudy databases, the Medicare Hospital Cost Reports, and data provided by the American Nurses Credentialing Center (ANCC). These data are used to construct control variables at the hospital and county level. The AHRF, maintained by the National Center for Health Workforce Analysis (NCHWA), Bureau of Health Workforce within the Health Resources and Services Administration (HRSA), encompasses over 6,000 current and historical data elements for counties nationwide, including population demographics, hospital utilization, health care professions, and health facilities. The HealthLeaders-InterStudy databases are used to obtain annual HMO and PPO enrollment data. The Healthcare Cost Report Information System (HCRIS), collected and maintained by the Centers for Medicare and Medicaid Services (CMS), provides a variety of financial performance data for Medicare-certified hospitals by fiscal year, including data elements from hospitals' income statements and balance sheets (Centers for Medicaid and Medicare Services, 2015b). Finally, information on hospitals recognized as a Magnet organization by the ANCC Magnet Recognition Program® in the years 2007 through 2011 are hand-collected from the ANCC's website. Magnet organizations are acknowledged for their excellence in a variety of nursing processes and high-quality patient care (American Nurses Credentialing Center, 2014).

Data from the AHA Annual Survey of Hospitals and SID are merged by the hospital's AHA identification number. The merged dataset is then linked with the Medicare Hospital Cost Reports by the hospital's Medicare provider number. Hospitals with a cost reporting period of less than 360 and more than 370 days are excluded. Hand-collected data on ANCC Magnet designation are manually added to the merged dataset by hospital name. Finally, market-level information from AHRF and HealthLeaders-InterStudy are merged by the hospital's county federal information processing standard (FIPS) code.

Study Sample

Data from hospitals in the following six states are used to examine the three research questions: Arizona, California, Florida, Maryland, New Jersey, and New York. There are several reasons for choosing hospitals from the aforementioned states. First, these states provide consistent and comprehensive information on hospital characteristics and hospitalized patients over the study period required to investigate the study's research questions. Hospitals within these states also experienced a growing trend in hospital-based palliative care provision over the study's time period. Additionally, the included states are located in three of the four U.S. census regions and constitute approximately 19% of general medical and surgical hospitals nationwide. These states also have a sufficiently large number of hospitals within counties and patients within hospitals, which is necessary to estimate this study's hierarchical models with random effects at the county and hospital level. Finally, three of the states, California, Arizona, and Florida, are traditional retirement states. As the elderly are one of the primary target populations for palliative care, findings from this study may provide valuable insight for policy makers in states with a high proportion of elderly residents.

Several additional sample exclusion criteria are employed to establish homogeneity of the study sample. First, specialty hospitals, such as prison hospitals, psychiatric hospitals, rehabilitation facilities, and hospitals that restrict admissions primarily to children, are excluded from the study sample. Specialty hospitals serve specific patient populations, to whom they provide a more limited array of services than general acute care hospitals. Patterns of palliative care adoption among specialty hospitals are therefore likely to be different from patterns at general acute care hospitals. Additionally, hospitals under federal control, such as Veterans Affairs (VA) hospitals, are also excluded from the study sample, because they are federally mandated to make a palliative care consult team available (Veterans Health Administration, 2008). The study focuses on non-federal, general acute care hospitals in metropolitan counties. Among the study states, the percentage of inpatient discharge records in metropolitan areas ranges from 91.83% in California to 100% in New Jersey. Finally, hospitals that did not respond to the AHA Annual Survey of Hospitals consistently throughout the study’s time period and hospitals that had missing values for key or control variables were excluded from the study sample.

Several additional patient-level exclusion criteria are employed in this study to establish a homogenous patient sample. First, SID inpatient discharge records are restricted to patients aged 18 and older. While pediatric and adult palliative care are similar in nature, palliative care needs of children with complex and serious illnesses often differ from palliative care needs of adult patients.

Second, SID inpatient discharge records are also limited to patients who are assigned one of the following eight primary diagnoses deemed most likely to benefit from and receive palliative care services: acute cerebrovascular disease, acute myocardial infarction, cancer, congestive heart failure, chronic obstructive pulmonary disease, dementia, HIV infection, and dementia. The selection of primary diagnoses is based on the most frequent causes of death nationwide (Murphy et al., 2013) and prior literature (Santa-Emma, Roach, Gill, Spayde, & Taylor, 2002; Stover, 2005; Weissman & Meier, 2011). Disease categories generated by the Clinical Classification Software (CCS) for the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) are used to identify this study's patient population. The CCS was developed by the Healthcare Cost and Utilization Project (HCUP) and is a standardized coding system, which places ICD-9-CM codes into manageable and clinically meaningful categories (Healthcare Cost and Utilization Project, 2015).

By limiting the study's patient sample to patients with the above-mentioned primary diagnoses, the analysis more clearly focuses on those individuals most likely to benefit from palliative care services. It may be noted that an inclusion criterion based on primary diagnosis may include inpatient discharge records from patients who did not receive palliative care services or, conversely, exclude inpatient discharge records from patients who received palliative care services. Hence, these sample selection criteria only approximate the hospital's patient population most likely to benefit and receive palliative care services. Table 5 displays the CCS categories and corresponding ICD-9-CM diagnosis chapters that are associated with the study's eight primary diagnoses.

Table 5

Primary Diagnosis, CCS Category, and ICD-9-CM Diagnosis Chapter

Primary Diagnosis	CCS Category	ICD-9-CM Diagnosis Chapter
Acute cerebrovascular disease	109	7 - Diseases of circulatory system
Acute myocardial infarction	100	7 - Diseases of circulatory system
Cancer	11-45	2 – Neoplasms
Congestive heart failure	108	7 - Diseases of circulatory system
COPD	127	8 - Diseases of respiratory system
Dementia	653	5 - Mental illness
HIV	5	1 - Infectious and parasitic diseases
Pneumonia	122	8 - Diseases of respiratory system

Note. CCS=Clinical classification software. COPD=Chronic obstructive pulmonary disease. HIV=Human immunodeficiency virus. ICD-9-CM=International Classification of Diseases, 9th Revision, Clinical Modification.

Approximating the study's palliative care patient population is necessary, as ICD-9-CM codes uniquely identifying palliative care patients are largely absent or lack consistent application. Finally, inpatient discharge records with missing values for any dependent or control variable and inpatient discharge records with reported hospital lengths of stay greater than 30 days are excluded from the study sample. Table 6 provides an overview of the number of patients, hospitals, and counties dropped based on this study's sample exclusion criteria, missing or invalid values.

According to Table 6, 93.66% of patients, 66.11% of hospitals, and 51.95% of counties were dropped based on the study's sample exclusion criteria, missing or invalid values for at least one of the study's patient and hospital characteristics. Note that there was no missing information on any of the study's county characteristics.

The majority of patients aged 18 and older (84.49%) did not have one of the study's eight selected primary diagnoses. About one in every four urban, non-federal, general, acute care hospitals (22.84%) did not have information on the availability of at least one of the three palliative care services (PAL, IPAL, or HOSPC) for one or more study years. For a given

Table 6

Stepwise Removal Process of Study Observations Across All Study Years

	Patient	Hospital	County
Overall sample	59,315,052	5,134	1,155
Sample criteria			
Patient: Patients aged < 18 years	9,783,840	12	0
Patient: Primary DX *not* ACD, AMI, cancer, CHF, COPD, dementia, HIV, or pneumonia	41,848,720	176	0
Patient: Length of stay > 30 days	124,338	4	0
Hospital: Federal, non-urban, long-term, and specialty hospitals	533,942	1,230	410
Missing/inconsistent values			
Key Variables			
PAL, IPAL, and/or HOSPC (missing)	1,127,506	848	60
PAL, IPAL, and/or HOSPC (unrealistic implementation patterns)	1,266,206	859	80
Number of set-up and staffed beds (Hypothesis 1)	0	0	0
1 minus Herfindahl-Hirschman Index (Hypothesis 2)	0	0	0
Presence of PC services in health system/network/JV (Hypothesis 3)	0	0	0
Share of Medicare patients (%) (Hypothesis 4)	0	0	0
Teaching hospital (Hypothesis 5)	0	0	0
Control Variables			
Hospital	627,701	265	50
Patient	239,460	0	0
County	0	0	0
Final sample	3,763,339	1,740	555
Annual average	752,668	348	111
% overall sample analyzed	6.34%	33.89%	48.05%

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. DX=Diagnosis. HIV=Human immunodeficiency virus. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. JV=Joint venture. PAL=Inpatient palliative care consultation service. PC=Palliative care.

palliative care service, information was missing both at random in a given study year for some hospitals and throughout the study period for other hospitals.

Moreover, 859 hospitals were excluded from the study sample because of unrealistic implementation patterns for PAL, IPAL, or HOSPC; that is, these hospitals repeatedly switched between having and not having a palliative care service during the five year study period. Note that consistent implementation patterns of palliative care services were an essential prerequisite for constructing the three key independent variables to address research question three, namely experience in providing PAL, IPAL, or HOSPC, as described later in this chapter. Regarding research question one, it is also important to avoid modeling false changes in palliative care provision over the study period, as within-hospital coding errors in the dependent variable are magnified in the context of modeling random effects.

In addition, imputations were performed for 27 hospitals. Specifically, 18 hospitals were categorized as hospitals with no palliative care service throughout the study period if they had no palliative care service in any study period except in one year between 2008 and 2010. Similarly, nine hospitals were categorized as hospitals with continuous provision of a palliative care service throughout the study period if they had a palliative care service in all study years except in one year between 2008 and 2010.

Variable Measurement

The following sections are grouped into descriptions of key variables, including dependent variables, key independent variables, and control variables for the three research questions. Dependent variables and control variables for research questions two and three are discussed within one section, as they are the same for both research questions.

Research question one: dependent and key independent variables.

Research question one examines which hospital and market characteristics are associated with the hospital provision of palliative care services. Five propositions and corresponding hypotheses have been proposed. Table 7 provides an overview of the dependent variable and five key independent variables constructed to model hospital-based palliative care provision.

Research question one: control variables.

Hospital provision of palliative care may be influenced by other factors present in the hospital's institutional environment. These factors are included as control variables in the analytical model and can be grouped into hospital and market characteristics.

Several hospital characteristics are included in the models to control for confounding factors associated with the provision of hospital-based palliative care. Specifically, lagged operating margin as a proxy for financial performance (measured as the ratio of net patient income and net profit revenue in the prior year), ANCC Magnet recognition as a proxy for higher quality of care, and ownership type as a proxy for a hospital's mission, are potential confounders that may affect the hospital's decision to adopt palliative care services. Binary variables, based on the information reported in the AHA Annual Survey of Hospitals, are used to denote the hospital's type of ownership: for-profit, public, and not-for-profit (reference group). In regard to ANCC Magnet recognition, a binary variable is constructed, using hand-collected information from the ANCC website, to identify hospitals that were recognized as Magnet organizations.

Additionally, patient severity or complexity may influence a hospital's decision to provide palliative care services. That is, hospitals with a higher case-mix index (CMI) may be more likely to offer palliative care services in order to meet patients' palliative care needs. This index is constructed and provided by the Centers for Medicare and Medicaid Services (CMS)

Table 7

A Description of Key Variables, Research Question One

Construct	Variable	Measurement	Unit	Database
Dependent Variable				
Hospital-based PC provision	Presence of PAL, IPAL, and/or HOSPC	Binary variable; =1 if hospital has PAL, IPAL, and/or HOSPC; =0 otherwise	Hospital	2007-2011 AHA Annual Hospital Surveys
Independent Variables				
H_1: Size	Hospital bed size	Continuous variable; measured as the number of staffed and set-up beds (in 10s).	Hospital	2007-2011 AHA Annual Hospital Surveys
H_2: Market competition	1 – Herfindahl-Hirschman Index (HHI)	Continuous variable; constructed by subtracting the sum of the squares of market shares of admissions for all hospitals in the county from 1; values range from 0 to 1. Values closer to 1 indicate higher levels of competition.	County	2007-2011 AHA Annual Hospital Surveys
H_3: Availability of alternative palliative care resources	Presence of PAL, IPAL, and/or HOSPC in a hospital's health system, network, and/or joint venture.	Binary variable; =1 if hospital has PAL, IPAL, and/or HOSPC in health system, network and/or joint venture; =0 otherwise. Hospitals in the same county belonging to the same health system are combined.	Hospital	2007-2011 AHA Annual Hospital Surveys
H_4: Medicare dependence	Share of Medicare patients	Continuous variable; calculated by dividing Medicare inpatient days by total inpatient days.	Hospital	2007-2011 AHA Annual Hospital Surveys
H_5: Teaching status	COTH membership	Binary variable; =1 if hospital is COTH-member; =0 otherwise.	Hospital	2007-2011 AHA Annual Hospital Surveys

Note. AHA=American Hospital Association. COTH=Council of Teaching Hospitals. HHI=Herfindahl-Hirschman Index. HOSPC=Hospice program. IPAL=Inpatient palliative care program. PAL=Inpatient palliative care consultation service.

and represents a hospital’s average diagnosis-related group (DRG) relative weight. It is calculated by summing the DRG weights for all Medicare discharges and dividing the sum by the total number of discharges. Similarly, several additional characteristics of the hospital’s patient population may influence the hospital’s need or desire to provide palliative care services, including the percentage of patients with primary diagnoses most likely to benefit from palliative care, the percentage of patients aged 65 and older, the percentage of Hispanic patients, the percentage of black patients, and the hospital’s average length of stay. Moreover, a hospital’s nursing capacity may influence the likelihood of providing palliative care services. Nursing capacity is measured as a continuous variable by dividing the hospital’s number of full-time registered nurses by total nurses.

Multiple demand-related county characteristics are included as control variables. Specifically, environmental uncertainty may affect the hospital’s managerial decision to conform to institutional demands (Oliver, 1990). Environmental uncertainty depends on the availability of critical resources in the environment (i.e., munificence) (Pfeffer & Salancik, 1978) and may influence the hospital’s decision or ability to provide palliative care services. The following variables are used in this study to account for munificence: the fraction of uninsured individuals aged between 18 and 64, market size (i.e., the number of total residents in the county), inflation-unadjusted per capita income, the unemployment rate for individuals aged 16 and older, HMO penetration (i.e., the percentage of fully insured lives covered by HMO), and PPO penetration (i.e., the percentage of fully insured lives covered by PPO) in the hospital’s county. Finally, the area wage index is included to account for geographic cost differences or price factors. This index is computed and provided by CMS and comprises the ratio of the average hourly wage of a geographic area to the average hourly wage nationwide. Hospital geographic areas are defined in accordance with the Core-Based Statistical Areas (CBSAs), established by the Office of Management and Budget. The national average hourly wage is calculated by dividing total wage costs by total hours for hospitals nationwide, whereas the average hourly wage for each geographic area is calculated by dividing total wage costs by total hours for hospitals in the geographic area. Therefore, hospitals located in the same geographic area are assigned the same values for the area wage index.

To account for time-specific effects, dummy variables are included for each year with year 2007 as the reference. Lastly, this study accounts for geographic variation by including five state indicators, as prior research consistently demonstrated significant geographic variation in hospital-based palliative care provision (e.g., Dumanovsky et al., 2015). California is treated as the reference.

Research questions two and three: dependent and key independent variables.

Research question two investigates whether patients treated in hospitals with palliative care services incur lower hospital costs, have shorter hospital stays, are less likely to die during hospitalization, and are more likely to be transferred to hospice, corresponding to hypotheses 6a through 6d. Research question three explores whether patients treated in hospitals that are more experienced in providing palliative care services incur lower hospital costs, have shorter hospital stays, are less likely to die during hospitalization, are more likely to be transferred to hospice, corresponding to Hypotheses 7a through 7d. Table 8 presents the dependent and independent variables used to test these eight hypotheses.

Four important features are noteworthy concerning the measurement of the key dependent and independent variables presented in Table 8. First, in regard to length of stay, the last day of hospitalization for patients transferred to hospice is determined by the day of hospice

Table 8

A Description of Key Variables, Research Questions Two and Three

Construct	Variable	Measurement	Unit	Database
Dependent Variables – Research Questions Two and Three				
Organizational outcome	Hospital costs	Continuous variable; measured in constant 2007 U.S. dollars; log of total patient charges multiplied by hospital's CCR and (PPI_{2007}/PPI_{2007+})	Patient	2007-2011 SID for AZ, CA, FL, MD, NJ, & NY
Patient outcome	Hospital length of stay (LOS)	Count variable; LOS is defined by the difference between day of admission and day of discharge or death	Patient	2007-2011 SID for AZ, CA, FL, MD, NJ, & NY
Patient Outcome	In-hospital mortality	Binary variable; 1=died during hospital stay; 0=otherwise.	Patient	2007-2011 SID for AZ, CA, FL, MD, NJ, & NY
Patient Outcome	Transfer to hospice	Binary variable; 1=discharged to home hospice or hospice facility; 0=otherwise.	Patient	2007-2011 SID for AZ, FL, NJ, & NY
Independent Variables – Research Question Two				
$H_{6a\text{-}d}$: Palliative care provision	Presence of hospital-based: 1) PAL 2) IPAL 3) HOSPC	Three binary variables; 1) 1=hospital has PAL; 0=otherwise. 2) 1=hospital has IPAL; 0=otherwise. 3) 1=hospital has HOSPC; 0=otherwise.	Hospital	2007-2011 AHA Annual Hospital Surveys
Independent Variables – Research Question Three				
$H_{7a\text{-}d}$: Palliative care experience	Years of experience providing hospital-based: 1) PAL 2) IPAL 3) HOSPC	Three continuous variables; 1) # of years PAL present (since 2006). 2) # of years IPAL present (since 2006). 3) # of years HOSPC present (since 2006).	Hospital	2007-2011 AHA Annual Hospital Surveys

Note. AHA=American Hospital Association. AZ=Arizona. CA=California. CCR=Cost-to-charge ratio. FL=Florida. HOSPC=Hospice program. IPAL=Inpatient palliative care program. LOS=Length of stay. MD=Maryland, NJ=New Jersey. NY=New York. PAL=Inpatient palliative care consultation service. PPI=Producer-price index. SID=State inpatient database.

transfer regardless of whether the patient is transferred to a hospital-based or an outside hospice facility.

Second, in regard to hospital costs, a hospital's cost-to-charge ratio (CCR) is the ratio of a hospital's total operating and capital-related expenses and total hospital charges using information from the Medicare Hospital Cost Reports. The ratio ranges from zero to one, where a value closer to zero constitutes a greater difference between hospital costs and hospital charges. The Agency for Healthcare Research and Quality provides CCR files for 2007 through 2011 used to convert the patient's hospital charges into their corresponding cost estimates. This study applies a hospital-specific all-payer inpatient CCR (APICC) if available. If APICC is not available, a weighted group-average all-payer inpatient CCR (GAPICC) is used, which is a weighted average of CCR for a hospital in a given group. A group is defined by state, urban/rural location, for-profit/not-for-profit ownership, and number of beds. The hospital's proportion of beds in a given group are used as the weight for each hospital.

Third, in regard to hospice transfers, transfers to home hospice include patients who were discharged to receive hospice care at their place of residence, which may include a patient's private residence, nursing home, or assisted-living facility. Transfers to a hospice facility include discharges to hospital-based hospices and outside hospice facilities.

Finally, in regard to palliative care experience, note that hospitals with PAL, IPAL, or HOSPC present in 2007 are treated as hospitals with one year of experience in 2007. Hospitals that discontinued a palliative care service were assigned a "0" in years of and after discontinuation. Additionally, hospitals without a palliative care service throughout the study period were assigned a "0" for experience in all years. This specification assumes time has a linear effect.

Two additional sample restrictions warrant further explanation. First, to examine research questions two and three in regard to transfer to hospice, the analytical model excludes patients treated in California and Maryland, because neither state provides information on transfer to hospice. Second, separate analytical models for decedents and patients discharged alive are estimated to assess research questions two and three concerning length of stay. In the context of outcome evaluation, length of stay has a considerably different meaning for these two patient populations. In particular, the end of the hospital stay is the time of discharge for survivors, whereas the end of the hospital stay is determined by the patient’s death for decedents.

Research questions two and three: control variables.

All analytical models include the same set of control variables, which may be grouped into patient, hospital, and market characteristics. Also, all hospital and market characteristics included in the analytical model to investigate research question one, as described in the previous sections, are incorporated as control variables in the analytical models to explore research questions two and three. Note that one hospital control variable, a hospital’s average length of stay, is not included in the 3-level HGLM with length of stay as the dependent variable to assure model convergence.

Several patient characteristics, including demographic and clinical factors that may affect hospital costs, length of stay, in-hospital mortality, and hospice transfers are included in the analytical models. Patient demographics include the patient’s age, gender, race or ethnicity, and payer type, income, residential location, and source of admission. This study focuses on patients aged 18 or older on the day of hospital admission. The patient’s age is categorized into five groups: 18-49 (the reference group), 50-64, 65-74, 75-84, and 85 or older. The patient’s gender is measured as a binary variable with male patients being the reference group. Individuals are classified into one of the four race/ethnicity categories: non-Hispanic white (the reference group), non-Hispanic African-American, Hispanic, and other. The patient's payer type is divided into five categories: Medicare (the reference group), Medicaid, private insurance, self-pay, or charity/other. The patient's income is approximated by a four-level categorical variable that identifies in which state level income quartile the median household income in the patient's zip code falls. Specifically, values between 1 and 4 are assigned to identify the poorest to wealthiest populations, respectively. The poorest population functions as the reference group. In addition, the patient's residential location is divided into one of the following categories: central/fringe area with at least 1 million residents (the reference group), large metropolitan area with between 50,000 and 999,999 residents, and micropolitan/rural areas with fewer than 50,000 residents. The patient's source of hospital admission is divided into five categories: emergency room (the reference group), routine, another hospital, another healthcare facility, and court/law enforcement. Note that routine admissions include physician or HMO referrals and outpatient or clinic transfers.

The following clinical indicators are also included in the analytical models. The patient's Charlson-Comorbidity Index (CCI) and number of surgical procedures are measured as continuous variables and used to capture the patient's medical severity. Furthermore, the patient's primary diagnosis is accounted for by seven binary variables indicating whether the patient was assigned one of seven primary diagnoses using the Clinical Classifications Software (CCS) based on ICD-9-CM codes: acute cerebrovascular disease (ACD) (ccs code = 109), acute myocardial infarction (AMI) (CCS category = 100), congestive heart failure (CHF) (CCS category = 108), chronic obstructive pulmonary disease (COPD) (CCS category = 127), dementia (CCS category = 653), pneumonia (CCS category = 122), and HIV infection (CCS category = 5). Cancer patients, identified by the CCS categories 11 through 45, are treated as the reference. Finally, a binary variable indicating whether a patient had a palliative care encounter is included by identifying the ICD-9 CM code *V66.7* among the patient's secondary diagnoses. Although patients can have palliative care encounters regardless of whether they are treated in hospitals with specialty palliative care services (i.e., PAL, IPAL, and HOSPC), hospitals with such services record about 30% more palliative care encounters than hospitals without such services. Note that including and excluding this variable suggested that the key parameter estimates in the models with hospital costs, length of stay, and transfer to hospice as dependent variables were robust to including and excluding this variable. However, the results of the model with in-hospital mortality as the dependent variable differ substantially and, thus, are discussed separately in Chapter 5.

Empirical Methodology

Preliminary analysis.

Several preliminary analyses are performed. First, the data are analyzed carefully to identify outliers and missing values, as described in a previous section of this chapter. Study variables are assessed individually, over time and in different binary combinations to examine the quality of the data. Scatterplots, histograms, and box plots are used to identify extreme values to be excluded from the study sample. Distributive properties are examined to determine appropriate data transformations. Descriptive statistics are also used to decide on the unit of measurement. Data management is performed using Stata/MP for Windows (64-bit), Version 14.0. Hierarchical linear modeling is conducted using MELOGIT command in Stata and the MIXED and GLIMMIX procedure in SAS for Windows (64-bit), Version 9.4.

Model assumptions.

In hierarchical modeling, several formal assumptions are required to be met to generate unbiased, consistent, and accurate estimates (Raudenbush & Bryk, 2002a). The first set of assumptions pertains to the unbiasedness of the coefficients estimating the effects of the covariates. Specifically, level-1 covariates are independent of the level-1 error term. Similarly, level-2 and level-3 covariates are independent of the level-2 and level-3 error terms, respectively. In addition, the covariates at each level are not correlated with the random effects at the other levels. The second set of assumptions relates to the random effects in the model and thus affects the consistency and accuracy of standard error estimation. In particular, in the case of continuous outcome models (i.e., hospital costs), each level-1 error term is normally distributed, independent, and has a mean of zero and variance of σ^2 for every level-1 unit. Furthermore, the random errors at higher levels are independent from each other. Note that in the case of binary outcome models (i.e., palliative care provision, in-hospital mortality, and transfer to hospice), the level-1 error variance has a mean of zero and a fixed variance at $\pi^2/3$. Finally, in the case of count outcome models (i.e., length of stay), the level-1 error variance is assumed to be equal to the mean.

Research question one: empirical model.

A two-level HGLM is employed to address research question one and the corresponding hypotheses 1 through 5. The empirical model is based on the notion that hospitals are nested within counties, meaning a hospital's log-odds of having at least one of three palliative care services (i.e., PAL, IPAL, and/or HOSPC) in place may differ across counties. Hospital characteristics are modeled at the lowest level with subscript *j* and county characteristics at the higher level with subscript *k*. Each hierarchical level is provided with a level-specific model, in which hospital characteristics predict palliative care provision and county characteristics predict the average county's palliative care provision. The level-specific models are then joined into a combined model for hypothesis testing. The combined model may be expressed by the following equation,

Empirical Model Research Question One, Palliative Care Provision

$$(PC\_PROV)_{jk} = \gamma_{00} + \gamma_{10}(SIZE)_{jk} + \gamma_{20}(ALT)_{jk} + \gamma_{30}(MEDC\_INPSHARE)_{jk} + \gamma_{40}(TEACH)_{jk} + \gamma_{50}(CNTRLS1)_{jk} + \gamma_{01}(COMP)_{k} + \gamma_{02}(CNTRLS2)_{k} + \gamma_{03}(YEAR)_{k} + e_{jk} + u_{0k}.$$

where j = 1, 2, …, n_k hospitals and k = 1, 2, …, N counties, $(\text{PC\_PROV})_{jk}$ is hospital j's log-odds of providing at least one of three palliative care services (i.e., PAL, IPAL, and/or HOSPC), and γ_{00} is the average log-odds of having at least one of three palliative care services across all hospitals when all covariates equal zero. Furthermore, $(SIZE)_{jk}$ is hospital j's bed size, $(ALT)_{jk}$ is a binary variable (1 = hospital j's has access to palliative care services through a health system, network, or a joint venture, 0 = otherwise), $(MEDC\_INPSHARE)_{jk}$ is hospital j's share of Medicare patients, $(TEACH)_{jk}$ is a binary variable (1 = hospital j is a member of COTH, 0 = otherwise), $(CNTRLS1)_{jk}$ is a vector of hospital-specific control variables, $(COMP)_{k}$ is county k's level of hospital competition, $(CNTRLS2)_{k}$ is a vector of county-specific control variables, $(YEAR)_{k}$ is a vector of year dummies for years 2008 through 2011, e_{jk} is the error variance across patients with mean 0 and fixed variance, and u_{0k} is the error variance across counties.

The five (alternative) hypotheses under research question one and their corresponding null hypotheses are stated below. Statistical significance is examined using individual t-tests.

Null and Alternative Hypotheses, Hypothesis 1

$H_0: \gamma_{10} = 0$; $H_1: \gamma_{10} > 0$.

Null and Alternative Hypotheses, Hypothesis 2

$H_0\colon \gamma_{01} = 0$; $H_2\colon \gamma_{01} > 0$.

Null and Alternative Hypotheses, Hypothesis 3

$H_0\colon \gamma_{20} = 0$; $H_3\colon \gamma_{20} < 0$.

Null and Alternative Hypotheses, Hypothesis 4

$H_0\colon \gamma_{30} = 0$; $H_4\colon \gamma_{30} > 0$.

Null and Alternative Hypotheses, Hypothesis 5

$H_0\colon \gamma_{40} = 0$; $H_5\colon \gamma_{40} > 0$.

Research questions two and three: empirical models.

Four three-level HGLM and HLM are employed to address research questions two and three and the corresponding hypotheses. The empirical models are based on the notion that patients are nested within hospitals, and hospitals are nested within counties. Specifically, patient characteristics are modeled at the first level with subscript *i*, hospital characteristics are modeled at the second level with subscript *j*, and county characteristics are modeled at the third level with subscript *k*. Each hierarchical level can be modeled separately. These models are then joined into combined models used for hypothesis testing for each of the four dependent variables, respectively. Specifically, the combined models for hospital costs, $(\mathrm{COSTS})_{ijk}$, length of stay, $(\mathrm{LOS})_{ijk}$, in-hospital mortality, $(\mathrm{INH\_MORT})_{ijk}$, and transfer to hospice, $(\mathrm{TR\_HOSPC})_{ijk}$, respectively are stated as follows,

Empirical Model Research Questions Two and Three, Hospital Costs

$$\begin{aligned}(\mathrm{COSTS})_{ijk} = \gamma_{000} &+ \gamma_{100}(CNTRLS1)_{ijk} + \gamma_{010}(PAL)_{jk} + \gamma_{020}(IPAL)_{jk} \\ &+ \gamma_{030}(HOSPC)_{jk} + \gamma_{040}(PAL\_EXP)_{jk} + \gamma_{050}(IPAL\_EXP)_{jk} \\ &+ \gamma_{060}(HOSPC\_EXP)_{jk} + \gamma_{070}(CNTRLS2)_{jk} + \gamma_{001}(CNTRLS3)_{k} \\ &+ \gamma_{002}(YEAR)_{k} + e_{ijk} + r_{0jk} + u_{00k}.\end{aligned}$$

where i = 1, 2… n_{jk} patients, j = 1, 2… n_k hospitals, k = 1, 2… N counties, $(\mathrm{COSTS})_{ijk}$ is patient i's hospital costs, and γ_{000} is the average hospital costs across all hospitals. In addition, $(CNTRLS1)_{ijk}$ is a vector of patient characteristics, $(PAL)_{jk}$ is a binary variable (1 = hospital j has an inpatient palliative care consultation service, 0 = otherwise), $(IPAL)_{jk}$ is a binary variable (1 = hospital j has an inpatient palliative care unit, 0 = otherwise), $(HOSPC)_{jk}$ is a binary variable (1 = hospital j has a hospice program, 0 = otherwise), $(PAL\_EXP)_{jk}$ is hospital j's years of experience in offering an inpatient palliative care consultation service, $(IPAL\_EXP)_{jk}$ is hospital j's years of experience in offering an inpatient palliative care unit, $(HOSPC\_EXP)_{jk}$ is hospital j's years of experience in providing a hospice program, $(CNTRLS2)_{jk}$ is a vector of hospital characteristics, $(CNTRLS3)_k$ is a vector of county characteristics, $(YEAR)_k$ is a vector of year dummies for years 2008 through 2011, e_{ijk} is the error variance between patients, r_{0jk} is the error variance across hospitals, and $u_{00k}$is the error variance across counties.

Empirical Model Research Questions Two and Three, Length of Stay

$$\begin{aligned}(\mathrm{LOS})_{ijk} = {} & \gamma_{000} + \gamma_{100}(CNTRLS1)_{ijk} + \gamma_{010}(PAL)_{jk} + \gamma_{020}(IPAL)_{jk} + \gamma_{030}(HOSPC)_{jk} \\ & + \gamma_{040}(PAL\_EXP)_{jk} + \gamma_{050}(IPAL\_EXP)_{jk} + \gamma_{060}(HOSPC\_EXP)_{jk} \\ & + \gamma_{070}(CNTRLS2)_{jk} + \gamma_{001}(CNTRLS3)_k + \gamma_{002}(YEAR)_k + e_{ijk} + r_{0jk} + u_{00k}.\end{aligned}$$

where i = 1, 2… n_{jk} patients, j = 1, 2… n_k hospitals, k = 1, 2… N counties, $(\mathrm{LOS})_{ijk}$ is patient i's hospital length of stay, γ_{000} is the average hospital length of stay across all hospitals, and e_{ijk} is the error variance across patients with a mean equal to the variance. The remaining variables have the same definitions as noted above.

Empirical Model Research Questions Two and Three, In-hospital Mortality

$$\begin{aligned}(\text{INH\_MORT})_{ijk} &= \gamma_{000} + \gamma_{100}(CNTRLS1)_{ijk} + \gamma_{010}(PAL)_{jk} + \gamma_{020}(IPAL)_{jk} \\ &+ \gamma_{030}(HOSPC)_{jk} + \gamma_{040}(PAL\_EXP)_{jk} + \gamma_{050}(IPAL\_EXP)_{jk} \\ &+ \gamma_{060}(HOSPC\_EXP)_{jk} + \gamma_{070}(CNTRLS2)_{jk} + \gamma_{001}(CNTRLS3)_{k} \\ &+ \gamma_{002}(YEAR)_{k} + e_{ijk} + r_{0jk} + u_{00k}.\end{aligned}$$

where *i* = 1, 2… n_{jk} patients, *j* = 1, 2… n_k hospitals, *k* = 1, 2… N counties, $(\text{INH\_MORT})_{ijk}$ is patient *i*'s log-odds of in-hospital mortality, γ_{000} is the average log-odds of in-hospital mortality across all hospitals, and e_{ijk} is the error variance across patients with mean 0 and fixed variance. The remaining variables have the same definitions as noted above.

Empirical Model Research Questions Two and Three, Transfer to Hospice

$$\begin{aligned}(\text{TR\_HOSPC})_{ijk} &= \gamma_{000} + \gamma_{100}(CNTRLS1)_{ijk} + \gamma_{010}(PAL)_{jk} + \gamma_{020}(IPAL)_{jk} + \gamma_{030}(HOSPC)_{jk} \\ &+ \gamma_{040}(PAL\_EXP)_{jk} + \gamma_{050}(IPAL\_EXP)_{jk} + \gamma_{060}(HOSPC\_EXP)_{jk} \\ &+ \gamma_{070}(CNTRLS2)_{jk} + \gamma_{001}(CNTRLS3)_{k} + \gamma_{002}(YEAR)_{k} + e_{ijk} + r_{0jk} + u_{00k}.\end{aligned}$$

where *i* = 1, 2… n_{jk} patients, *j* = 1, 2… n_k hospitals, *k* = 1, 2… N counties, $(\text{TR\_HOSPC})_{ijk}$ is patient *i*'s log-odds of hospice transfer, γ_{000} is the average log-odds of hospice transfer across all hospitals, and e_{ijk} is the error variance across patients with mean 0 and fixed variance. The remaining variables have the same definitions as noted above.

To test the four (alternative) hypotheses under research question two, joint hypothesis tests are used. Note that statistical significance of the three key parameters (i.e., dummy variables for PAL, IPAL, and HOSPC) cannot be tested using individual t-tests due to the nature of the palliative care experience variable used to address research question three. Specifically, hospitals with a palliative care service in a given year are coded having at least one year of experience providing this service. Individual t-tests are invalid in this set-up, as they test the statistical significance of the key parameters when palliative care experience and other covariates is zero. Therefore, three joint hypothesis tests are conducted to address research question two, which evaluate a 1-year effect of PAL, IPAL, and HOSPC on hospital costs, length of stay, in-hospital mortality, and transfer to hospice, respectively.

Null and Alternative Hypotheses 6a, Hospital Costs

$H_0: \gamma_{010} + \gamma_{040} = 0; H_{6a}: \gamma_{010} + \gamma_{040} < 0.$

$H_0: \gamma_{020} + \gamma_{050} = 0; H_{6a}: \gamma_{020} + \gamma_{050} < 0.$

$H_0: \gamma_{030} + \gamma_{060} = 0; H_{6a}: \gamma_{030} + \gamma_{060} < 0.$

Null and Alternative Hypotheses 6b, Length of Stay

$H_0: \gamma_{010} + \gamma_{040} = 0; H_{6b}: \gamma_{010} + \gamma_{040} < 0.$

$H_0: \gamma_{020} + \gamma_{050} = 0; H_{6b}: \gamma_{020} + \gamma_{050} < 0.$

$H_0: \gamma_{030} + \gamma_{060} = 0; H_{6b}: \gamma_{030} + \gamma_{060} < 0.$

Null and Alternative Hypotheses 6c, In-hospital Mortality

$H_0: \gamma_{010} + \gamma_{040} = 0; H_{6c}: \gamma_{010} + \gamma_{040} < 0.$

$H_0: \gamma_{020} + \gamma_{050} = 0; H_{6c}: \gamma_{020} + \gamma_{050} < 0.$

$H_0: \gamma_{030} + \gamma_{060} = 0; H_{6c}: \gamma_{030} + \gamma_{060} < 0.$

Null and Alternative Hypotheses 6d, Transfer of Hospice

$H_0: \gamma_{010} + \gamma_{040} = 0; H_{6d}: \gamma_{010} + \gamma_{040} > 0.$

$H_0: \gamma_{020} + \gamma_{050} = 0; H_{6d}: \gamma_{020} + \gamma_{050} > 0.$

$H_0: \gamma_{030} + \gamma_{060} = 0; H_{6d}: \gamma_{030} + \gamma_{060} > 0.$

To address research question three, the effects of palliative care experience are tested using individual t-tests. The four (alternative) hypotheses and their corresponding null hypotheses are stated as follows,

Null and Alternative Hypotheses 7a, Hospital Costs

$H_0: \gamma_{040} = 0; H_{7a}: \gamma_{040} < 0.$

$H_0: \gamma_{050} = 0; H_{7a}: \gamma_{050} < 0.$

$H_0: \gamma_{060} = 0; H_{7a}: \gamma_{060} < 0.$

<u>Null and Alternative Hypotheses 7b, Length of Stay</u>

$H_0: \gamma_{040} = 0; H_{7b}: \gamma_{040} < 0.$

$H_0: \gamma_{050} = 0; H_{7b}: \gamma_{050} < 0.$

$H_0: \gamma_{060} = 0; H_{7b}: \gamma_{060} < 0.$

<u>Null and Alternative Hypotheses 7c, In-hospital Mortality</u>

$H_0: \gamma_{040} = 0; H_{7c}: \gamma_{040} < 0.$

$H_0: \gamma_{050} = 0; H_{7c}: \gamma_{050} < 0.$

$H_0: \gamma_{060} = 0; H_{7c}: \gamma_{060} < 0.$

<u>Null and Alternative Hypotheses 7d, Transfer to Hospice</u>

$H_0: \gamma_{040} = 0; H_{7d}: \gamma_{040} > 0.$

$H_0: \gamma_{050} = 0; H_{7d}: \gamma_{050} > 0.$

$H_0: \gamma_{060} = 0; H_{7d}: \gamma_{060} > 0.$

Sensitivity Analysis

Several sensitivity analyses are performed to evaluate the robustness of the empirical results regarding the associations between the five key independent variables and the probability of palliative care provision corresponding to research question one. Specifically, three alternative specifications using respectively the provision of inpatient palliative care consultation services, inpatient palliative care units, and hospice programs are used to determine whether the results are robust across alternative measures of palliative care provision. It is possible that the effects of key independent variables have different effects on the provision of the three different types of palliative care services.

Several sensitivity analyses are conducted to examine the effects of palliative care on hospital performance. First, in regard to hospital costs, separate models for decedents and survivors are estimated to evaluate whether palliative care services have consistent effects on hospital costs across the two patient populations. Empirical evidence exists that patients who received a palliative care consultation and subsequently died during hospitalization incurred significantly lower hospital costs than survivors who received a palliative care consultation during their hospital stay (Whitford et al., 2014). Second, length of stay for patients who were transferred to hospice is examined to assess the effects of palliative care services on discharge timing when subsequent hospice transfers were initiated. Third, the effects of palliative care services on transfer to hospice are examined based on a patient sample, which includes patients who were transferred to hospice and patients who were discharged to home health care or a skilled nursing facility. This sensitivity analysis is performed to assess whether hospital-based palliative care services increases a patient’s probability of hospice transfer when compared to patients with the above-mentioned discharge statuses. Finally, the effects of palliative care services on in-hospital mortality are evaluated for each primary diagnosis individually to determine how sensitive the results are to the selection of different patient populations.

Summary

This chapter identified the research design, data sources, study sample, variable measurement, the empirical methodology, and sensitivity analyses used in this study. This study employs a pooled, cross-sectional research design. Data elements from six different data sources are linked to create the study’s sample, including a variety of patient, hospital, and county information.

The study’s three research questions are investigated with a balanced panel of hospitals from six states over a period of five years. A two-level HGLM is used to address research question one. Three-level HGLM and HLMs are used to investigate research questions two and three. The empirical findings of these analytical models and their corresponding sensitivity analyses are presented in Chapter 5.

Chapter 5: Results

This chapter presents the study findings based on the data and methodology discussed in the previous chapter and is divided into four sections. The first section provides descriptive statistics on patients, hospitals, and counties for Arizona, California, Florida, Maryland, New Jersey, and New York during the study period 2007 to 2011. The second and third sections report the empirical results of the study's analytical models and sensitivity analyses for each research question. The last section provides a brief summary.

Results of Descriptive Analysis

Number of patients, hospitals, and counties.

During the study period, a total of 59,315,052 patient visits across all hospitals in the study states were recorded in the SID discharge files. About 6.34% of those were included in the study, amounting to 3,763,339 patient records. As discussed earlier, patient records were included in the study sample only if they belonged to patients who were 18 years or older, had one of eight primary diagnoses, and were treated in urban, non-federal, general, and acute care hospitals. More than half of patients in the study sample were treated in California (30.49%) and Florida (23.14%). Patients in New York and New Jersey accounted for approximately 15% of the study sample, respectively. Arizona and Maryland had the smallest patient shares with 7.05% and 9.24%, respectively. The study's patients received medical care in 348 hospitals located in 111 counties across the six study states. The average state in the study sample is comprised of 19 urban counties, with Arizona having the least (*n*=5) and California the most (*n*=28). The number of hospitals per county varied from one to 37, with a sample average of three. Specifically, 42 counties had one hospital, 41 counties had between two and three hospitals, 17 counties had four to six hospitals, and 10 counties had seven to 14 hospitals. One county consisted of 37 hospitals. The average hospital had 2,163 patients meeting the sample criteria annually, with one reporting only 37 and another reporting 16,773 patients.

Characteristics of patients.

Table 9 provides a comparison of patients across patient disposition. The majority of patients were 65 years and older (61.06%), and white (67.02%). The sample was almost evenly split between female and male patients. While the distribution of patient gender and race/ethnicity was similar across patient disposition, the average patient who expired during the hospital stay was five years older than the average patient discharged alive, with 73 and 68 years respectively. The median household income quartile by patient zip code as a proxy for patient income was relatively evenly distributed among the four quartiles. Relatively more patients belonged to the lowest quartile (26.72%) than the wealthiest quartile (22.02%). Most patients resided in central/fringe areas with at least one million residents (73.72%). The remaining patients lived in metropolitan areas with 50,000 to 999,999 residents (23.42%) or micro/rural areas with fewer than 50,000 residents (2.92%). Note that while the study examined urban hospitals only, patients who were treated in these hospitals may live in non-urban areas.

Most patients were covered by Medicare (60.92%), followed by private insurance (22.52%), Medicaid (9.82%), self-pay (3.72%), and other means (3.02%). The distributions of patient income, urban/rural residence, and type of health insurance were comparable across patient disposition. The majority of patients were admitted through the emergency room

Table 9

Descriptive Statistics for Patient Characteristics by Patient Disposition, 2007-2011

	Patient Disposition				Total	
Patient Characteristics	Discharged Alive		Died in Hospital			
	#	(%)	#	(%)	#	(%)
Control Variables						
Gender						
Male	1,788,429	(49.82)	85,265	(50.42)	1,873,694	(49.82)
Female	1,805,702	(50.22)	83,943	(49.62)	1,889,645	(50.22)
Age						
18-49 (reference)	482,482	(13.42)	12,735	(7.52)	495,217	(13.22)
50-64	941,314	(26.22)	32,328	(19.12)	973,642	(25.92)
65-74	774,266	(21.52)	33,409	(19.72)	807,675	(21.52)
75-84	843,400	(23.52)	48,534	(28.72)	891,934	(23.72)
85+	552,669	(15.42)	42,202	(24.92)	594,871	(15.82)
Race/Ethnicity						
White (reference)	2,403,946	(66.92)	116,865	(69.12)	2,520,811	(67.02)
Black	511,582	(14.22)	19,370	(11.42)	530,952	(14.12)
Hispanic	430,656	(12.02)	18,747	(11.12)	449,403	(11.92)
Other	247,947	(6.92)	14,226	(8.42)	262,173	(7.02)
Median HH Income (level: ZIP)						
Lowest quartile (reference)	963,620	(26.82)	42,879	(25.32)	1,006,499	(26.72)
2nd lowest quartile[b]	906,482	(25.22)	42,831	(25.32)	949,313	(25.22)
2nd highest quartile[b]	934,837	(26.02)	43,929	(26.02)	978,766	(26.02)
Highest quartile	789,192	(22.02)	39,569	(23.42)	828,761	(22.02)
Urban/Rural Residence[c]						
Central/Fringe (reference)	2,651,346	(73.82)	123,559	(73.02)	2,774,905	(73.72)
Metro	839,217	(23.32)	40,732	(24.12)	879,949	(23.42)
Micro/Rural[b]	103,568	(2.92)	4,917	(2.92)	108,485	(2.92)

Table 9 (continued)

Patient Characteristics	Patient Disposition				Total	
	Discharged Alive		Died in Hospital			
	#	(%)	#	(%)	#	(%)
Health Insurance						
Medicare (reference)	2,181,588	(60.72)	112,118	(66.32)	2,293,706	(60.92)
Medicaid	357,106	(9.92)	13,443	(7.92)	370,549	(9.82)
Private	814,570	(22.72)	32,255	(19.12)	846,825	(22.52)
Self-pay	131,655	(3.72)	5,989	(3.52)	137,644	(3.72)
Other	109,212	(3.02)	5,403	(3.22)	114,615	(3.02)
Source of Admission						
Emergency room (reference)	1,838,797	(51.22)	98,704	(58.32)	1,937,501	(51.52)
Another hospital	140,063	(3.92)	13,643	(8.12)	153,706	(4.12)
Another HCF	85,786	(2.42)	7,370	(4.42)	93,156	(2.52)
Court/Law enforcement[b]	2,076	(0.12)	84	(0.02)	2,160	(0.12)
Routine	1,527,409	(42.52)	49,407	(29.22)	1,576,816	(41.92)
Primary Diagnosis						
Cancer (reference)	1,035,008	(28.82)	51,520	(30.42)	1,086,528	(28.92)
ACD	384,756	(10.72)	38,976	(23.02)	423,732	(11.32)
AMI	416,531	(11.62)	25,171	(14.92)	441,702	(11.72)
CHF	679,175	(18.92)	21,354	(12.62)	700,529	(18.62)
COPD	404,673	(11.32)	6,558	(3.92)	411,231	(10.92)
Dementia	65,411	(1.82)	976	(0.62)	66,387	(1.82)
HIV	42,644	(1.22)	2,678	(1.62)	45,322	(1.22)
Pneumonia	565,933	(15.72)	21,975	(13.02)	587,908	(15.62)
Charlson-Comorbidity Index[a]	2.50	(2.50)	3.16	(2.68)	2.53	(2.22)
Number of surgical procedures[a]	2.03	(2.71)	3.46	(3.77)	2.09	(2.78)
Palliative care encounter						
No (reference)	3,538,455	(98.52)	125,997	(74.52)	3,664,452	(97.42)
Yes	55,676	(1.52)	43,211	(25.52)	98,887	(2.62)
Dependent Variables						
Length of stay[a]	5.39	(4.60)	6.88	(6.57)	5.46	(4.72)

Table 9 (continued)

Patient Characteristics	Patient Disposition				Total	
	Discharged Alive		Died in Hospital			
	#	(%)	#	(%)	#	(%)
Hospital costs (in 2007 US$)[a]	12,380	(12,948)	19,547	(23,426)	12,703	(13,675)
Died in hospital						
No	-	-	-	-	3,594,131	(95.52)
Yes	-	-	-	-	169,208	(4.52)
Transferred to hospice						
No	2,768,815	(96.52)	-	-	2,178,845	(96.12)
Yes	101,065	(3.52)	-	-	89,321	(3.92)
Total	3,594,131	(100)	169,208	(100)	3,763,339	(100)

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. HCF=Healthcare facility. HH=Household. HIV=Human immunodeficiency virus. ZIP=Zone improvement plan. Two-sample *z*-tests are used to compare the proportions across patient disposition.

[a] Means and standard deviations are reported for Charlson-Comorbidity Index, number of surgical procedures, length of stay, and hospital costs; *t*-tests are used to test differences in means across patient disposition. All differences across patient disposition are significant at the p<.05 level. [b] The proportions by patient disposition are not statistically significant (p>.1). [c] Central/Fringe: ≥1 million residents; Metro: 50,000-999,999 residents; Micro/Rural: <50,000 residents.

(51.52%) and more than a third of patients were admitted routinely (41.92%). A significantly higher percentage of expired patients were admitted from another hospital or healthcare facility (12.54%) compared with patients discharged alive (6.34%). Patients discharged alive were also more likely to be admitted routinely (42.52%) than expired patients (29.22%).

A total of 169,208 patients died during hospitalization (4.52%) and 89,321 of patients who lived to be discharged were transferred to hospice (3.92%). About a third of patients had a cancer-related primary diagnosis (28.92%). The second most common primary diagnosis was congestive heart failure (18.62%), followed by pneumonia (15.62%), acute myocardial infarction (11.72%), acute cerebrovascular disease (11.32%), COPD (10.92%), dementia (1.82%), and HIV (1.22%). Acute cerebrovascular disease was more prevalent among decedents (23.02%) compared with survivors (10.72%). In contrast, COPD was significantly less prevalent among expired patients (3.92%) than patients discharged alive (11.32%). Altogether, decedents were sicker than patients who were discharged alive. On average, decedents had a higher Charlson-Comorbidity Index (3.16 versus 2.5) and more surgical procedures (3.46 versus 2.03). Decedents also stayed in the hospital longer and incurred higher hospital costs than survivors. The average decedent had a hospital LOS of 6.88 days and incurred $19,547 in hospital costs, whereas the average survivor was discharged after 5.39 days and incurred $12,380 in hospital costs. The differences were statistically significant. In addition, one in four decedents had a palliative care encounter (25.52%). Among survivors, very few had a palliative care encounter (1.52%).

In summary, the majority of patients were white, at least 65 years old, covered by Medicare, and lived in urban areas. Most patients were admitted to the hospital through the emergency room and had a primary diagnosis related to cancer, congestive heart failure, or pneumonia. There were also noteworthy differences between patients who died during hospitalization and patients who lived to be discharged. On average, expired patients were sicker than survivors with longer hospital LOS, more surgical procedures, and a higher Charlson-Comorbidity Index. Decedents also incurred higher hospital costs, were more likely to have a palliative care encounter and to be admitted to the hospital for acute cerebrovascular disease.

Characteristics of hospitals.

In Table 10, the hospitals in the study sample are compared with all general, acute care, short-term, non-federal, and urban hospitals present in the 2007-2011 AHA Annual Survey of Hospitals data. Each hospital-year combination was treated as an observation to calculate the averages and percentages presented in Table 10.

Table 10

Comparison of Hospitals in the AHA Database and the Study Sample, 2007-2011

Hospital Characteristics	National Sample (n=1,687)		Study Sample (n=348)		Difference
Bed size *M (SD)*	267	(229)	331	(234)	***
Ownership *n (%)*					
For-profit	248	(14.70)	45	(12.93)	***
Public	256	(15.17)	52	(14.95)	
Not-for-profit	1,183	(70.13)	251	(72.12)	**
Teaching status *n (%)*					
COTH member	228	(13.51)	62	(17.82)	***
Non-teaching	1,460	(86.54)	286	(82.18)	***
PC provision *n (%)*					
PAL, IPAL, and/or HOSPC	943	(55.89)	216	(61.95)	***
PAL	820	(48.60)	200	(57.36)	***
IPAL	227	(13.44)	61	(17.53)	***
HOSPC	449	(26.60)	86	(24.83)	*
Years of experience with PC (since 2006) *M (SD)*					
PAL	1.38	(1.72)	1.64	(1.77)	***
IPAL	0.34	(0.99)	0.45	(1.13)	***
HOSPC	0.73	(1.41)	0.66	(1.35)	**

Note. AHA=American Hospital Association. COTH=Council of Teaching Hospitals. HOSPC=Hospice program. IPAL= Inpatient palliative care unit. M=Mean. PAL=Inpatient palliative care consultation service. PC=Palliative care. SD=Standard deviation. *t*-tests were conducted to compare means of national and study samples for bed size and years of PC in place. Two-sample *z*-tests of proportions were performed to compare proportions of national and study samples for all other variables.
* p < .1 ** p < .05 *** p < .01.

Note that results were computed and reported for hospitals with complete information only and for hospitals that were in operation throughout the study period. It is expected that hospitals with palliative care services are more prevalent in the study sample than in the national sample. Several of the states in the study sample have passed or introduced legislation or initiatives promoting increased access to palliative care, including California, Florida, Maryland, and New Jersey (Adondakis & Daniell, 2015; Center to Advance Palliative Care, 2016). In comparison to the national sample, these states may be more proactive in supporting palliative care than other states. Thus, hospitals with palliative care services are more likely to be located in these states. It is also expected that the average number of hospital beds is higher in the study sample than in the national sample, as every study state (except Arizona) has a higher population density than the national average and thus needs to be equipped to serve more patients. No notable differences in teaching status or hospital ownership are expected.

The average hospital in the study sample is larger than the average hospital in the national sample. The study sample has proportionately more not-for-profit and teaching hospitals, but fewer for-profit hospitals than the national sample. The two samples also differ significantly in regard to their palliative care adoption characteristics. As anticipated, the study sample has proportionately more hospitals with at least one of three palliative care services. Hence, the results from this study sample may only be generalizable across the study states or to states with similarly high hospital-based palliative care prevalence.

The distribution of the individual palliative care services also differs significantly. Specifically, the study sample has a significantly higher proportion of hospitals with inpatient palliative care consultation services and inpatient palliative care units, but significantly fewer hospitals that provide hospice programs. Similarly, the average hospital in the study sample has inpatient palliative care consultation services and inpatient palliative care units in place longer and hospice programs in place shorter compared with the average hospital in the national sample.

Characteristics of counties.

Table 11 compares urban counties in the study sample with urban counties in the national sample. Note that results are computed and reported for counties with non-missing information only. It is expected that market competition is higher in the study sample than in the national sample, as the study states have, on average, more hospitals located in urban counties than all U.S. states. Furthermore, it is expected that the average population size is larger among urban counties in the study sample than the national sample due to higher population density in the majority of study states compared to the national average. No noteworthy differences in the remaining county characteristics are expected.

Table 11

Comparison of Urban Counties in the AHA Database and the Study Sample, 2007-2011

County Characteristics	National Sample (n=899)		Study Sample (n=111)		Difference
	Mean	SD	Mean	SD	
Market competition	0.33	(0.30)	0.49	(0.29)	***
Area wage index	0.96	(0.15)	1.12	(0.19)	***
HMO penetration rate	6.5	(7.39)	12.89	(10.08)	***
PPO penetration rate	13.4	(6.22)	13.32	(8.03)	
Per capita income	36,826	(9,143)	43,765	(13,453)	***
Population size	283,918	(548,743)	762,012	(1,117,598)	***
Unemployment rate	7.45	(2.88)	8.38	(3.87)	***
Uninsured rate	19.34	(6.27)	20.42	(6.32)	***

Note. AHA=American Hospital Association. HMO=Health maintenance organization. PPO=Preferred provider organization. SD=Standard deviation. *t*-tests were conducted to compare means.
* p < .1 ** p < .05 *** p < .01.

While the differences in means for most county characteristics were statistically significant at the 1% level, the average PPO penetration rates were not statistically different between the two groups. Compared to counties in the national sample, counties in the study sample were on average more competitive, had a higher area wage index, higher HMO penetration rate, higher per capita income, larger population, and higher unemployment rate.

Descriptive statistics of key variables.

Table 12 presents the annual means and standard deviations of the dependent variable and the five key independent variables used to examine research question one. There was an increase in palliative care provision (i.e., hospitals with PAL, IPAL, and/or HOSPC) over the study period, with levels of palliative care provision ranging between 59% in 2007 and 66% in 2011 ($p = .051$). In addition, hospitals experienced a slight increase in hospital beds. Specifically, the average hospital had 326 and 334 beds in 2007 and 2011, respectively. However, the increase was not statistically significant. Hospitals also experienced a small increase in Medicare inpatient days between 2007 and 2011, ranging from 46.4% in 2007 to 48.5% in 2011 ($p < .036$). This increase may be an indication of an aging patient population. Moreover, while 51% of hospitals had access to palliative care services through a health system, network, or joint venture in 2007, 56% of hospitals had such access in 2011. The difference was not statistically significant. There were no notable and statistically significant fluctuations in the number of teaching hospitals or market competition over the study period. Note that there was little within-variation for teaching status and hospital beds. Therefore, the coefficients estimated for these variables are likely to derive from between-hospital variation.

Table 13 presents annual means and standard deviations of the four dependent variables and key independent variables used to examine research questions two and three. According to Table 13, the number of patients transferred to hospice and the log of inflation-adjusted hospital costs remained stable over the study period. On average, 4% of patients in the study sample were transferred to hospice annually.

Table 12

Descriptives Statistics of Key Variables by Year, Research Question One

Variable	2007		2008		2009		2010		2011	
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Dependent Variable										
Provision of PAL, IPAL, and/or HOSPC	0.59	(0.49)	0.60	(0.49)	0.62	(0.49)	0.63	(0.48)	0.66	(0.48)
Independent Variables										
H_1: Number of staffed and set-up beds	326	(227)	329	(234)	331	(235)	335	(238)	334	(236)
H_2: 1 minus HHI	0.47	(0.31)	0.48	(0.29)	0.48	(0.29)	0.49	(0.29)	0.50	(0.28)
H_3: Presence of PC in health system/network/JV	0.51	(0.50)	0.52	(0.50)	0.53	(0.50)	0.54	(0.50)	0.56	(0.50)
H_4: Share of Medicare inpatient days (%)	46.4	(13.8)	46.9	(13.3)	47.4	(13.3)	47.3	(13.6)	48.5	(13.2)
H_5: Membership with COTH	0.18	(0.38)	0.18	(0.38)	0.18	(0.38)	0.18	(0.38)	0.18	(0.38)

Note. COTH=Council of Teaching Hospitals. HHI=Herfindahl-Hirschman Index. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. JV=Joint venture. PAL=Inpatient palliative care consultation service. PC=Palliative care. SD=Standard deviation.

Table 13

Descriptive Statistics of Key Variables by Year, Research Questions Two/Three

Variable	2007		2008		2009		2010		2011	
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Dependent Variables (n=3,763,339)										
In-hospital mortality	0.05	(0.22)	0.05	(0.21)	0.05	(0.21)	0.04	(0.20)	0.04	(0.20)
Length of stay	5.60	(4.80)	5.54	(4.77)	5.44	(4.71)	5.39	(4.67)	5.32	(4.63)
Transfer to hospice*	0.04	(0.19)	0.04	(0.20)	0.04	(0.20)	0.04	(0.20)	0.04	(0.20)
Hospital costs (2007 US$)	12,779	(13,695)	12,676	(13,446)	12,475	(13,412)	12,679	(13,767)	12,911	(14,045)
Log of hospital costs (2007 US$)	9.09	(0.84)	9.09	(0.82)	9.07	(0.83)	9.09	(0.83)	9.11	(0.82)
Independent Variables (n=348)										
H_7: Presence of PAL	0.52	(0.50)	0.54	(0.50)	0.59	(0.49)	0.60	(0.49)	0.62	(0.49)
Presence of IPAL	0.16	(0.37)	0.17	(0.37)	0.18	(0.39)	0.18	(0.39)	0.19	(0.39)
Presence of HOSPC	0.27	(0.45)	0.26	(0.44)	0.25	(0.43)	0.23	(0.42)	0.23	(0.42)
H_8: Years of experience with PAL (since ‘06)	0.52	(0.50)	1.05	(0.98)	1.63	(1.44)	2.19	(1.90)	2.80	(2.35)
Years of experience with IPAL (since ‘06)	0.16	(0.37)	0.31	(0.70)	0.45	(1.02)	0.61	(1.36)	0.74	(1.65)
Years of experience with HOSPC (since ’06)	0.27	(0.45)	0.52	(0.87)	0.68	(1.23)	0.84	(1.59)	1.01	(1.94)

Note. IPAL=Inpatient palliative care unit. HOSPC=Hospice program. PAL=Inpatient palliative care consultation service. SD=Standard deviation.
* Means and deviations calculated based on patients treated in hospitals in Arizona, Florida, New Jersey, and New York (n=2,268,166).

The average patient's hospital costs fluctuated between $12,475 and $12,911 over the study period. The average length of stay decreased slightly over the study period, from 5.6 days in 2007 to 5.32 days in 2011 ($p < .001$). Similarly, the number of patients who died in the hospital declined from 5% in the first three study years to 4% in 2010 and 2011.

Table 13 also shows a steady growth in the number of hospitals with PAL. Specifically, while 52% of hospitals offered PAL in 2007, 62% of hospitals had such a service in place by 2011. Hospitals also experienced an increase in IPAL, from 16% of hospitals in 2007 to 19% of hospitals in 2011. Conversely, HOSPC were less prevalent in 2011 compared to 2007, with 23% and 27% of hospitals, respectively reporting having such programs. Not surprisingly, the average years of having PAL, IPAL, or HOSPC in place since 2006 increased over the study period.

Descriptive statistics of control variables.

Table 14 reports means and standard deviations of all hospital and market control variables used for all three research questions averaged across the study period. Specifically, hospital control variables and state indicators were averaged across all hospitals and study years, while market control were averaged across all counties and study years. Natural log-transformations were used for three variables, namely average length of stay, population size, and unemployment rate.

The majority of hospitals were not-for-profit (72%). The patient population of an average hospital consisted of 13.88% black patients, 18.97% Hispanic patients, and 36.05% patients aged 65 years and older. On average, patients stayed in the hospital for 4.6 days (or 1.5 mean log). Note that calculations of means and standard deviations for patient characteristics in Table 14 are based on all hospital patients, whereas those in Table 9 are based on the study's patient sample.

Table 14

Descriptive Statistics of Control Variables, All Research Questions

Control Variables	Mean	(SD)
Hospital Control Variables (n = 348)		
Operating margin (lagged)	-0.15	(0.12)
Ownership		
For-profit	0.13	(0.34)
Public	0.15	(0.36)
Not-for-profit (reference)	0.72	(0.48)
Magnet hospital	0.03	(0.17)
Average length of stay (log)*	1.50	(0.19)
Hospital patients with 1 of 8 primary DX (%)	13.61	(3.89)
Hospital patients aged ≥ 65 (%)	36.05	(13.17)
Hospital patients black (%)	13.88	(15.92)
Hospital patients Hispanic (%)	18.97	(20.28)
Ratio of RN to total nurses	0.80	(0.11)
Hospital all-patient DRG case mix	1.51	(0.24)
County Control Variables (n = 111)		
Area Wage Index	1.12	(0.19)
HMO Penetration (%)	12.89	(10.07)
PPO Penetration (%)	13.32	(8.03)
Per capita income (in 1,000)	43.76	(13.45)
Population size (in 10,000) (log)	3.81	(0.98)
Unemployment rate (for ages ≥ 16 in county) (log)	2.03	(0.44)
Rate of uninsured (for ages < 65 in county) (%)	20.42	(6.32)
Year 2007 (reference)	0.20	(0.40)
Year 2008	0.20	(0.40)
Year 2009	0.20	(0.40)
Year 2010	0.20	(0.40)
Year 2011	0.20	(0.40)
State		
Arizona	0.07	(0.25)
California	0.39	(0.49)
Florida	0.20	(0.40)
Maryland	0.08	(0.28)
New Jersey	0.12	(0.33)
New York	0.14	(0.35)

Note. DRG=Diagnosis-related group. DX=Diagnosis. HMO=Health maintenance organization. PPO=Preferred provider organization. RN=Registered nurse. SD=Standard deviation.
* Not included in model with length of stay as a dependent variable.

The average hospital served a patient population consisting of 13.61% patients with PC-benefiting primary diagnoses, ranging from 3.04% to 35.28%. The spread indicates that some hospitals in the study sample serve relatively few patients with diagnoses likely to utilize and benefit from palliative care, whereas others serve relatively high numbers of such patients. In addition, hospital beds, teaching status, and ownership type did not have substantial within-hospital variation over the study period.

On average, the study's counties had PPO and HMO penetration rates of 13.32% and 12.89%, respectively. In addition, the average county had an unemployment rate of 8.38% (or 2.03 mean log), 20.42% uninsured rate, and about 43,760 US dollars per capita income across all study years. The majority of hospitals were located in California and Florida, amounting to 59% of hospitals in the study sample. In addition, area wage index, per capita income, and population size have little within-hospital variation. Overall, county characteristics hardly change over the study period. Finally, due to the study's balanced sample, the number of hospitals in the sample was unchanged over time.

Empirical Analysis: Research Question One

This section is divided into two parts. The empirical results of the main analytical model are first reported and discussed, followed by a presentation and summary of sensitivity analyses conducted to evaluate the robustness of the results generated by the main analytical model. Prior to estimating the full model, an unconditional model (i.e., a model without any covariates) is estimated to calculate the intra-class correlation coefficient (ICC), which is employed to identify how the total variance in the probability of palliative care provision is divided into between-hospital variation and between-county variation.

Results of main analysis.

Table 15 reports the results generated from the two-level HGLM with hospital-based palliative care provision as the dependent variable. Note that the ICC indicated that a statistically significant proportion of the variation in the probability of palliative care provision was at the county level (22.66%).

Table 15

Results of 2-Level Model for Palliative Care Provision

Variable	Odds Ratio	SE
Key Independent Variables		
Number of set-up and staffed beds (in 10s)	1.0375***	0.0068
1 - Herfindahl-Hirschman Index	3.0801	2.9928
Presence of PC services in health system/network/JV	0.5564***	0.0971
Share of Medicare patients (%)	0.9958	0.0089
Teaching hospital	1.2330	0.3635
Hospital Control Variables		
Operating margin (lagged)	0.4322	0.2912
Public	0.2779***	0.0799
For-profit	0.1059***	0.0282
Magnet Hospital	1.3544	0.6922
Ratio RN to total nurses	4.4536**	3.3621
Hospital all-patient DRG case-mix	7.3099***	3.3836
Patients with 1 of 8 primary DX (%)	1.0043	0.0355
Hospital patients Hispanic (%)	0.9825***	0.0056
Hospital patients Black (%)	0.9908	0.0079
Hospital patients aged ≥ 65 (%)	0.9784	0.0134
Average length of stay (log)	1.2021	0.6719
County Control Characteristics		
Area Wage Index	1.8982	3.2079
PPO penetration rate (%)	0.9950	0.0258
HMO penetration rate (%)	1.0043	0.0298
Per Capita Income (in 1,000 US$)	1.0317	0.0202
Population size (in 10,000 residents) (log)	0.7672	0.2462
Unemployment rate (log)	0.7146	0.6146
Rate of uninsured aged 18 through 64 (%)	1.0733*	0.0450
Year		
2008	1.2240	0.4322

Table 15 (continued)

Variable	Odds Ratio	SE
2009	1.5246	1.0548
2010	1.5514	1.1593
2011	1.7526	1.2440
State		
Arizona	1.9942	2.6016
Florida	0.2396	0.2397
Maryland	3.2205	3.7562
New Jersey	1.3769	1.2880
New York	1.7324	1.7296
Intercept	0.0056*	0.0176

Note. DRG=Diagnosis-related group. DX=Diagnosis. HMO=Health maintenance organization. JV=Joint venture. PC=Palliative care. PPO=Preferred provider organization. RN=Registered nurse. SE=Standard error.
* p < .1 ** p < .05 *** p < .01.

In support of Hypothesis 1, the results indicated that the ratio of the probability of providing palliative care services compared to the probability of not providing such services was 3.75% higher for a 10-bed increase in hospital size ($p < .01$), controlling for other variables in the model. In reference to Hypothesis 2, the results suggested that market competition was not significantly associated with the likelihood of palliative care provision ($p = .25$), *ceteris paribus*. In favor of Hypothesis 3, the findings showed that the ratio of the probability of providing palliative care services compared to the probability of not providing such services was 44.36% lower if a hospital had access to palliative care services through a health system, network, or joint venture ($p < .01$), keeping other variables constant in the model. Against the predictions posited in Hypothesis 4 and 5, the results indicated that hospitals' dependence on Medicare and teaching status were not significantly associated with the probability of palliative care provision ($p > .1$), *ceteris paribus*.

Five hospital control variables and one county control variable yielded statistically significant results. Specifically, the ratio of the probability of providing palliative care services compared to the probability of not providing such services was 72.21% and 89.41% lower for public and for-profit hospitals, respectively, compared with not-for-profit hospitals (p < .01). In addition, the odds of providing hospital-based palliative care was positively associated with the ratio of registered nurses and total nurses (odds ratio: 4.45; *p* = .048) and hospital all-patient DRG case-mix (odds ratio: 7.31; *p* < .01). That is, an increase in the ratio of registered nurses to total nurses by one standard deviation (SD = 0.11) increases the odds of hospital-based palliative care provision by 18%, whereas an increase in case-mix by one standard deviation (SD = 0.24) increases the odds by 62.37%. Conversely, the odds of providing palliative care was significantly negatively associated with the percentage of Hispanic patients (odds ratio: 0.98; *p* < .01). Finally, a county's rate of the uninsured (odds ratio: 1.07; *p* = .091) was positively associated with the odds of providing palliative care.

Results of sensitivity analysis.

Table 16 presents the results of the sensitivity analyses using alternative measures for hospital-based palliative care provision. Three alternative models were employed to examine the effects of the study's five key independent variables on the provision of inpatient palliative care consultation services, inpatient palliative care units, and hospice programs, respectively.

According to Table 16, hospital size had a consistently positive association with each of the three palliative care services. The odds ratios were larger than 1, indicating a 2.9% to 4.3% higher probability of providing PAL, IPAL, or HOSPC compared to the probability of not providing PAL, IPAL, or HOSPC for every 10-bed increase in hospital size. These empirical findings are consistent with the results produced in the main analytical model and with the relational expectation suggested in Hypothesis 1. In addition, market competition was not significant in any of the three alternative scenarios.

Table 16

Sensitivity Analyses with Alternative Measures for Palliative Care Provision

Variable	PAL		IPAL		HOSPC	
	Odds Ratio	SE	Odds Ratio	SE	Odds Ratio	SE
H_1: Number of set-up and staffed beds (in 10s)	1.043***	0.007	1.029***	0.006	1.037***	0.007
H_2: 1 - HHI	2.545	2.572	0.204	0.220	1.028	1.327
H_3: Presence of PC services in health system/network/JV	0.856	0.144	0.673**	0.123	0.081***	0.018
H_4: Share of Medicare patients	0.999	0.009	1.022*	0.012	0.974***	0.010
H_5: Teaching hospital	1.998**	0.594	0.541**	0.168	0.979	0.297

Note. HHI=Herfindahl-Hirschman Index. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. JV=Joint venture. PAL=Inpatient palliative care consultation service. PC=Palliative care. SE=Standard error.
* $p < .1$ ** $p < .05$ *** $p < .01$.

The presence of palliative care services in a hospital's health system, network, or joint venture was not significant in predicting the odds of providing PAL, but in predicting the odds of providing HOSPC (odds ratio: 0.081; $p < .01$) and IPAL (odds ratio: 0.673; $p < .05$). These findings partially supported the relationship depicted in Hypothesis 3 with two of three palliative care services being positively associated with the presence of palliative care services in a hospital's local community. Although a hospital's share of Medicare patients was not associated with the probability of providing PAL, this variable significantly predicted the odds of providing IPAL and HOSPC. While a hospital's share of Medicare patients was positively (odds ratio: 1.02; $p < .05$) associated with the odds of providing IPAL, it was negatively associated with the odds of providing HOSPC (odds ratio: 0.97, $p < .01$). These findings partially agreed with the predictions posited in Hypotheses 4. Finally, while a hospital's teaching status was negatively associated with the odds of providing IPAL (odds ratio: 0.541, $p < .05$) and was not significantly associated with the odds of providing HOSPC, it was positively associated with providing PAL (odds ratio: 1.998, $p < .01$) as proposed in Hypothesis 5.

Empirical analysis: research questions two and three

This section is structured in a way similar to the previous section. After the empirical results of the main analytical model are presented, the findings of several sensitivity analyses are reported and summarized for each dependent variable separately. Unconditional models are estimated to calculate the ICC to identify how the total variance in hospital costs, in-hospital mortality, transfer to hospice, and length of stay, respectively, is distributed among the patient, hospital, and county level.

Hospital costs.

Results of main analysis.

Table 17 presents the results generated from the three-level HGLM with hospital costs as the dependent variable. Note that the ICC suggested that a statistically significant proportion of the variation in hospital costs were at the patient (87.68%), hospital (7.39%), and county level (4.93%).

Table 17

Results of 3-Level Model for Hospital Costs, 2007-2011

Variable	Coefficient	SE
Research Questions Two and Three		
PAL	-0.0087***	0.0020
IPAL	-0.0163***	0.0020
HOSPC	0.0004	0.0021
Years of PAL experience (since 2006)	0.0115***	0.0005
Years of IPAL experience (since 2006)	0.0018***	0.0006
Years of HOSPC experience (since 2006)	-0.0034***	0.0006
Patient Control Variables		
Patient Age		
50-64	0.0300***	0.0011
65-74	0.0222***	0.0013
75-84	0.0275***	0.0014
85+	0.0155***	0.0015

Table 17 (continued)

Variable	Coefficient	SE
Patient Gender		
Female	-0.0135***	0.0006
Patient Ethnicity/Race		
Black	-0.0057***	0.0011
Hispanic	-0.0143***	0.0011
Other	-0.0093***	0.0013
Median HH Income (level: ZIP)		
2nd lowest quartile	0.0083***	0.0010
2nd highest quartile	0.0048***	0.0010
Highest quartile	-0.0035***	0.0011
Patient Location		
Metro	0.0431***	0.0017
Micro/Rural	0.0638***	0.0022
Health Insurance		
Medicaid	-0.0102***	0.0013
Private	-0.0720***	0.0010
Self-pay	-0.1094***	0.0019
Other	-0.0930***	0.0020
Admission Source		
Another hospital	-0.1033***	0.0017
Another HCF	0.0041*	0.0021
Court/Law enforcement	-0.0923***	0.0132
Routine	-0.0764***	0.0009
Primary Diagnosis		
HIV	0.0802***	0.0031
AMI	-0.1560***	0.0013
ACD	0.2123***	0.0013
CHF	0.0292***	0.0011
COPD	-0.0633***	0.0013
Pneumonia	0.0482***	0.0012
Dementia	-0.1129***	0.0025
Charlson-Comorbidity Index	0.0314***	0.0002
Number of surgical procedures	0.1890***	0.0001
Palliative care encounter	-0.1481***	0.0020
Hospital Control Variables		
Number of set-up and staffed beds (in 10s)	0.0014***	0.0001
Operating margin (lagged)	0.0652***	0.0064
Presence of PC services in health system/network/JV	-0.0111***	0.0016
Share of Medicare patients (%)	-0.0012***	0.0001

Table 17 (continued)

Variable	Coefficient	SE
Teaching hospital	0.0544***	0.0038
Public	0.0119**	0.0060
For-profit	0.0313***	0.0058
Magnet Hospital	-0.0200***	0.0017
Ratio RN to total nurses	-0.0329***	0.0053
Hospital all-patient DRG case-mix	-0.0324***	0.0064
Patients with 1 of 8 primary DX (%)	-0.0010*	0.0006
Hospital patients Hispanic (%)	-0.0007***	0.0001
Hospital patients Black (%)	-0.0030***	0.0004
Hospital patients aged ≥ 65 (%)	-0.0030***	0.0003
Average length of stay (log)	0.2263***	0.0103
County Control Characteristics		
1 - Herfindahl-Hirschman Index	-0.0367***	0.0061
Area Wage Index	0.5084***	0.0155
PPO penetration rate (%)	0.0010***	0.0001
HMO penetration rate (%)	-0.0024***	0.0003
Per Capita Income (in 1,000 US$)	-0.0011***	0.0002
Population size (in 10,000 residents) (log)	0.0347***	0.0133
Unemployment rate (log)	0.0573***	0.0057
Rate of uninsured aged 18 through 64 (%)	-0.0015***	0.0002
Year		
2008	-0.0230***	0.0022
2009	-0.0794***	0.0047
2010	-0.0755***	0.0052
2011	-0.0353***	0.0050
State		
Arizona	-0.0462	0.0718
Florida	-0.1514***	0.0425
Maryland	-0.1454***	0.0555
New Jersey	-0.1261***	0.0471
New York	-0.3635***	0.0466
Intercept	7.9857***	0.0710

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. DRG=Diagnosis-related group. DX=Diagnosis. HCF=Healthcare facility. HH=Household. HIV=Human immunodeficiency virus. HMO=Health maintenance organization. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. PC=Palliative care. PPO=Preferred provider organization. RN=Registered nurse. SE=Standard error. ZIP=Zone improvement plan.

* $p < .1$ ** $p < .05$ *** $p < .01$.

The point estimate for a 1-year-effect of IPAL was associated with 1.43% lower hospital costs (i.e., $e^{-0.0163\,+\,0.0018} - 1 = -0.014$, $p < .01$). Although the financial benefits of having an IPAL diminished over time, the point estimates for annual effects after the first year were consistently associated with lower hospital costs given that years of experience never exceeded five years. Specifically, the point estimates for hospitals with two to five years of IPAL experience ranged between 1.25% (i.e., $e^{-0.0163\,+2*\,0.0018} - 1 = -0.0125$, $p < .01$) and 0.7% (i.e., $e^{-0.0163\,+\,5*0.0018} - 1 = -0.007$, $p < .01$) lower hospital costs, respectively. While the point estimate of a 1-year effect of HOSPC was statistically insignificant, each additional year of HOSPC experience significantly reduced hospital costs by 0.34% ($p < .01$). Taking this pattern of decline into account, after the first year in place, the presence of HOSPC was associated with significantly lower hospital costs, ranging between 1.67% and 0.65% lower hospital costs. Furthermore, the point estimate of a 1-year effect of PAL was not statistically significant (i.e., $e^{-0.0087+0.0115} - 1 = 0.003$, $p = .143$). However, each additional year of PAL experience was associated with 1.16% higher hospital costs ($p < .01$), *ceteris paribus*. Thus, while IPAL and HOSPC were generally associated with lower hospital costs, PAL programs were generally associated with higher hospital costs.

The majority of patient characteristics significantly affected hospital costs, *ceteris paribus*. First, patient age had a positive association with hospital costs. Compared to the patients aged between 18 and 49, patients in age group 50-64, 65-75, 75-84, and 85 and older incurred 3.05%, 2.24%, 2.79%, and 1.57% higher hospital costs, respectively. In addition, female patients incurred 1.34% lower hospital costs than male patients. Black, Hispanic, and other races/ethnicities had 0.57%, 1.42%, and 0.92% lower hospital costs compared to white patients. Compared to the patients in the lowest quartile of median household income, patients in the second lowest and second highest quartiles accumulated between 0.83% and 0.49% higher hospital costs, respectively. Conversely, patients in the highest quartile incurred 0.34% lower hospital costs than patients in the lowest quartile. Patients from metro and micro/rural areas incurred significantly higher hospital costs (4.41% and 6.58%, respectively) compared to patients from central/fringe areas.

Compared to patients covered by Medicare, patients covered by Medicaid, private insurance, self-pay, and other means (e.g., charity), incurred 1.01%, 6.95%, 10.36%, and 8.88% lower hospital costs, respectively. Furthermore, patients who were transferred from another hospital, admitted by court or law enforcement, and patients who were admitted routinely incurred 9.81%, 8.82%, and 7.36% lower hospital costs respectively, compared to patients who were admitted through the emergency room. However, patients transferred from another health care facility incurred slightly higher hospital costs (0.41%) than patients who were admitted through the emergency room.

Moreover, compared to cancer patients, patients with HIV, ACD, CHF, and pneumonia incurred 8.35%, 23.65%, 2.96%, and 4.94% higher hospital costs. Patients with any of the remaining primary diagnoses had significantly lower costs compared to cancer patients. For example, patients with AMI incurred 14.44% lower hospital costs compared to cancer patients. Similarly, compared to cancer patients, dementia patients incurred 10.68% lower hospitals costs. The number of surgical procedures and Charlson-Comorbidity Index were positively associated with hospital costs. Specifically, one additional surgical procedure was associated with an increase in hospital costs of 20.8%. An increase of Charlson-Comorbidity Index by one standard deviation (SD = 2.22) resulted in 7.2% higher hospital costs. Finally, patients with a documented palliative care encounter had 13.77% lower hospital costs compared to patients without such a documented encounter.

At the hospital level, several control variables were significantly associated with hospital costs, although their effect sizes were small, *ceteris paribus*. Specifically, an increase in ten hospital beds and one-percentage point increase in lagged operating margin were associated with a 0.14% and 6.74% increase in hospital costs, respectively. Hospitals with access to palliative care services through a health system, network, or joint venture incurred 1.11% lower hospital costs compared to hospitals without such access. A one-percentage point increase in a hospital's share of Medicare patients was associated with a 0.12% decrease in hospital costs. Teaching hospitals incurred 5.59% higher hospital costs compared to non-teaching hospitals. For-profit and public hospitals had 3.18% and 1.2% higher hospital costs compared to not-for-profit hospitals, respectively. Magnet hospitals incurred 1.98% lower hospital costs compared to hospitals without Magnet designation. A hospital's all-patient DRG case-mix and ratio of registered nurses to total nurses were negatively associated with hospital costs, with coefficients of -0.03 respectively. A one percent increase in a hospital's share of patients with one of the study's eight primary diagnoses, percentage of Hispanic patients, percentage of Black patients, and percentage of patients aged 65 were also associated with somewhat lower hospital costs. Finally, a 10% increase in average length of stay was associated with a 2.18% increase in hospital costs.

All eight market control variables were significantly associated with hospital costs, keeping other variables constant in the model. Specifically, market competition, HMO penetration rate, per capita income, and the rate of uninsured were associated with somewhat lower hospital costs. On the other hand, the population size, unemployment rate, PPO penetration rate, and area wage index were positively associated with hospital costs. For example, a 10% increase in county's area wage index was associated with 7.49% higher hospital costs.

Results of sensitivity analysis.

Table 18 reports the results of the sensitivity analyses for hospital costs. Separate models were employed for patients who died during hospitalization and patients who were discharged alive.

Table 18

Sensitivity Analyses for 3-Level Model for Hospital Costs by Patient Disposition

Variable	Decedents		Survivors	
	Coefficient	SE	Coefficient	SE
Research Questions Two and Three				
PAL	-0.0053	0.012	-0.0095***	0.0020
IPAL	0.0003	0.012	-0.0185***	0.0020
HOSPC	-0.0308**	0.013	0.0020	0.0021
Years of PAL experience (since 2006)	0.0175***	0.003	0.0117***	0.0005
Years of IPAL experience (since 2006)	0.0034	0.004	0.0022***	0.0006
Years of HOSPC experience (since 2006)	-0.0106***	0.003	-0.0033***	0.0006

Note. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. SE=Standard error.
* p < .1 ** p < .05 *** p < .01.

Among decedents, the 1-year effects of PAL and IPAL on hospital costs were statistically insignificant, while a 1-year effect of HOSPC reduced hospital costs by 4.06% (i.e., $e^{-0.0308-0.0106} - 1 = -0.0406$, $p < .01$). Among survivors, the 1-year effect of IPAL resulted in 1.62% (i.e., $e^{-0.0185+0.0022} - 1 = -0.0162$, $p < .01$) reduced hospital costs, whereas the 1-year effects of PAL and HOSPC had no significant impact on hospital costs among survivors.

The effects of a hospital's experience in providing PAL, IPAL, or HOSPC were similar across patient disposition. Among survivors, one additional year of PAL experience was associated with 1.18% higher hospital costs, whereas one additional year of PAL experience was associated with 1.77% higher hospital costs for decedents. Furthermore, one additional year of HOSPC was associated with 1.05% lower hospital costs among decedents, while one additional year of HOSPC was associated with 0.33% lower hospital costs for survivors. In addition, one additional year of IPAL was associated with 0.22% higher hospital costs among patients who were discharged alive, but was not associated with hospital costs among decedents.

Length of stay.

Results of main analysis.

Table 19 reports the results generated from the three-level hierarchical models with LOS as a dependent variable for patients discharged alive and patients who died during hospitalization, respectively. The effects of the model parameters on length of stay are reported in incidence rate ratios (IRR). Note that the ICC provided evidence that 99.72% of the variance in length of stay was at the patient level, whereas less than half of a percent was at the hospital (0.22%) and county level (0.06%).

Table 19

Results of 3-Level Model for Length of Stay, 2007-2011

Variable	Survivors		Decedents	
	IRR	SE	IRR	SE
Research Questions Two and Three				
PAL	1.0078***	0.0015	1.0164***	0.0058
IPAL	0.9875***	0.0014	0.9769***	0.0056
HOSPC	1.0036**	0.0015	0.9970	0.0060
Years of PAL experience (since 2006)	0.9926***	0.0004	0.9934***	0.0016
Years of IPAL experience (since 2006)	1.0056***	0.0004	1.0109***	0.0018
Years of HOSPC experience (since 2006)	1.0014***	0.0004	1.0026*	0.0016
Patient Control Variables				
Patient Age				
50-64	1.0285***	0.0008	1.0413***	0.0041
65-74	1.0545***	0.0010	1.0327***	0.0046
75-84	1.1272***	0.0011	1.0614***	0.0047

Table 19 (continued)

Variable	Survivors		Decedents	
	IRR	SE	IRR	SE
85+	1.1918***	0.0013	1.0522***	0.0050
Patient Gender				
Female	1.0226***	0.0005	0.9998	0.0019
Patient Ethnicity/Race				
Black	1.0338***	0.0008	1.0360***	0.0034
Hispanic	1.0021***	0.0008	1.0002	0.0034
Other	1.0014	0.0010	0.9883***	0.0036
Median HH Income (level: ZIP)				
2nd lowest quartile	0.9880***	0.0007	1.0012	0.0029
2nd highest quartile	0.9791***	0.0007	0.9876***	0.0030
Highest quartile	0.9615***	0.0008	0.9887***	0.0033
Patient Location				
Metro	1.0016	0.0012	1.0003	0.0051
Micro/Rural	0.9699***	0.0016	0.9701***	0.0066
Health Insurance				
Medicaid	1.0573***	0.0010	1.0733***	0.0042
Private	0.8923***	0.0007	0.9931**	0.0030
Self-pay	0.9397***	0.0013	0.9282***	0.0057
Other	0.9554***	0.0014	0.9276***	0.0060
Admission Source				
Another hospital	1.0772***	0.0013	1.0364***	0.0041
Another HCF	1.0393***	0.0015	0.9190***	0.0028
Court/Law enforcement	1.1628***	0.0100	0.8334***	0.0051
Routine	0.8568***	0.0005	0.8249***	0.0053
Primary Diagnosis				
HIV	1.2425***	0.0024	1.0666***	0.0073
AMI	0.6002***	0.0006	0.4957***	0.0019
ACD	1.2154***	0.0011	0.7210***	0.0025
CHF	1.0526***	0.0008	0.9737***	0.0033
COPD	1.0776***	0.0010	1.1753***	0.0056
Pneumonia	1.2368***	0.0010	1.0664***	0.0035
Dementia	1.4466***	0.0025	1.2182***	0.0155
Charlson-Comorbidity Index	1.0504***	0.0001	1.0298***	0.0005
Number of surgical procedures	1.1311***	0.0001	1.1032***	0.0002
Palliative care encounter	1.2256***	0.0020	1.0636	0.0027
Hospital Control Variables				
Number of set-up and staffed beds (in 10s)	1.0011***	0.0001	1.0007***	0.0002
Operating margin (lagged)	1.0440***	0.0049	1.1268**	0.0203

Table 19 (continued)

Variable	Survivors		Decedents	
	IRR	SE	IRR	SE
Presence of PC services in health system/network/JV	1.0001	0.0011	0.9913	0.0044
Share of Medicare patients (%)	1.0009	0.0001	0.9997***	0.0003
Teaching hospital	1.0557***	0.0029	1.0350***	0.0111
Public	0.9995***	0.0042	0.9374	0.0123
For-profit	1.0169***	0.0042	0.9940***	0.0129
Magnet Hospital	1.0017***	0.0012	0.9578*	0.0048
Ratio RN to total nurses	0.9692***	0.0037	1.0287***	0.0157
Hospital all-patient DRG case-mix	0.9824***	0.0045	0.9472*	0.0153
Patients with 1 of 8 primary DX (%)	0.9958	0.0004	0.9975***	0.0015
Hospital patients Hispanic (%)	0.9997***	0.0001	0.9990	0.0002
Hospital patients Black (%)	0.9992***	0.0002	0.9997**	0.0005
Hospital patients aged ≥ 65 (%)	1.0016	0.0002	0.9988	0.0006
County Control Characteristics				
1 - Herfindahl-Hirschman Index	0.9840***	0.0043	1.0207***	0.0181
Area Wage Index	0.8050***	0.0089	1.1863***	0.0431
PPO penetration rate (%)	1.0002**	0.0001	0.9977	0.0003
HMO penetration rate (%)	1.0004*	0.0002	0.9998**	0.0007
Per Capita Income (in 1,000 US$)	1.0002	0.0002	0.9989**	0.0004
Population size (in 10,000 residents) (log)	1.0335***	0.0062	1.0229***	0.0097
Unemployment rate (log)	1.0422***	0.0043	0.9204***	0.0142
Rate of uninsured aged 18 through 64 (%)	0.9984***	0.0002	1.0021	0.0007
Year				
2008	0.9629***	0.0015	0.9907	0.0059
2009	0.8498***	0.0029	1.0013	0.0126
2010	0.8279***	0.0031	0.9841***	0.0136
2011	0.8260***	0.0030	0.9645	0.0132
State				
Arizona	0.9901	0.0283	0.8915	0.0370
Florida	1.0840***	0.0209	1.0240**	0.0310
Maryland	1.0273	0.0263	0.9158***	0.0338
New Jersey	1.1755***	0.0258	1.1084***	0.0338
New York	1.0751***	0.0223	1.1666***	0.0354
Intercept	3.4726***	0.1285	4.6567***	0.3530

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. DRG=Diagnosis-related group. DX=Diagnosis. HCF=Healthcare facility. HH=Household. HIV=Human immunodeficiency virus. HMO=Health maintenance organization. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. IRR=Incidence rate ratio. PAL=Inpatient palliative care consultation service. PC=Palliative care. PPO=Preferred provider organization. RN=Registered nurse. SE=Standard error. ZIP=Zone improvement plan.

* p < .1 ** p < .05 *** p < .01.

The following results are interpreted controlling for other variables in the model. The empirical results were mixed concerning research questions two and three. The point estimate of a 1-year effect of HOSPC was associated with 0.5% (i.e., $e^{0.0036+0.0014} - 1 = 0.005$, $p < .01$) longer lengths of stay for survivors. Each additional year of HOSPC experience was also associated with 0.14% longer lengths of stay ($p < .01$), leading HOSPC of all durations to be positively associated with length of stay among survivors. Furthermore, the point estimate of a 1-year effect of IPAL was associated with 0.7% (i.e., $e^{-0.0126+0.0056} - 1 = -0.007$, $p < .01$) shorter lengths of stay for survivors, whereas each additional year of IPAL experience was associated with 0.56% longer lengths of stay ($p < .01$). That is, while the point estimate of a 2-year effect was still associated with shorter lengths of stay without being statistically significant, the point estimates of the following years were significantly associated between 0.41% and 1.54% longer lengths of stay. Moreover, the point estimate of a 1-year effect of PAL was not statistically significant among survivors. However, each additional year of PAL experience was associated with 0.74% shorter lengths of stay ($p < .01$). Specifically, the point estimates of a second through fifth year were consistently associated between 0.7% and 2.88% shorter lengths of stay.

Among decedents, the point estimate of a 1-year effect of PAL was associated with 0.97% (i.e., $e^{0.0163-0.0066} - 1 = 0.0097$, $p < .1$) longer lengths of stay, whereas each additional year of PAL experience yielded 0.66% shorter lengths of stay ($p < .01$). Specifically, the point estimates of a fifth year yielded 1.66% shorter lengths of stay ($p < .05$). The point estimates of a second through fourth year were not statistically significant. Furthermore, the point estimate of a 1-year effect of IPAL was associated with a 1.25% (i.e., $e^{-0.0234+0.0108} - 1 = -0.0125$, $p < .05$) decrease in length of stay for decedents. However, each additional year of IPAL experience was associated with 1.09% longer lengths of stay ($p < .01$). In particular, the point estimates of a third through fifth year were associated with 0.92%, 2.01%, and 3.12% longer lengths of stay, respectively. The point estimate of a second year was not significantly associated with length of stay among decedents. Although the point estimate of a 1-year-effect of HOSPC was not statistically significant (i.e., $e^{-0.003+0.0026} - 1 = -.0004, p = .95$), each additional year of HOSPC experience yielded 0.26% longer lengths of stay among decedents. However, the point estimates of a second through fifth year were not significantly associated with length of stay.

Several patient control variables were associated with length of stay, *ceteris paribus*. Specifically, patient age is a significant risk factor of length of stay among both survivors and decedents. Compared with survivors aged 18-49, lengths of stay of survivors in age groups 50-64, 65-74, 75-85, and 85+ were on average 2.85%, 5.45%, 12.72%, and 19.18% longer, respectively. Similar age effects were detected among decedents such that the effects were generally larger for older patients. Female survivors had 2.26% longer length of stay compared with male survivors. Among decedents, patient gender was not significantly associated with length of stay. Black and Hispanic survivors had 3.38% and 0.21% longer length of stay compared with white survivors. Decedents of other ethnicities had shorter lengths of stay compared with white decedents, whereas Black decedents had 3.6% longer lengths of stay. Compared with patients in the lowest quartile of income, patients in the higher quartiles of income had between 1.2% and 3.85% shorter lengths of stay. Similar income effects were observed among decedents. Moreover, among survivors and decedents, patients residing in micro or rural areas had 3% shorter lengths of stay compared with patients residing in urban areas.

Survivors covered by Medicaid had 5.73% longer lengths of stay compared to Medicare patients, while survivors covered by self-pay, private insurance, and other means had between

4.46% and 10.7% shorter lengths of stay compared with Medicare patients. Health insurance had a similar effect on the study's decedents' lengths of stay. Both survivors and decedents with routine admissions had 14.32% and 17.51% shorter lengths of stay compared with patients admitted through the emergency room, respectively. In addition, patients in both groups transferred from another hospital had 3.64% and 7.72% longer lengths of stay compared to patients in the reference group, respectively. Survivors transferred from other health care facilities and admitted through court/law enforcement had on average 3.93% and 16.28% longer lengths of stay respectively compared to survivors admitted through the emergency room, whereas decedents had 8.1% and 16.66% shorter lengths of stay, respectively.

Compared with cancer survivors, HIV, COPD, pneumonia, and dementia survivors had longer lengths of stay. Conversely, survivors with AMI had on average 40% shorter lengths of stay than cancer patients. Similar patterns were observed among decedents. Furthermore, survivors with ACD and CHF had 21.54% and 5.26% longer lengths of stay respectively, whereas decedents with these primary diagnoses had 27.9% and 2.63% shorter lengths of stay compared with cancer patients. One additional surgical procedure was associated with 13.11% longer length of stay among survivors and 10.32% longer lengths of stay among decedents. A one standard deviation (SD=2.22) increase in a patient's Charlson-Comorbidity Index was associated with 11.53% longer lengths of stay among survivors and 6.7% longer lengths of stay among decedents. Survivors with a documented palliative care encounter experienced a 22.56% longer lengths of stay compared with survivors without a documented palliative care encounter. Among decedents, lengths of stay were 6.36% longer when a palliative care encounter was documented.

Several hospital control variables were significantly associated with length of stay, keeping other variables constant. Note that hospital effects differed between patient groups. Specifically, survivors treated in teaching, for-profit, and Magnet hospitals had longer lengths of stay, whereas survivors treated in public hospitals had shorter lengths of stay. More hospital beds and a higher lagged operating margin were associated with longer lengths of stay. Conversely, a higher ratio of registered nurses and total nurses, hospital all-patient DRG case-mix, percentage of Hispanic and Black patients were associated with shorter lengths of stay. Among decedents, more hospital beds, a higher lagged operating margin, and a higher ratio of registered nurses and total nurses were associated with longer lengths of stay. Decedents treated in for-profit and Magnet hospitals had significantly shorter lengths of stay. A higher hospital all-patient DRG case-mix, a higher percentage of patients with the study's eight primary diagnoses, and a higher percentage of Black patients were associated with shorter lengths of stay among decedents.

The majority of market control variables were significantly associated with length of stay, *ceteris paribus*. Among survivors, patients treated in hospitals located in counties with higher market competition, area wage index, and rate of uninsured had shorter lengths of stay. In addition, survivors treated in hospitals located in counties with higher PPO and HMO penetration rates, population sizes, and unemployment rates had longer lengths of stay. Decedents treated in hospitals located in counties with higher market competition, area wage index, and population sizes had longer lengths of stay, whereas decedents treated in hospitals located in counties with higher HMO penetration rates, per capita income, and unemployment rates had shorter lengths of stay.

Results of sensitivity analysis.

Table 20 presents the results of the sensitivity analyses for length of stay for patients who were transferred to hospice.

Table 20

Sensitivity Analyses for Length of Stay until Transfer to Hospice

Variable	IRR	SE
Research Questions Two and Three		
PAL	0.9592***	0.0082
IPAL	0.9879	0.0073
HOSPC	1.0333***	0.0091
Years of PAL experience (since 2006)	1.0063***	0.0022
Years of IPAL experience (since 2006)	1.0108***	0.0025
Years of HOSPC experience (since 2006)	0.9879***	0.0023

Note. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. IRR=Incidence rate ratio. PAL=Inpatient palliative care consultation service. SE=Standard error.
* p < .1 ** p < .05 *** p < .01.

The 1-year effect of PAL resulted in 3.47% (i.e., $e^{-0.0416+0.0063} - 1 = -0.0347$, $p <$ .01) shorter lengths of stay for patients who were transferred to hospice after hospital discharge, whereas the 1-year effect of HOSPC was associated with 2.09% (i.e., $e^{0.0328-0.0122} - 1 = 0.0209$, $p < .01$) longer lengths of stay for patients who were transferred to hospice after hospital discharge. The 1-year effect of hospital-based IPAL was not significantly associated with length of stay. Furthermore, one additional year of PAL and IPAL was associated with 0.63% and 1.08% longer lengths of stay, respectively, whereas one additional year of HOSPC resulted in 1.21% shorter lengths of stay for patients who were transferred to hospice following discharge.

In-hospital mortality.

Results of main analysis.

Table 21 presents the results generated from the three-level HGLM with in-hospital mortality as the dependent variable. According to the ICC, the vast majority of the total variance

Table 21

Results of 3-Level Model for In-Hospital Mortality, 2007-2011

Variable	Odds Ratio	SE
Research Questions Two and Three		
PAL	0.9732**	0.0127
IPAL	0.9282***	0.0135
HOSPC	0.9750*	0.0139
Years of PAL experience (since 2006)	0.9822***	0.0040
Years of IPAL experience (since 2006)	1.0336***	0.0050
Years of HOSPC experience (since 2006)	0.9885***	0.0043
Patient Control Variables		
Patient Age		
50-64	1.2414***	0.0143
65-74	1.8080***	0.0234
75-84	2.4890***	0.0324
85+	3.5884***	0.0486
Patient Gender		
Female	0.9488***	0.0052
Patient Ethnicity/Race		
Black	0.8709***	0.0085
Hispanic	0.8708***	0.0086
Other	1.0246**	0.0109
Median HH Income (level: ZIP)		
2nd lowest quartile	0.9944	0.0080
2nd highest quartile	0.9661***	0.0082
Highest quartile	1.0018	0.0093
Patient Location		
Metro	0.9516***	0.0113
Micro/Rural	0.9098***	0.0169
Health Insurance		
Medicaid	1.2162***	0.0145
Private	1.2103***	0.0108
Self-pay	1.5481***	0.0252
Other	1.3531***	0.0228
Admission Source		
Another hospital	1.2164***	0.0141
Another HCF	1.2870***	0.0187
Court/Law enforcement	0.8973	0.1081
Routine	0.6516***	0.0050

Table 21 (continued)

Variable	Odds Ratio	SE
Primary Diagnosis		
HIV	1.7896***	0.0416
AMI	1.0525***	0.0113
ACD	3.1308***	0.0306
CHF	0.9458***	0.0095
COPD	0.6625***	0.0098
Pneumonia	1.3795***	0.0141
Dementia	0.4200***	0.0144
Charlson-Comorbidity Index	1.1419***	0.0016
Number of surgical procedures	1.1990***	0.0010
Palliative care encounter	20.8885***	0.1705
Hospital Control Variables		
Number of set-up and staffed beds (in 10s)	1.0002	0.0002
Operating margin (lagged)	1.0658*	0.0385
Presence of PC services in health system/network/JV	1.0170**	0.0085
Share of Medicare patients (%)	0.9953***	0.0005
Teaching hospital	0.8953***	0.0123
Public	0.9122***	0.0126
For-profit	1.0833***	0.0169
Magnet Hospital	0.9759*	0.0139
Ratio RN to total nurses	0.9343*	0.0338
Hospital all-patient DRG case-mix	0.6508***	0.0150
Patients with 1 of 8 primary DX (%)	0.9786***	0.0019
Hospital patients Hispanic (%)	1.0034***	0.0003
Hospital patients Black (%)	1.0000	0.0004
Hospital patients aged ≥ 65 (%)	1.0040***	0.0008
Average length of stay (log)	1.9967***	0.0693
County Control Characteristics		
1 - Herfindahl-Hirschman Index	0.9817	0.0274
Area Wage Index	0.8762***	0.0365
PPO penetration rate (%)	0.9947***	0.0008
HMO penetration rate (%)	0.9951***	0.0008
Per Capita Income (in 1,000 US$)	1.0010**	0.0004
Population size (in 10,000 residents) (log)	0.9075***	0.0078
Unemployment rate (log)	0.9454**	0.0244
Rate of uninsured aged 18 through 64 (%)	1.0082***	0.0014
Year		
2008	0.8851***	0.0107
2009	0.8137***	0.0181

Table 21 (continued)

Variable	Odds Ratio	SE
2010	0.7433***	0.0181
2011	0.7532***	0.0186
State		
Arizona	0.6731***	0.0192
Florida	0.7539***	0.0194
Maryland	1.1247***	0.0367
New Jersey	0.9725	0.0250
New York	1.0718**	0.0290
Intercept	0.0192***	0.0020

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. DRG=Diagnosis-related group. DX=Diagnosis. HCF=Healthcare facility. HH=Household. HIV=Human immunodeficiency virus. HMO=Health maintenance organization. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. PC=Palliative care. PPO=Preferred provider organization. RN=Registered nurse. SE=Standard error. ZIP=Zone improvement plan.

* p < .1 ** p < .05 *** p < .01.

in the probability of in-hospital mortality was at the patient level (99.25%), whereas the remaining variance was between at the hospital (0.39%) and county level (0.36%).

The point estimates for a 1-year effect of PAL, IPAL, and HOSPC were associated with 4.4% (i.e., $e^{-0.02713-0.01793}-1=-0.0441$, $p < .01$), 4.06% (i.e., $e^{-0.07449+0.03307}-1=-0.0406$, $p < .01$), and 3.63% (i.e., $e^{-0.02534-0.01159}=-0.0363$, $p < .01$) lower odds of in-hospital mortality, controlling for other variables in the model. Furthermore, one additional year of experience with PAL and HOSPC was associated with 1.78% and 1.15% lower odds of in-hospital mortality, respectively. However, one additional year of IPAL experience yielded 3.36% higher odds of in-hospital mortality. Specifically, the point estimate for a 2-year effect of IPAL was not significantly associated with the odds of in-hospital mortality, whereas the effects of the following years yielded between 2.5% and 9.51% higher odds of in-hospital mortality ($p < .05$). Thus, PAL and HOSPC were generally associated with lower odds of in-hospital mortality, while IPAL was not.

While the results of three of the outcomes were robust to the addition of the palliative care encounter control variable, results with respect to in-hospital mortality were fairly sensitive. Hence, this paragraph summarizes the empirical results of the model estimating in-hospital mortality without the palliative care encounter control variable. Specifically, when estimating the model without the palliative care encounter control variable, only the point estimate for a 1-year effect of PAL was associated with a 2.6% (i.e., $e^{-0.03417+0.0077} - 1 = -0.026$, $p < .05$) reduction in the odds of in-hospital mortality, *ceteris paribus.* One additional year of experience with PAL and IPAL was associated with 0.77% and 2.4% higher odds of in-hospital mortality, respectively.

Several patient control variables are significant predictors of in-hospital mortality. Specifically, patient age is a significant risk factor of in-hospital mortality. Compared with patients aged 18-49, the odds of in-hospital mortality were 24%, 81%, 249%, and 359% higher for patients aged 50-64, 65-74, 75-84, and 85 and older, respectively. In addition, the odds of in-hospital mortality was 5.12% lower for female patients compared with male patients. Compared with white patients, the odds of in-hospital mortality were 11.9% lower for black and Hispanic patients, respectively. Conversely, the odds of in-hospital mortality was 2.46% higher for patients of other ethnicities/races compared with white patients. Compared with patients in the lowest income quartile, the odds of in-hospital mortality was 3.39% lower for patients in the second highest quartile. The odds of in-hospital mortality for patients who lived in metro and micro/rural areas were 4.84% and 9.02% lower, respectively, compared with patients who resided in central/fringe areas. Compared with Medicare patients, patients with other types of health insurance had higher odds of in-hospital mortality, with odds ratios ranging between 1.21 for patients covered by private insurance and 1.55 for patients covered by self-pay. In addition, the odds of in-hospital mortality were 21.64% and 28.7% higher for patients transferred from another hospital and health care facility, respectively, compared with patients who were admitted through the emergency room. On the contrary, the odds of in-hospital mortality was 34.84% lower for patients who were admitted routinely compared with patients in the reference group. The odds of in-hospital mortality were 5.42%, 33.75%, and 58% lower for patients with CHF, COPD, and dementia, respectively, compared with cancer patients. Conversely, the odds of in-hospital mortality were 78.96%, 313.08%, and 37.95% higher for patients with HIV, ACD, and pneumonia, respectively, compared with cancer patients. Patient severity measures were also associated with higher odds of in-hospital mortality. Specifically, one additional surgical procedure was associated with 19.9% higher odds of in-hospital mortality. Similarly, an increase in Charlson-Comorbidity Index by one standard deviation (SD = 2.22) resulted in 34.25% higher odds of in-hospital mortality. Finally, patients with a documented palliative care encounter had a 2089% higher odds of in-hospital mortality compared with patients who did not have a palliative care encounter recorded in their medical records.

Several hospital control variables exhibited statistical significance in predicting in-hospital mortality, *ceteris paribus*. Specifically, patients treated in teaching, public, and Magnet hospitals had lower odds of in-hospital mortality. In addition, a higher share of Medicare patients, ratio of registered nurses to total nurses, number of patients with one of the study's eight primary diagnoses, and hospital all-patient DRG case-mix were associated with lower odds of in-hospital mortality. Conversely, higher lagged operating margin, percentages of Hispanic patients, patients aged 65 and older, and average length of stay were associated with a higher odds of in-hospital mortality. Finally, patients treated in hospitals with access to palliative care services through a health system, network, or joint venture had higher odds of in-hospital mortality.

Some market control variables were significantly associated with the odds of in-hospital mortality, keeping other variables constant. Higher area wage index, PPO and HMO penetration rates, population size, and unemployment rate were associated with lower odds of in-hospital mortality. Higher rates of uninsured and per capita income were associated with somewhat higher odds of in-hospital mortality.

Results of sensitivity analysis.

Table 22 presents the results of the sensitivity analyses for in-hospital mortality. Separate analyses for patients with each of the study's primary diagnoses were estimated.

In regard to research question two, the 1-year effects of PAL had a consistently negative association with the odds of in-hospital mortality for patients with cancer, CHF, COPD, dementia, and pneumonia, with odds ratios ranging between 5.64% for cancer patients and 48.28% for dementia patients. In addition, the 1-year effects of IPAL were associated with 4.38%, 4.87%, and 9.71% lower odds of in-hospital mortality for patients with ACD, cancer, and COPD, respectively. The 1-year effects of HOSPC was associated with 6.46% and 6.11% lower odds of in-hospital mortality for patients with ACD and AMI, respectively. But the 1-year effect of HOSPC was associated with 11.07% higher odds of in-hospital mortality for COPD patients.

In regard to research question three, one additional year of PAL experience resulted in lower in-hospital mortality for patients with AMI, cancer, and HIV, whereas one additional year of PAL experience resulted in somewhat higher odds of in-hospital mortality for patients with dementia and pneumonia. One additional year of IPAL experience was consistently associated with higher in-hospital mortality for ACD, AMI, cancer, and dementia patients. Finally, one

Table 22

Sensitivity Analyses for In-hospital Mortality by Primary Diagnosis, 2007-2011

Variable	ACD		AMI		Cancer		CHF	
	Odds Ratio	SE	Odds Ratio	SE	Odds Ratio	SE	Odds Ratio	SE
Research Questions Two and Three								
PAL	1.0394	0.0313	1.0127	0.0323	0.9739	0.0232	0.9322**	0.0313
IPAL	0.9319**	0.0303	0.9436	0.0341	0.9082***	0.0230	0.9521	0.0367
HOSPC	0.9394*	0.0309	0.9538	0.0331	0.9889	0.0242	1.0304	0.0382
Years of PAL experience (since 2006)	0.9900	0.0090	0.9726***	0.0098	0.9688***	0.0073	1.0053	0.0108
Years of IPAL experience (since 2006)	1.0261**	0.0109	1.0300**	0.0126	1.0475***	0.0088	1.0186	0.0134
Years of HOSPC experience (since 2006)	0.9958	0.0097	0.9844	0.0109	0.9979	0.0076	0.9853	0.0117

Variable	COPD		Dementia		HIV		Pneumonia	
	Odds Ratio	SE	Odds Ratio	SE	Odds Ratio	SE	Odds Ratio	SE
Research Questions Two and Three								
PAL	0.8390***	0.0510	0.4678***	0.0811	1.0254	0.1046	0.8254***	0.0288
IPAL	0.8952	0.0665	0.7581	0.1505	0.8460	0.0976	0.9565	0.0396
HOSPC	1.1096	0.0769	0.9568	0.1889	0.9981	0.1097	1.0385	0.0407
Years of PAL experience (since 2006)	1.0068	0.0195	1.1055*	0.0618	0.9440*	0.0331	1.0306***	0.0114
Years of IPAL experience (since 2006)	1.0086	0.0258	1.2188***	0.0728	1.0416	0.0459	0.9983	0.0141
Years of HOSPC experience (since 2006)	1.0010	0.0222	0.9847	0.0574	1.0058	0.0402	0.9825	0.0123

Note. ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. HIV=Human immunodeficiency virus. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. SE=Standard error.
* p < .1 ** p < .05 *** p < .01.

additional year of HOSPC was not associated with the odds of in-hospital mortality for any of the eight patient groups.

Transfer to hospice.

Results of main analysis.

Table 23 presents the results generated from the three-level HGLM with transfer to hospice as the dependent variable. Note that the ICC suggested that statistically significant proportions of the variation in the probability of transfer to hospice were at the patient (70.96%), hospital (16.48%), and county level (12.55%).

Table 23

Results of 3-Level Model for Transfer to Hospice, 2007-2011

Variable	Odds Ratio	SE
Research Questions Two and Three		
PAL	1.1500***	0.6130
IPAL	0.9586***	0.0249
HOSPC	0.8843*	0.0198
Years PAL in place (since 2006)	0.9081***	0.0058
Years IPAL in place (since 2006)	0.9965	0.0077
Years HOSPC in place (since 2006)	1.0401***	0.0074
Patient Control Variables		
Patient Age		
50-64	1.5264***	0.0281
65-74	2.0263***	0.0416
75-84	3.2082***	0.0655
85+	5.8944	0.1232
Patient Gender		
Female	1.1366***	0.0086
Patient Ethnicity/Race		
Black	0.7555***	0.0105
Hispanic	0.8807***	0.0133
Other	0.8510***	0.0178
Median HH Income (level: ZIP)		
2nd lowest quartile	1.0221*	0.0119
2nd highest quartile	1.0177	0.0121

Table 23 (continued)

Variable	Odds Ratio	SE
Highest quartile	1.0383***	0.0135
Patient Location		
Metro	0.9126***	0.0189
Micro/Rural	0.8291***	0.0216
Health Insurance		
Medicaid	1.3115***	0.0240
Private	0.8708***	0.0120
Self-pay	0.9683	0.0270
Other	1.3956***	0.0296
Admission Source		
Another hospital	0.6286***	0.0139
Another HCF	0.8791***	0.0191
Court/Law enforcement	0.0901***	0.0347
Routine	0.4194***	0.0044
Primary Diagnosis		
HIV	0.4475***	0.0151
AMI	0.4129***	0.0071
ACD	0.7821***	0.0109
CHF	0.3681***	0.0047
COPD	0.2679***	0.0047
Pneumonia	0.3759***	0.0054
Dementia	0.4940***	0.0137
Charlson-Comorbidity Index	1.2815***	0.0023
Number of surgical procedures	0.9281***	0.0017
Palliative care encounter	15.1091***	0.1809
Hospital Control Variables		
Number of set-up and staffed beds (in 10s)	1.0005	0.0010
Operating margin (lagged)	0.9652	0.0801
Presence of PC services in health system/network/JV	1.0272	0.0198
Share of Medicare patients (%)	1.0059***	0.0010
Teaching hospital	1.0949**	0.0448
Public	0.8317***	0.0528
For-profit	0.8386*	0.0767
Magnet Hospital	1.0139	0.0199
Ratio RN to total nurses	1.1587**	0.0693
Hospital all-patient DRG case-mix	1.0469	0.0804
Patients with 1 of 8 primary DX (%)	0.9691***	0.0066
Hospital patients Hispanic (%)	1.0014*	0.0007
Hospital patients Black (%)	1.0117***	0.0037

Table 23 (continued)

Variable	Odds Ratio	SE
Hospital patients aged ≥ 65 (%)	0.9959	0.0034
Average length of stay (log)	0.6028***	0.0755
County Control Characteristics		
1 - Herfindahl-Hirschman Index	0.8256***	0.0498
Area Wage Index	0.4958***	0.0930
PPO penetration rate (%)	1.0003	0.0015
HMO penetration rate (%)	0.9899**	0.0040
Per Capita Income (in 1,000 US$)	0.9960*	0.0024
Population size (in 10,000 residents) (log)	0.8867	0.0869
Unemployment rate (log)	1.2984***	0.0942
Rate of uninsured aged 18 through 64 (%)	1.0018	0.0032
Year		
2008	0.9492*	0.0295
2009	0.8090***	0.0520
2010	1.0061	0.0695
2011	1.5086***	0.1000
State		
Arizona	3.3555***	1.2244
Florida	2.5531***	0.6084
New Jersey	1.5675*	0.3911
Intercept	0.0384***	0.0205

ACD=Acute cerebrovascular disease. AMI=Acute myocardial infarction. CHF=Congestive heart failure. COPD=Chronic obstructive pulmonary disease. DRG=Diagnosis-related group. DX=Diagnosis. HCF=Healthcare facility. HH=Household. HIV=Human immunodeficiency virus. HMO=Health maintenance organization. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. PC=Palliative care. PPO=Preferred provider organization. RN=Registered nurse. SE=Standard error. ZIP=Zone improvement plan.

* p < .1 ** p < .05 *** p < .01.

The following results are interpreted controlling for other variables in the model. The point estimate of a 1-year effect of IPAL resulted in 4.47% (i.e., $e^{-0.0422-0.0035}-1=-0.0447$, p < .05) lower odds of hospice transfer. Although one additional year of IPAL experience was not significantly associated with the odds of hospice transfer, all year effects of IPAL were associated with lower odds of hospice transfer, averaging around 5% lower odds of hospice transfer (p < .1). Moreover, the point estimate of a 1-year effect of HOSPC was associated with 8.02% (i.e., $e^{-0.123+0.0394}-1=-0.0802$, p < .01) lower odds of hospice transfer, while one additional year of HOSPC experience was associated with 4.01% higher odds of hospice transfer. Specifically, the point estimate of a 2-year effect of HOSPC resulted in 4.3% lower odds of hospice transfer ($p < .05$), whereas the point estimate of a 5-year effect of HOSPC was associated with 7.67% higher odds of hospice transfer ($p < .05$). In addition, the point estimate of a 1-year effect of PAL was associated with 4.43% (i.e., $e^{0.1398-0.0964} - 1 = 0.0443, p < .1$) higher odds of hospice transfer. However, one additional year of having a PAL in place was associated with a 9.19% lower odds of transfer to hospice. In summary, IPAL were generally associated with lower odds of hospice transfer, but PAL and HOSPC did not yield consistent effects on hospice transfer. Specifically, while the 1-year effect of PAL was associated with higher odds of transfer to hospice, the remaining year effects yielded lower odds of transfer to hospice. Finally, although the first two year effects of HOSPC were negatively associated with hospice transfer, the fifth year effect was associated with higher odds of transfer to hospice.

Several patient characteristics were significantly associated with the odds of transfer to hospice. Specifically, the odds of transfer to hospice was increasingly higher for patients in higher age groups. Compared with patients aged between 18 and 49, the odds of transfer to hospice were 53%, 203%, 321%, and 589% higher for patients in age groups 50-64, 65-74, 75-84, and 85 and older, respectively. In addition, the odds of transfer to hospice was 13.66% higher for female patients compared with male patients. Compared with white patients, black, Hispanic, and patients of other races/ethnicities had 24.45%, 11.93%, and 14.9% lower odds of transfer to hospice. Patients in higher income quartiles had higher odds of transfer to hospice compared with patients in the lowest income quartile. Patients in metro and micro/rural areas had 8.74% and 17.09% lower odds of transfer to hospice compared with patients in central/fringe areas. Compared with Medicare patients, patients covered by Medicaid and other types of insurance had 31.15% and 39.56% higher odds of transfer to hospice, whereas patients covered by private insurance had 12.92% lower odds of transfer to hospice.

Moreover, patients admitted to the hospitals through the emergency room had a higher odds of transfer to hospice compared to patients not admitted through the emergency room. For example, patients who were admitted routinely had a 58.06% lower odds of transfer to hospice compared with patients admitted through the emergency room. Non-cancer patients had a lower odds of transfer to hospice compared with cancer patients, with odds ratios ranging between 0.7821 for patients with ACD and 0.2679 for COPD patients. Furthermore, an increase in Charlson-Comorbidity Index by one standard deviation (SD=2.22) resulted in 73.42% higher odds of transfer to hospice. Conversely, one additional surgical procedure yielded a 10.21% lower odds of transfer to hospice. Patients with a documented palliative care encounter had a 1511% higher odds of transfer to hospice compared with patients without a documented palliative care encounter.

Several hospital characteristics were associated with transfer to hospice, *ceteris paribus*. A higher share of Medicare patients, Black, and Hispanic patients, and ratio of registered nurses to total nurses were associated with higher odds of transfer to hospice. Patients treated in public and for-profit had lower odds of transfer to hospice, whereas patients treated in teaching hospitals were more likely to be transferred to hospice. In addition, a higher average length of stay and percentage of patients with the study’s primary diagnoses were associated with a lower odds of transfer to hospice.

Some market control variables were significantly associated with transfer to hospice, keeping other variables constant in the model. Specifically, patients treated in hospitals located in counties with a higher market competition, area wage index, HMO penetration rates, and per capita income had lower odds of transfer to hospice. On the other hand, patients treated in hospitals in counties with higher unemployment rates had higher odds of transfer to hospice.

Results of sensitivity analysis.

Table 24 presents the results of the sensitivity analyses for transfer to hospice. Separate analyses for patients transferred to hospice compared to patients transferred to skilled nursing facilities (SNF) or home-health care (HHC).

Table 24

Sensitivity Analyses for Transfer to Hospice vs. Skilled Nursing Facilities/Home-Health Care

Variable	Transfer to Hospice vs. SNF/HHC	
	Odds Ratio	SE
Research Questions Two and Three		
PAL	1.1412***	0.0323
IPAL	0.9792	0.0242
HOSPC	0.8525***	0.0252
Years of PAL experience (since 2006)	0.9069***	0.0064
Years of IPAL experience (since 2006)	0.9940	0.0085
Years of HOSPC in place (since 2006)	1.0406***	0.0081

Note. HHC=Home-health care. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. PAL=Inpatient palliative care consultation service. SE=Standard error. SNF=Skilled nursing facility.
* p < .1 ** p < .05 *** p < .01.

Among patients discharged to skilled nursing facilities or home/self-care, the 1-year effect of HOSPC was associated with 11.29% (i.e., $e^{-0.1596+0.0398} - 1 = -0.1129$, $p < .01$) lower odds of hospice transfer. One additional year of PAL in place was associated with 9.31% lower odds of transfer to hospice, whereas one additional year of HOSPC was associated with 4.06% higher odds of transfer to hospice.

Note that the results from a supplemental analytical model for transfer to hospice, which excluded decedents from the study sample to allow for a comparison of patients who were transferred to hospice and patients who were discharged alive and transferred to other settings, were similar to the results from the main analysis.

Summary

This chapter summarized the results of descriptive, main, and sensitivity analyses to address the study's three research questions. Regarding research question one, the study findings indicated that hospital size was significantly associated with a higher probability of hospital-based palliative care provision (Hypothesis 1). In addition, the presence of palliative care services through a hospital's health system, network, or joint venture was associated with a lower probability of hospital-based palliative care provision (Hypothesis 3). Hospital market competition (Hypothesis 2), a hospital's share of Medicare patients (Hypothesis 4) and teaching status (Hypothesis 5) were not significantly associated with the probability of hospital-based palliative care provision.

The study findings also suggested that the 1-year effects of IPAL and HOSPC were associated with lower hospital costs; the 1-year effect of PAL was not significantly associated with hospital costs (Hypothesis 6a). One additional year of experience in providing IPAL or PAL was associated with higher hospital costs, while one additional year of experience in providing HOSPC was associated with lower hospital costs (Hypothesis 7a).

Among survivors and decedents, the 1-year effect of IPAL was associated with shorter lengths of stay. Among decedents, the 1-year effect of PAL was associated with longer lengths of stay. In addition, the 1-year effect of HOSPC was associated with longer lengths of stay among survivors. Among decedents, the 1-year effect of HOSPC was not significantly associated with length of stay (Hypothesis 6b). One additional year of PAL was associated with shorter lengths of stay, while one additional year of IPAL or HOSPC was associated with longer lengths of stay for decedents and survivors (Hypothesis 7b).

The 1-year effects of PAL, IPAL, and HOSPC were associated with reduced odds of in-hospital mortality (Hypothesis 6c). The alternative model specification without the patient control variable palliative care encounter yielded significantly lower odds of in-hospital mortality for a 1-year effect of PAL only. One additional year of providing PAL or HOSPC was associated with lower odds of in-hospital mortality but one additional year of IPAL resulted in higher odds of in-hospital mortality (Hypothesis 7c). The alternative model specification produced higher odds of in-hospital mortality for one additional year of PAL and IPAL.

The 1-year effect of PAL was associated with higher odds of hospice transfer, whereas the 1-year effects of IPAL and HOSPC were associated with lower odds of hospice transfer (Hypothesis 6d). One additional year of providing PAL resulted in a lower probability of being transferred to hospice; one additional year of HOSPC resulted in a higher probability of transfer to hospice (Hypothesis 7d).

The next chapter summarizes and interprets the research findings and closes with a review of the study’s limitations, a discussion of the theoretical, practical, and policy implications of the empirical results, and suggestions for future research.

Chapter 6: Discussion

Palliative care promises to improve organizational and patient outcomes in the hospital setting. Specifically, a hospital's decision to integrate palliative care models into its service mix may influence both hospital performance and quality of patient care, as captured in such important metrics as hospital length of stay, hospital costs, in-hospital mortality, and patient disposition (e.g., transfer to hospice). Chapter 2 provided a comprehensive overview and examination of prior research supporting this notion.

The study's three research questions were stated in the first chapter: 1) Which organizational and environmental forces are associated with the provision of hospital-based palliative care services? 2) Do hospitals that provide palliative care services have improved organizational and patient outcomes compared to those not providing such services? and 3) Is a hospital's experience in providing palliative care services associated with improved organizational and patient outcomes? Chapter 3 continued with a presentation and discussion of the study's theoretical framework used to develop propositions and hypotheses to answer the study's research questions. To explore the association between key independent variables and palliative care provision and hospital performance measures, analytical models were employed controlling for additional patient, hospital, and market characteristics.

The study's methodology, including research design, data sources, study sample, variable measurement, and analytical strategy, was developed in Chapter 4. Detailed results from these models were presented in Chapter 5. Chapter 6 starts with a summary and interpretation of the research findings, followed by a review of the study's limitations and a discussion of the theoretical, practical, and policy implications of the empirical results. The chapter closes with suggestions for future research.

Summary of Study Findings

Hospital adoption of palliative care.

This study used Institutional Theory and Resource Dependence Theory to examine the association between hospital and market characteristics and the provision of palliative care services. The study tested five hypotheses for research question one using a two-level hierarchical generalized linear model with a binomial sampling model and a logit link function to describe under which circumstances hospitals tend to provide palliative care services. Table 25 summarizes the five hypotheses and specifies whether they were supported based on the results of the main analytical models, as reported in Chapter 5.

Regarding Hypothesis 1, the findings suggested that hospital size is positively associated with the odds of providing one or more of the three palliative care services under study (i.e., PAL, IPAL, and/or HOSPC). This notion was further supported when exploring the relationship between hospital size and each of the three palliative care services individually. As hospital size increases, a hospital may decide that providing services in-house is necessary to meet the needs of its patient population in an efficient and timely manner.

The findings did not support the proposition that hospitals located in more competitive hospital markets were more likely to provide palliative care services in order to secure revenue flow and patient referrals, as proposed in Hypothesis 2. The study's sensitivity analyses also failed to produce significant results regarding this hypothesis. It is possible that hospitals are unable to react to higher levels of market competition due to workforce shortages. Since the

Table 25

Summary of Study Findings, Research Question One

Hypothesis	Supported
Research Question One: Which organizational and environmental forces are associated with the provision of hospital-based palliative care services?	
Hypothesis 1: Hospitals with more staffed and set-up beds are more likely to provide palliative care services compared to hospitals with fewer staffed and set-up beds.	Yes
Hypothesis 2: Hospitals in more competitive markets are more likely to provide palliative care services compared to hospitals in less competitive markets.	No
Hypothesis 3: Hospitals that have access to palliative care services through a health system, network, and/or joint venture in their local community are less likely to provide palliative care services in-house.	Yes
Hypothesis 4: Hospitals with a greater Medicare share of inpatient days are more likely to provide palliative care services compared to hospitals with a smaller Medicare share of inpatient days.	No
Hypothesis 5: Hospitals that are members of the COTH are more likely to provide palliative care services compared to hospitals that are non-COTH members.	No

Note. COTH=Council of Teaching Hospitals.

American Board of Medical Specialties (ABMS) and the American Osteopathic Association (AOA) recognized Hospice and Palliative Medicine (HPM) as a subspecialty in 2008, 7,351 physicians achieved subspecialty certification in HPM as of 2015 (American Academy of Hospice and Palliative Medicine, n.d.). Lupu and the American Academy of Hospice and Palliative Medicine Workforce Task Force (2010) estimated that between 6,000 and 18,000 additional hospice and palliative care physicians were needed to close the gap between the physician supply and national demand for hospice and palliative care. However, the current board certification process does not facilitate the increase in hospice palliative care physicians to meet the supply shortage. Specifically, while physicians with clinical experience and competence in hospice and palliative care were eligible to take the certification exam without completing a 12-month, accredited HPM fellowship until 2013, subsequent physicians are required to complete an HPM fellowship (American Academy of Hospice and Palliative Medicine, n.d.). Hospitals that are interested in providing specialty palliative care may be unable to create such services because of a lack of HPM-certified physicians. Instead, hospitals in counties with a higher level of market competition may resort to focusing on educating clinicians to provide primary palliative care to their patients. As this study focused on specialty palliative care provision, this relationship may need to be explored in future research studies.

The results supported the proposition presented in Hypothesis 3 that the presence of palliative care services through a hospital’s health system, network, or joint venture was negatively associated with the provision of hospital-based palliative care services. Sensitivity analyses further indicated hospitals with access to palliative care services outside the hospital were less likely to offer hospital-based IPAL and HOSPC. Although hospitals in highly interconnected environments may be more likely to abide by the environmental pressures to integrate medical services linked to high-quality care (Zinn et al., 2010), the study findings suggested that the availability of such services through other means regulated the need to comply with such pressures. Future research may consider including interaction terms of hospital-based palliative care services and their not-hospital-based counterparts.

The results related to Hypothesis 4 provided no evidence that hospitals with a higher percentage of Medicare patients were more likely to provide palliative care services. A possible explanation for this finding may be that hospitals with higher percentages of Medicare patients incorporate primary palliative care into existing clinical procedures without establishing specialty palliative care delivery models. Further research is required to investigate whether having a high percentage of Medicare patients affected the prevalence of primary palliative care. It is also probable that CMS's commitment to high-quality, patient-centered care for seriously ill and medically complex patients, including allowing separate billing for advance care planning effective in early 2016, did not provide adequate motivation for a hospital to provide palliative care services during the study period. Additional research is needed to examine the relationship between a hospital's patient population covered by Medicare and the provision of hospital-based palliative care services in the years following the study period. Sensitivity analyses produced mixed findings in regard to Hypothesis 4. Supporting the hypothesis' notion, a hospital's share of Medicare patients was positively associated with the probability of providing IPAL. Conversely, hospitals with higher shares of Medicare patients were less likely to offer hospital-based HOSPC. One explanation for this negative relationship may be the emergence of hospital partnerships with local hospices to provide hospice care to hospital patients with end-of-life care needs. In addition, hospital-based hospice programs are expensive and hospitals amy struggle to cover the costs associated with caring for hospice patients who are covered by the Medicare Hospice Benefit.

Regarding Hypothesis 5, the study found that teaching hospitals were not significantly more likely to provide palliative care services compared to non-teaching hospitals. The sensitivity analyses, however, demonstrated that teaching hospitals were more likely to provide inpatient palliative care consultation services (PAL) compared to non-teaching hospitals, which is consistent with the proposition presented in Hypothesis 5. This finding is similar to those from prior research examining hospital adoption of PAL (Stover, 2005). Conversely, teaching hospitals were less likely to provide inpatient palliative care units (IPAL) compared to non-teaching hospitals. It is possible that teaching hospitals prefer inpatient palliative care consultation services, as these services have a more flexible and versatile scope of application within the hospital and may therefore be viewed as more useful in a teaching environment than IPAL or HOSPC. Specifically, teaching hospitals are likely to focus on maintaining continuity of care to optimize learning, which is easier to accomplish with inpatient palliative care consultation services compared to inpatient palliative care units or hospice programs as patients' palliative care needs can be addressed without transferring them to a different unit.

Several hospital and market control variables used in the analytical model to address research question one were significantly associated with the provision of palliative care services, including hospital ownership, the ratio of registered nurses to total nurses, hospital all-patient DRG case-mix index, and percentage of Hispanic patients. Note that a hospital's lagged operating margin, although not statistically significant, may be influenced by prior palliative care provision such that palliative care might result in lower hospital costs. Finally, the rate of uninsured in a county was the only market control variable that reached statistical significance.

Not-for-profit hospitals were more likely to provide palliative care services than for-profit and public hospitals. This finding is consistent with prior research (Dumanovsky et al., 2015; Morrison et al. 2011; Morrison et al., 2005; Stover, 2005, White et al., 2002). The mission of not-for-profit hospitals tends to focus on serving the greater good and prioritizing community health needs as required to be granted tax exempt status (Proenca et al., 2000). Among not-for-profit hospitals, providing access to a variety of palliative care services may be viewed as an essential component of high-quality care for patients with serious and terminal illnesses, even if these services are potentially not economically viable. Catholic hospitals, in particular, are considered early adopters of palliative care, as it aligns with Catholic theology, philosophy and mission of care (White, Cochran, & Patel, 2002).

In addition, hospitals with a higher proportion of registered nurses to total nurses were more likely to provide palliative care services. Nursing capacity defined by a higher proportion of highly skilled nurses, such as registered nurses, may influence a hospital's decision to provide palliative care services. As the nursing profession traditionally focuses on caregiving instead of curing, including the care of seriously ill and terminal patients, hospitals that employ more registered nurses may also be more likely to integrate services into the service mix that are not aimed to cure diseases. Conversely, it is also possible that hospitals with palliative care services have a higher demand for higher skill mix of nurses and are therefore more likely to hire highly skilled nurses. Furthermore, hospitals with a higher hospital all-patient DRG case-mix were more likely to provide palliative care services. These findings are consistent with the proposition that hospitals with a sicker patient population are more likely to see the need to provide services aimed to manage complex patient needs. Conversely, hospitals with higher percentages of Hispanic patients were less likely to provide palliative care services. This finding is in accordance with prior research suggesting that barriers to palliative care exist among ethnic minorities due to cultural differences in attitudes toward and perceptions of terminal illnesses (Johnson, 2013; Johnstone & Kanitsaki, 2009; Kwak & Haley, 2005).

Finally, hospitals located in counties with higher rates of uninsured aged 18-64 were more likely to provide palliative care services. Kazley and Ozcan (2007) suggested that hospitals in wealthier counties, a proxy for resource availability in the environment (i.e., munificence), may be more inclined to attract patients who can afford to pay for high-quality services. Specifically, a low rate of uninsured in a market may be viewed as a measure of munificence. But this study found that hospitals located in markets with a higher rate of uninsured were more likely to provide palliative care services. It could be speculated that the predominant focus on curative treatment within the U.S. healthcare system encouraging the provision of (typically expensive) life-prolonging treatment implicitly incentivizes hospitals to transition patients to palliative care, especially hospice care, when patients are not insured or underinsured. Additional research is needed to investigate this relationship.

Performance effects of palliative care.

This study applied Donabedian's (1980) Structure-Process-Outcome model to examine the relation between hospital-based palliative care services and hospital costs, in-hospital mortality, transfer to hospice, and length of stay. The study tested eight hypotheses to address research questions two and three. The following three-level hierarchical models were employed: a Bernoulli sampling model and a logit link function to examine in-hospital mortality and transfer to hospice, a normal sampling model and an identity link function to evaluate hospital costs, and a Poisson sampling model and log link function to assess hospital length of stay.

Tables 26 and 27 present the hypotheses related to research questions two and three, respectively, and indicate whether they were supported based on the findings of the main analytical models, as reported in the previous chapter. Note that it is difficult to distinguish between research questions two and three due to the nature of the palliative care experience variables, as discussed in Chapter 4. Consequently, to address research question two, the point estimates of a 1-year effect of the three palliative care services were used to approximate the effects of such services on the study outcomes. The coefficients of the three palliative care experience variables were examined to address research question three.

Table 26

Summary of Study Findings, Research Question Two

Hypothesis	Hypothesis Supported (by Patient Disposition)		
	Survivors	Decedents	Total
Research Question Two: Do hospitals that provide palliative care services have improved organizational and patient outcomes compared to those not providing such services?			
Hypothesis 6a: Patients treated in hospitals that provide palliative care services have lower hospital costs than patients treated in hospitals that do not provide such services.			
PAL	-	-	No
IPAL	-	-	Yes
HOSPC	-	-	No
Hypothesis 6b: Patients treated in hospitals that provide palliative care services have shorter hospital LOS than patients treated in hospitals that do not provide such services.			
PAL	No	No	-
IPAL	Yes	Yes	-
HOSPC	No	No	-
Hypothesis 6c: Patients treated in hospitals that provide palliative care services are less likely to die during hospitalization than patients treated in hospitals that do not provide such services.			
PAL	-	-	Yes
IPAL	-	-	Yes
HOSPC	-	-	Yes
Hypothesis 6d: Patients treated in hospitals that provide palliative care services are more likely to be transferred to hospice than patients treated in hospitals that do not provide such services.			
PAL	-	-	Yes
IPAL	-	-	No
HOSPC	-	-	No

Note. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. LOS=Length of stay. PAL=Inpatient palliative care consultation service.

Table 27

Summary of Study Findings, Research Question Three

Hypothesis	Hypothesis Supported (by Patient Disposition)		
	Survivors	Decedents	Total
Research Question Three: Is a hospital’s experience in providing palliative care services associated with improved organizational and patient outcomes?			
Hypothesis 7a: Patients treated in hospitals that are more experienced in providing palliative care services have lower hospital costs than patients treated in hospitals that are less experienced.			
Years of PAL experience (since 2006)	-	-	No
Years of IPAL experience (since 2006)	-	-	No
Years of HOSPC experience (since 2006)	-	-	Yes
Hypothesis 7b: Patients treated in hospitals that are more experienced in providing palliative care services have shorter hospital LOS than patients treated in hospitals that are less experienced.			
Years of PAL experience (since 2006)	Yes	Yes	-
Years of IPAL experience (since 2006)	No	No	-
Years of HOSPC experience (since 2006)	No	No	-
Hypothesis 7c: Patients treated in hospitals that are more experienced in providing palliative care services are less likely to die during hospitalization than patients treated in hospitals that are less experienced.			
Years of PAL experience (since 2006)	-	-	Yes
Years of IPAL experience (since 2006)	-	-	No
Years of HOSPC experience (since 2006)	-	-	Yes
Hypothesis 7d: Patients treated in hospitals that are more experienced in providing palliative care services are more likely to be transferred to hospice than patients treated in hospitals that are less experienced.			
Years of PAL experience (since 2006)	-	-	No
Years of IPAL experience (since 2006)	-	-	No
Years of HOSPC experience (since 2006)	-	-	Yes

Note. HOSPC=Hospice program. IPAL=Inpatient palliative care unit. LOS=Length of stay. PAL=Inpatient palliative care consultation service.

Hospital costs.

The results suggested that the relationship between palliative care services and lower hospital costs was partially supported. The 1-year-effect of an inpatient palliative care unit (IPAL) was associated with lower hospital costs (Hypothesis 6a). The point estimates for year effects after the first year were also consistently associated with lower hospital costs, although the financial benefits of having an IPAL diminished over time (Hypothesis 7a). Conversely, the 1-year effect of HOSPC was not significantly associated with hospital costs (Hypothesis 6a), but one additional year of experience in providing HOSPC was significantly associated with lower hospital costs (Hypothesis 7a). The year effects of HOSPC ranged between 0.65% for the second year and 1.67% for the fifth year. Finally, the 1-year effect of an inpatient palliative care consultation service (PAL) was not significantly associated with hospital costs (Hypothesis 6a), and one additional year of experience in providing PAL was significantly associated with incrementally higher hospital costs (Hypothesis 7a). That is, the year effects of PAL ranged between 1.45% for the second year and 5.02% for the fifth year. In sum, IPAL and HOSPC were associated with lower hospital costs, whereas PAL was associated with higher hospital costs.

A possible explanation for these mixed findings is that PAL, IPAL, and HOSPC potentially have different effects on hospital costs, unlike what has been proposed in this study. In future analyses, one may need to address how each of the study's three types of palliative care services individually affect hospital costs. Further research is needed to explain above-mentioned differences in effects on hospital costs. It is possible that PAL are focused on providing palliative care services to patients in conjunction with curative treatments and thus potentially increase hospital costs. On the other hand, HOSPC and IPAL may aim toward transitioning patients from curative treatment plans to comfort care only, which potentially reduces hospital costs.

Moreover, analyzing the effects of PAL, IPAL, and HOSPC on different subsets of hospital costs, such as pharmacy, laboratory, ICU, cardiology, emergency room, or physical therapy costs may also provide additional information on the financial impact of palliative care services.

The study found several significant associations between patient control variables and hospital costs. Compared to patients aged 18-49, patients in the older age groups incurred significantly lower hospital costs. While this finding contradicts national findings concerning hospital costs for all hospital patients, it is possible that younger age groups incur higher hospital costs if they have one of the study's eight primary diagnoses. It is possible that younger patients with these primary diagnoses are more likely to receive curative than palliative treatment. Female patients incurred lower hospital costs than male patients. Furthermore, white patients incurred higher costs than patients of other ethnicities. Medicare patients incurred higher hospital costs than patients covered by Medicaid, private insurance, self-pay, and other means. The study findings on patient gender and primary payer are largely consistent with national findings concerning hospital costs for all hospital patients (Weiss & Elixhauser, 2014). In addition, patients admitted through the emergency room incurred higher hospital costs than patients transferred from another hospital, admitted by court or law enforcement or admitted routinely. Patients with HIV, ACD, CHF, and pneumonia were among the most expensive patients. Furthermore, the number of surgical procedures was associated with higher hospital costs, which is consistent with findings from a prior study (Stover, 2005). Furthermore, a higher Charlson-Comorbidity Index, as a proxy for patient severity, was associated with higher hospital costs, consistent with findings from prior studies (e.g., Charlson et al., 2008). Finally, patients with a documented palliative care encounter incurred lower hospital costs than patients without a documented palliative care encounter.

All hospital control variables were significantly associated with hospital costs. On average, higher lagged operating margin, number of beds, and average length of stay were associated with higher hospital costs. The findings for hospital costs and number of hospital beds are similar to those reported by Jiang et al. (2013). Regarding lagged operating margin, reverse causality may exist, because reduced hospital costs influence a hospital's operating margin. Conversely, the presence of palliative care services through a hospital's health system, network, or joint venture, higher share of Medicare patients, higher ratio of registered nurses to total nurses, higher hospital all-patient DRG case-mix, higher percentage of Hispanic patients, Black patients, and patients aged 65 and older were, on average, associated with lower hospital costs. Nurse staffing measures have been found to reduce hospital costs (e.g., Weiss, Yakusheva, & Bobay, 2011). White et al. (2005) found a positive association of hospital all-patient DRG case-mix with hospital costs, although it did not reach statistical significance. In addition, public and for-profit hospitals incurred higher hospital costs than not-for-profit hospitals. Teaching hospitals incurred higher hospital costs than non-teaching hospitals, which is consistent with prior studies (e.g., Jiang et al., 2013; Stover, 2005). Magnet hospitals incurred lower hospital costs than non-Magnet hospitals. A study published in 2014 found a positive relationship between Magnet status and hospital costs (Jayawardhana, Welton, & Lindrooth, 2014).

All market control variables were significantly associated with hospital costs. On average, higher area wage index, PPO penetration rate, log-transformed population size, and log-transformed unemployment rate were associated with higher hospital costs. On the contrary, higher market competition, HMO penetration rate, per capita income, and rate of uninsured were associated with lower hospital costs. The findings for the relationship between HMO penetration, per capita income, and area wage index were similar to those reported by Jiang et al. (2013) and Stover (2005).

Length of stay.

The 1-year effect of IPAL was associated with shorter lengths of stay for survivors and decedents, supporting Hypothesis 6b. However, one additional year of IPAL experience resulted in longer lengths of stay for both patient groups (Hypothesis 7b). Specifically, among decedents, the year effects of the third through fifth year ranged between 0.91% longer lengths of stay for the third year and 3.12% longer lengths of stay for the fifth year. Among survivors, the year effects were between 0.41% longer lengths of stay for the third year and 1.54% longer lengths of stay for the fifth year.

The 1-year effect of HOSPC was significantly associated with longer lengths of stay among survivors, whereas the 1-year effect of HOSPC was not significantly associated with length of stay among decedents (Hypothesis 6b). The results of Hypothesis 7b suggested that one additional year of HOSPC was associated with longer lengths of stay for both patient groups. However, among decedents, the individual year effects were not significantly associated with length of stay. Among survivors, all year effects were positively associated with length of stay, but with relatively small magnitudes.

The 1-year effect of PAL was positively associated with length of stay among decedents, but not significantly associated with length of stay among survivors (Hypothesis 6b). One additional year of PAL experience was associated with shorter lengths of stay for both patient groups (Hypothesis 7b). Among decedents, the fifth year was associated with a 1.66% shorter length of stay. Among survivors, all year effects after the first year were statistically significant and ranged between 0.7% shorter lengths of stay for the second year and 2.88% shorter lengths of stay for the fifth year. Findings from prior research were also mixed (Cassel et al., 2010b). A potential explanation for these inconsistent findings may be that palliative care services have different effects at different stages during a patient's hospitalization. For example, palliative care services may reduce LOS in the ICU by earlier transfers to other hospital wards, but may not necessarily reduce a patient's hospital LOS. In addition, patients with a documented palliative care encounter stayed significantly longer in the hospital than patients without such an encounter. While this finding may suggest that palliative care is associated with longer hospital LOS, it may also indicate that palliative care encounters, identified by the billable ICD-9-CM code V66.7, were merely assigned to patients with a high likelihood of mortality and patients with prolonged LOS. Specifically, endogeneity in terms of reverse causality may be a threat to causal inference when examining the effects of palliative care services on hospital LOS, because clinical guidelines used regularly include extended hospital LOS as a trigger to initiate palliative care consultations (Norton et al., 2007). Moreover, the three-level hierarchical model used to examine hospital LOS produced very small hospital-level and market-level ICC (< 1%), which indicates that the majority of variation in hospital LOS lies between patients. Hierarchical models with very small ICC at the higher levels may increase the potential of Type I errors (Barcikowski, 1981). Small ICCs also indicate that the assumption of independence may hold, which means that traditional statistical approaches potentially suffice to examine hospital LOS. The sensitivity analysis demonstrated that, among patients who were transferred to hospice, patients treated in hospitals with PAL had shorter in-hospital stays than patients treated in hospitals without PAL. This findings suggests that PAL may facilitate hospice transfers for patients at the end of life, and is consistent with palliative care teams actively trying to transfer patients out of the hospital to their homes or community hospices.

Several patient control variables were significantly associated with length of stay. For both survivors and decedents, patient age was positively associated with length of stay. Prior studies found similar results for the relationship between length of stay and patient age (e.g., Shi, 1996; van de Vijsel, Heijink, & Schipper, 2015). On average, female survivors stayed in the hospital longer than male survivors. Among decedents, patient gender was not significantly associated with length of stay. Compared with white patients, black patients stayed in the hospital longer, regardless of patient disposition. Among survivors, Hispanic patients had longer lengths of stay than white patients. Conversely, expired patients of other ethnicities had shorter lengths of stay.

Patient health insurance had similar effects across patient disposition. Compared to Medicare patients, patients covered by Medicaid had longer lengths of stay. Patients covered by private insurance, self-pay, or other types had shorter lengths of stay than Medicare patients. Among survivors, patients with HIV, ACD, CHF, COPD, pneumonia, and dementia had longer lengths of stay than cancer patients, whereas AMI patients had significantly shorter lengths of stay. The results regarding primary diagnosis were similar for decedents. Among decedents, patients with ACD and CHF as a primary diagnoses had a shorter lengths of stay than cancer patients. More surgical procedures and a higher Charlson-Comorbidity Index were associated with longer hospital stays for both patient groups, which is consistent with prior studies (e.g., van de Vijsel et al., 2015). Finally, patients with a documented palliative care encounter had, on average, longer hospital stays than patients without such a documented encounter, regardless of patient disposition. Again, it is possible that this variable is endogenous, as patients with longer lengths of stay are more likely to have a palliative care encounter compared to patients with shorter lengths of stay.

Several hospital control variables were significantly associated with length of stay. The relationships were similar for survivors and decedents. Specifically, a higher number of hospital beds and lagged operating margin were associated with longer lengths of stay. The findings for length of stay and number of hospital beds contradicted those reached by White and et al. (2005). Conversely, having a higher hospital all-patient DRG case-mix, higher percentage of Hispanic and black patients were associated with shorter lengths of stay. A higher ratio of registered nurses to total nurses was associated with shorter lengths of stay among survivors, but associated with longer lengths of stay among decedents. The findings for length of stay and hospital all-patient DRG case-mix contradict those reached by White and et al. (2005). Nursing capacity measures have been associated with shorter length of stay in prior studies (e.g., Voepel-Lewis, Pechlavanidis, Burke, & Talsma, 2013). Compared with non-teaching hospitals, teaching hospitals had on average longer lengths of stay. This may indicate that teaching hospitals spend more time treating patients than non-teaching hospitals. The findings for length of stay and teaching status are similar to those reached by White et al. (2005) and Lin et al. (2006). Furthermore, for-profit hospitals had longer lengths of stay than not-for-profit hospitals, whereas public hospitals had shorter hospital stays than not-for-profit hospitals among survivors.

Seven market control variables were found to be significantly associated with length of stay. Higher PPO penetration rate, log-transformed population size, and log-transformed unemployment rate were associated with longer lengths of stay. A higher HMO penetration rate was associated with longer lengths of stay among survivors, whereas a higher HMO penetration rate was associated with shorter lengths of stay. Higher market competition, area wage index, and rate of uninsured were associated with shorter lengths of stay. The findings for length of stay and population size and area wage index were consistent with findings reached by White et al. (2005).

In-hospital mortality.

Regarding Hypotheses 6c and 7c, the results consistently supported the hypothesis that palliative care services reduce the odds of in-hospital mortality. The 1-year effects of PAL, IPAL, and HOSPC were associated with reduced odds of in-hospital mortality (Hypothesis 6c). One additional year of PAL experience resulted in reduced odds of in-hospital mortality, ranging between 4.41% lower odds of in-hospital mortality in the first year and 11% lower odds of in-hospital mortality in the fifth year. Similarly, one additional year of HOSPC experience was associated with lower odds of in-hospital mortality, ranging between 3.63% and 7.99% lower odds of in-hospital mortality for the effect of a given year. However, one additional year of IPAL resulted in higher odds of in-hospital mortality. That is, the year effects of the third through fifth year were associated with incrementally higher odds of in-hospital mortality, ranging between 2.5% higher odds of in-hospital mortality for the third year and 9.51% higher odds of in-hospital mortality for the fifth year. The point estimate of the 2-year effect was negative but statistically not significant. It is possible that hospitals with more experience in providing IPAL are more likely to provide palliative care to terminally-ill patients rather than transferring them to hospice or other health care settings. Transfers out of the hospital are often too time-intensive and painful for terminally-ill patients who are imminently dying, so that remaining in the IPAL is often preferred over a transfer to hospice. Furthermore, IPAL patients and their families often decide against transfers out of the unit because of the bonds made between them and the IPAL staff (K.R. White, personal communication, July 5, 2016).

When estimating the model without the palliative care encounter control variable, only the 1-year effect of PAL resulted in reduced in-hospital mortality. Similarly, the effects of one additional year of providing PAL or IPAL was associated with a higher risk of dying during hospitalization.

The sensitivity analyses conducted regarding in-hospital mortality were largely consistent with the findings of the main analyses. Specifically, separate analyses were estimated for patients with the study’s eight primary diagnoses, and the majority of analyses revealed either significantly lower in-hospital mortality or no effect on in-hospital mortality for patients treated in hospitals with PAL, IPAL, or HOSPC. Similar to the analytical model for length of stay, the three-level hierarchical model used to examine in-hospital mortality produced very small hospital-level and market-level ICC (< 1%), which indicates that the majority of variation in in-hospital mortality lies between patients. Hierarchical models with very small ICC at the higher levels may increase the potential of Type I errors (Barcikowski, 1981). Small ICCs provide evidence that the assumption of independence of hospitals may hold. Therefore, conventional single-level approaches may be adequate to evaluate in-hospital mortality.

The majority of patient control variables were significant predictors of in-hospital mortality. Higher patient age was associated with higher odds for in-hospital mortality. Female patients were less likely to die during hospitalization than male patients. Black and Hispanic patients had lower odds of in-hospital mortality than white patients. Patients of other ethnicities were more likely to die during hospitalization than white patients. These findings are consistent with those reported by Stover (2005) and Lackan et al. (2009). Research has shown that minorities may have limited resources and access to end-of-life services in their communities, such as home hospice services or nursing homes (Kirby & Kaneda, 2005). In addition, Johnson

(2013) discussed the factors contributing to racial and ethnic disparities in palliative care, including knowledge gaps about palliative care, religious beliefs not in line with palliative care delivery models, general distrust in the medical system, and greater preference for curative treatment among minority patients. These patients may therefore be more likely to die in the hospital than opting for alternative sites of death outside of the hospital. Compared with Medicare patients, patients covered by Medicaid, private health insurance, self-pay, and other payer types had, on average, higher odds of in-hospital mortality. Patients transferred from other hospitals or healthcare facilities had on average higher odds of in-hospital mortality compared with patients admitted through the emergency room. Patients admitted routinely were on average less likely to die during hospitalization than patients in the reference group. Compared with cancer patients, patients with HIV, AMI, ACD, and pneumonia had higher odds of in-hospital mortality, whereas patients with CHF, COPD, and dementia had lower odds of in-hospital mortality. In addition, a higher Charlson-Comorbidity Index and more surgical procedures were associated with higher odds of in-hospital mortality. The findings for in-hospital mortality and surgical procedures are similar to those attained by Stover (2005) and for in-hospital mortality and the Charlson-Comorbidity Index similar to those reported by Ladha et al. (2015). Finally, patients who had a documented palliative care encounter had a higher odds of in-hospital mortality than patients without such a documented encounter.

Among hospital control variables, lagged operating margin, log-transformed average length of stay, percentage of Hispanic patients and patients aged 65 and older were associated with higher odds of in-hospital mortality. Conversely, a higher share of Medicare patients, ratio of registered nurses to total nurses, hospital all-patient DRG case-mix, and percentage of patients with the study’s primary diagnoses were associated with lower odds of in-hospital mortality.

Teaching hospitals had lower odds of in-hospital mortality than non-teaching hospitals. The findings for teaching status and in-hospital mortality are similar to those reported by Allison et al. (2000), who examined the association between teaching status and hospital mortality between thirty days and two years after hospital admission for patients with AMI. Shahian et al. (2014) also found significantly lower 30-day risk-standardized mortality rates for patients with AMI, heart failure, and pneumonia treated in teaching hospitals. Magnet hospitals had lower odds of in-hospital mortality than non-Magnet hospitals, which is consistent with prior studies (McHugh et al., 2013). While public hospitals had lower odds of in-hospital mortality than not-for-profit hospitals, for-profit hospitals had higher odds of in-hospital mortality.

Among market control variables, higher area wage index, PPO and HMO penetration rates, log-transformed population size, and log-transformed unemployment rate were associated with lower odds of in-hospital mortality. The findings for in-hospital mortality, PPO and HMO penetration, and area wage index are consistent with those reported in prior studies (e.g., Stover, 2005). Per capita income and rate of uninsured were associated with higher odds of in-hospital mortality.

Transfer to hospice.

The study results generally contradicted the effects of palliative care services on hospice transfers depicted in Hypotheses 6d and 7d. The 1-year effect of PAL was associated with higher odds of hospice transfer (Hypothesis 6d), whereas one additional year of PAL experience was negatively associated with odds of hospice transfer (Hypothesis 7d). Specifically, the year effects of PAL after the first year were significantly associated with incrementally lower odds of hospice transfer, ranging between 5.17% lower odds of hospice transfer for the second year and 28.99% lower odds of hospice transfer for the fifth year. Furthermore, the year effects of IPAL were consistently associated with lower odds of hospice transfer, although one additional year of IPAL was not significantly associated with odds of hospice transfer (Hypothesis 7d). In other words, the year effects of IPAL remained relatively constant with 4.47% lower odds of hospice transfer in the first year and 5.8% lower odds of hospice transfer in the fifth year. The year effects of the first two years of HOSPC were associated with 8% and 4.33% lower odds of hospice transfer respectively (Hypothesis 6d), whereas the fifth year was associated with 7.67% higher odds of hospice transfer. The year effects of the third and fourth year of HOSPC were not statistically significant. The findings largely contradicted Hypotheses 6d and 7d and further research is needed to understand this relationship. It is possible that hospitals with IPAL and PAL are more likely to treat patients at the end of life and therefore view these services as a suitable alternative to transferring patients to hospice. A lack of community-based alternatives, such as home hospice services, home health services, or nursing homes, may also contribute to fewer hospice transfers. Future research studies may need to account for market characteristics that capture the availability of alternative resources outside of the hospital setting.

All patient control variables significantly predicted the odds of transfer to hospice. On average, older patient age were associated with higher odds of transfer to hospice. In addition, female patients had a higher odds of transfer to hospice than male patients. Compared to white patients, black, Hispanic, and patients of other ethnicities had lower odds of transfer to hospice. Compared with any other primary diagnosis, cancer patients had a higher odds of transfer to hospice. The findings for hospice transfer, patient age, ethnicity/race, gender, and primary diagnosis are consistent with reports on characteristics of the U.S. hospice patient population (National Hospice and Palliative Care Organization, 2014). Compared to Medicare patients, Medicaid patients and patients covered by other payer types had higher odds of transfer to hospice. Conversely, patients covered by private insurance were less likely to be transferred to hospice. Furthermore, patients admitted through the emergency room had higher odds of transfer to hospice than patients transferred from another hospital or healthcare facility, admitted by court or law enforcement, and admitted routinely. A higher Charlson-Comorbidity Index was associated with higher odds of transfer to hospice, whereas a higher number of surgical procedures was associated with lower odds of transfer to hospice. Patients with a documented palliative care encounter had a higher odds of transfer to hospice than patients who did not have such an encounter.

Several hospital control variables significantly predicted the odds of transfer to hospice. Teaching hospitals had higher odds of transfer to hospice than non-teaching hospitals. Public and for-profit hospitals had lower odds of transfer to hospice than not-for-profit hospitals. A higher ratio of registered nurses to total nurses, percentage of Hispanic and Black patients, and share of Medicare patients were associated with higher odds of transfer to hospice. Conversely, a higher percentage of patients with one of eight primary diagnoses and log-transformed average length of stay were associated with lower odds of transfer to hospice.

Among market control variables, higher market competition, area wage index, HMO penetration rate, and per capita income were associated with lower odds of transfer to hospice, whereas a higher log-transformed unemployment rate was associated with higher odds of transfer to hospice. This study is among the first to examine the relationship between hospice transfers and hospital and market characteristics, which limits the ability to compare the study findings with those attained by prior studies.

Study Limitations

This study has six noteworthy limitations. These limitations relate to the use of administrative data, the construction and representativeness of key variables, the type of analysis, the generalizability of the study findings, and the scope of outcome measures.

First, this study relied on administrative data, primarily information from the AHA Annual Survey of Hospitals for the key variables related to palliative care provision and from the HCUP SID for the study's dependent variables to examine research questions two and three. The use of these administrative databases has several caveats. First, HCUP SID data are based on patient discharge files. This study relies on the fact that patient information is recorded in a correct and complete manner. Specifically, discharge coding for patients transferred to hospice may be prone to coding errors. Although hospitals should code a patient as discharged to hospice regardless of whether that patient is transferred to a hospital-based or on outside hospice facility, it is possible that in some instances patients transferred to a hospital-based facility are not coded in this manner, which may affect the measurement of hospice transfers and lengths of stay for these patients. Second, the AHA Survey of Hospitals was used to determine whether hospitals had PAL, IPAL, and/or HOSPC in place in a given year. Approximately 23% of urban, non-federal, acute care hospitals across the study states had missing information for PAL, IPAL, and/or HOSPC in one or more study years and about 30% of hospitals with non-missing information showed inconsistent palliative care implementation patterns prior to and during the study period, which may be an indication of inaccurate coding. The AHA Survey of Hospitals is completed on a voluntary basis by hospital administrative staff. The information provided in the survey is not externally checked for accuracy. Third, a definitional issue may arise when identifying the source of palliative care services. That is, the AHA Survey of Hospitals distinguishes between palliative care services provided by the health system, network, and joint venture. It is unclear whether this distinction is understood and interpreted uniformly across participating hospitals. It is also possible that the distinction between hospital-based and not-hospital-based palliative care services is not fully understood by those completing the survey. Thus, these data points may be prone to misinterpretation, which may lead to data inaccuracy.

Second, the key independent variable to examine research question three is limited in its capability to represent the overall construct of a hospital's experience providing palliative care services. First, due to data inconsistencies, information on the presence of palliative care services prior to the study period could not be taken into account to determine each service's implementation year. In other words, hospitals with a service in place in 2007 were assigned a "1" in that year; that is, these hospitals were considered to have one year of experience in providing a palliative care service in 2007. However, these hospitals may have had these services in place longer than one year. The palliative care experience variable also assumes that time has a linear effect. Given the possibility that the palliative care programs have been in existence for several years prior to 2007, this specification may be an imprecise presentation of the underlying construct of palliative care experience. It is also possible that there is a selection effect such that hospitals that adopted palliative care services early are inherently different from hospitals that adopted such services later. Therefore, estimating whether or not a hospital had a palliative care service may not be sufficient to explain the true nature of hospital adoption of palliative care services. In addition, due to a high rate of inconsistent implementation patterns within the study period (~30%), it is also possible that the measurement of palliative care experience for all hospital cases suffers from inaccuracy. In addition, this study did not take non-linear effects of palliative care services on patient and organizational outcomes into account. For example, it is possible that hospital costs and length of stay increase during the first year of implementation of a palliative care service and decrease in the years after due to learning effects. Such non-linear effects need to be considered carefully in future study development, data collection, and analysis. Similarly, the measurement of market competition corresponding to Hypothesis 5 may not be able to accurately define the notion that hospitals are more likely to provide hospital-based palliative care services if they are located in a highly competitive market. This study used the Herfindahl-Hirschman Index to represent market competition, which was calculated using information on total hospital admissions in the county. However, it may be more appropriate to focus on hospital admissions of patients with primary diagnoses most likely to benefit and utilize palliative care services instead, as hospitals are likely to assess this patient population as a potential source of revenue when deciding for or against providing hospital-based palliative care services.

Third, it is likely that not only the presence of palliative care services, but also other structural characteristics, such as utilization, organization, or staffing, influence the effectiveness of palliative care provision. Integrating procedural attributes (e.g., work processes, care protocols) may also help to identify how hospitals deliver palliative care services, which can in turn influence hospital costs, length of stay, in-hospital mortality, and transfer to hospice. This also raises the question of how experience in providing a palliative care service can influence the study's empirical results, as hospitals potentially need time to identify procedures that are most effective in addressing specific patients' palliative care needs. Similarly, due to limited data availability, this study was unable to control for all relevant factors influencing hospital adoption of palliative care services and patient outcome measures. Specifically, the prevalence of hospices and home health services in the county, as a measure of market supply of palliative care services, may influence a hospital's decision to provide hospital-based palliative care services. Similarly, a large number of hospices and home health services may also affect a hospital's discharge pattern and, in turn, affect the odds of hospice transfers, in-hospital mortality, and length of stay.

Fourth, the effect of palliative care services on patient and organizational outcomes would ideally be evaluated by focusing on patients who actually utilized palliative care services (and to what extent). Although the distinction between patients with and without primary diagnoses most likely to benefit from and use palliative care services attempts to resolve this issue, it is merely an approximation of actual palliative care utilization. For example, it might be possible that patients categorized as most likely to benefit from and utilize palliative care services in this study did not receive any palliative care. Even in hospitals with established specialty palliative care, many patients with palliative care needs do not have access to such care. While, on average, 3.4% of hospital admissions receive palliative care, more than twice as many hospital patients are estimated to have palliative care needs (Morrison & Meier, 2015). Non-referrals or late referrals are attributable to uncertainty about disease progression; misconception and lack of knowledge about palliative care among medical professionals, families, and patients; poor communication skills; and inadequate capacity of specialty palliative care programs to serve all hospital patients with palliative care needs (Melvin & Oldham, 2009). Conversely, patients who were not categorized as most likely to benefit from and utilize palliative care services may have received palliative care services during their hospital stays. A fundamental problem with this type of analysis would be related to the identification of a control group; that is, patients who did not receive palliative care services. A suitable control group may include hospital patients who qualify for palliative care but do not receive such care. Palliative care assessment criteria have been introduced to screen patients and assure that unmet palliative care needs are identified and met efficiently, such as repeated hospital admissions, comprehensive care needs, advanced and incurable cancer, or inadequate social support (Weissman & Meier, 2011). Given such information is available for all patients admitted to a hospital, a control group could be constructed from patients who meet these and other criteria. However, due to limited patient information available through the HCUP SID, this type of study cannot be conducted on a large scale and may need to be limited to patients admitted to one or a few hospitals for which additional relevant patient data can be obtained.

Fifth, the generalizability of this study may be limited. Specifically, although this study aims for geographic diversity in terms of state selection by choosing states from three of the four U.S. census regions, the results may not be reproducible in other states.

Finally, this study evaluated a limited set of outcome measures due to restricted data availability and thus other important quality indicators of palliative care could not be examined. Comprehensive assessments of patient-centered health care services, such as palliative care, should include a broader set of outcome measures, including patient and family satisfaction, symptom and pain management, and alignment of goals of care with patient preferences.

Implications of the Findings

Theoretical implications.

Regarding research question one, this study used two widely-used organizational theories, namely Institutional Theory (IT) and Resource Dependence Theory (RDT), to study hospital adoption of palliative care services and derive five propositions and hypotheses. While two hypotheses were supported, the remaining three were not. In future analysis, it may therefore be necessary to identify additional theories to reconsider the study’s conceptual framework in an attempt to assess the hypotheses that were not supported in this study or to establish new hypotheses to provide a more complete perspective on a hospital’s adoption behavior. The application of institutional economics, such as transaction cost economics (TCE), may shed further light on a hospital’s decision to provide palliative care services. This theory provides a rational perspective on organizational decision-making, whereas IT and RDT tend to emphasize the role of external constituents to explain organizational behavior (Shortell, 1997). Specifically, TCE may be used to explain why hospitals decide to invest in hospital-based palliative care services rather than to rely on palliative care services available through the health system, network, or joint venture. This theory is often used in the context of make-or-buy decisions, and its basic premise is that it is more efficient to produce transactions (or services) in-house if they are frequently occurring, uncertain, and asset-specific (Williamson, 1975). Finally, it may also be useful to utilize qualitative research methods to gain a more comprehensive understanding about the drivers of hospital-based palliative care adoption. It is essential to note that palliative care adoption is likely driven by a variety of factors and may be more fully understood when additional or alternative theoretical perspectives are utilized.

The study also drew from Donabedian’s Structure-Process-Outcome (SPO) model to address research questions two and three. However, the SPO model largely failed to explain how palliative care services are associated with hospital performance measures and explain associations clearly, which may be due to the limited depth of the model. While a framework based on structures, processes, and outcomes may be useful to describe and quantify the main dimensions of health care quality, it may not be able to sufficiently explain how organizational structures, such as the presence of PAL, IPAL, and HOSPC, influence hospital performance measures.

In addition, this study does not take procedural dimensions regarding the provision of palliative care into account due to data limitations, but instead focuses on the presence of hospital-based palliative care services and their impact on hospital performance. In the context of palliative care, however, it may be more appropriate to quantify a hospital's processes of how, when, and where palliative care services are delivered. While the presence of palliative care services is an essential structural component, the procedural characteristics of care delivery and management promise more predictive power in terms of hospital performance. Additional data and research are required to establish causal relationships between palliative care services and hospital performance by focusing on processes related to care delivery and other structural components of such services that go beyond the provision of access to palliative care in the hospital setting. In order to test these relationships empirically, primary data collection may need to be conducted because administrative data on procedural characteristics of health care service delivery are currently not collected on a large scale.

Health care policy implications.

Since the publication of the SUPPORT study in 1995, policy makers and leaders in the healthcare industry have focused on improving care for patients with serious, complex, life-limiting and potentially life-threatening illnesses (Cassel, 2014). Given the rising demand for palliative care due to an aging population with chronic life-limiting diseases, the results of this study provide valuable insight for policy makers in regard to potential barriers or drivers of palliative care provision.

Increased presence of PAL in the hospital setting has been viewed as a trend toward improvement of care for this patient population (Dumanovsky et al., 2015; Morrison et al., 2005). From a policy perspective, a better understanding of the drivers behind hospital adoption of palliative care may help to accomplish two goals: (1) to ensure full access to palliative care to patients with palliative care needs, and (2) to create incentives that motivate hospitals to integrate these services in a way that improves both hospital performance and care provision for patients with palliative care needs. These goals may be accomplished by overcoming persistent barriers to palliative care provision, including payment models (Cassel, 2014; Center to Advance Palliative Care, 2016). For example, linking hospital performance with financial incentive programs, such as value-based purchasing, is an important step toward rewarding quality rather than quantity of care. It is questionable, however, whether the presence of such services is synonymous with adequate delivery. Merely encouraging hospitals to provide palliative care may not suffice to ensure that patients with palliative care needs are effectively identified and managed. In other words, providing palliative care does not necessarily equate with quality of palliative care. Consequently, policy makers could structure incentive programs based on outcome-related quality measures that can be addressed effectively by palliative care, such as the alignment of goals of care with patient preferences, provider-patient and provider-family communication and interaction, bereavement support, and symptom management. In addition to outcome-related quality measures, incentives should also reward the structural and procedural components of palliative care services, such as those promoted in NCP’s clinical practice guidelines for quality palliative care (National Consensus Project for Quality Palliative Care, 2013). For example, the NCP encourages “a comprehensive and timely interdisciplinary assessment of patient and family” (p. 14) to identify patient and family needs early in the disease trajectory, typically within 24-72 hours of hospital admission. Processes and structures that ensure early identification of patients with palliative care needs may be a better indication of quality palliative care than the mere presence of palliative care services.

Practice implications.

Healthcare administrators, in cooperation with clinical staff, need to decide whether and how palliative care services fit into their service mix. A variety of factors drive the decision-making process, including available resources and demand. Although clinical guidelines proposed by the National Quality Forum and NCP provide general guidance on how optimal palliative care should be structured and delivered, clearer direction is needed for hospitals to decide which type of palliative care service is most appropriate to meet the palliative care needs of their patient population.

This study has shed some light on the association of three types of hospital-based specialty palliative care services with hospital costs, in-hospital mortality, length of stay, and transfer to hospice. However, the study findings are in part inconclusive and may not provide clear guidance in regard to the benefits of specialty palliative care in the hospital setting. Therefore, healthcare administrators may also investigate the use of primary palliative care, although not examined in this study, as a means to improve care for patients with serious and potentially life-limiting illnesses. Relying on palliative care competencies of clinical staff to provide basic palliative care to patients on a day-to-day basis may provide hospitals with an opportunity to reserve palliative care specialists for managing the most complex patients (Weissman & Meier, 2011). While prior research has shown that primary palliative care services, such as integrative care models, are associated with hospital performance, further research is needed to determine to what extent both primary and specialty palliative care fit into a hospital's service mix. In this context, it is also important to assess how hospitals educate clinical staff to provide primary palliative care. Primary palliative care education often lacks an interdisciplinary team approach, where clinical staff are trained within their respective professions (K. White, personal communication, July 7, 2016). A hospital may be better equipped to meet patients' basic palliative care needs if its clinical staff trains in a collaborative environment, in which the roles of each profession or discipline are taught and applied.

In addition, health care administrators may be advised to evaluate a variety of outcome measures, not just the outcome measures evaluated in this study. Prior research, as summarized in Chapter 2, and this study have provided evidence of palliative care's benefits with respect to cost savings, efficient delivery of patient-centered care and health care utilization, and patient discharge patterns. Research findings consistently support the notion that palliative care reduces hospital costs, whereas the empirical evidence on how hospital LOS and in-hospital mortality are influenced is mixed. Thus, health care administrators may be advised to avoid hospital LOS and in-hospital mortality as measures to evaluate quality of care in the context of palliative care and instead "focus on other validated and highly valued outcomes that their work produces, such as reductions in hospital costs and improved clinical outcomes." (Cassel et al., 2010b, p. 766)

Suggestions for Future Research

This study provides several suggestions for future research based on the limitations identified in the previous section. First, future studies could optimize the measurement accuracy of palliative care variables and reduce missing information. The use of additional data sources may be able to validate the presence of palliative care services as indicated in the AHA Annual Survey of Hospitals. Furthermore, the construction of palliative care experience could be optimized by using information from years prior to the study period to determine the year of service inception. This study treated hospitals with palliative care services in place at the beginning of the study period as hospitals with one year of experience. In particular, information from prior years were not used due to missing values and inconsistent implementation patterns.

Additional data sources to confirm palliative care presence may be used to reach a more accurate presentation of palliative care diffusion and experience. Alternatively, future studies may include a dummy variable to identify programs that were already in place in 2007 to capture the effect of having a program in place for more than five years; that is, the average effect of palliative care experience prior to 2006. Ideally, however, future studies focus on tracing the origins of palliative care services to measure the exact length of time they have been in effect. Also, as hospitals may not adopt palliative care services randomly (i.e., possible selection effects), it may be useful to consider modeling the effects of hospital and environmental factors on the timing of palliative care service adoption. In addition, future research may consider constructing the Herfindahl-Hirschman Index using only information on hospital admissions for patients with primary diagnoses most likely to benefit and use palliative care services in a county to measure market competition, as a hospital's decision to provide hospital-based palliative care provision is likely influenced by a perceived competitive advantage in securing revenue from a patient population that may benefit from palliative care.

Second, this study evaluated the impact of palliative care on four outcome measures, namely hospital LOS, in-hospital mortality, transfer to hospice, and hospital costs. Future research should evaluate the effects of palliative care services on additional outcome measures, including pain and symptom management, patient and family satisfaction, ICU LOS, ICU mortality, alignment of goals of care with patient preferences, and hospital readmissions. In regard to hospital costs, it is also important to examine hospital costs pertaining to specific costs centers, such as ICU, emergency room, pharmacy, laboratory, subacute care, or oncology. More specific data collection is needed as these measures are all dependent on the availability of well-defined data. With regard to estimating the effects of palliative care services on length of stay, future research may also consider modeling length of stay as a duration model with competing hazards, where death and discharge to other settings are distinct outcomes.

Third, this study was limited to evaluating the association of the presence of specialty palliative care, namely inpatient palliative care consultation services, hospice programs, and inpatient palliative care units on certain dependent variables. The AHA Survey of Hospitals does not collect detailed information on structural or procedural attributes of hospital services, such as palliative care services. Researchers could therefore gather primary data on processes of care (e.g., timing of services, care protocols) and structural components (e.g., staffing, resources) and examine their impact on patient and organizational outcomes. Future research could also examine the nature and diffusion of primary palliative care in different hospital units, such as ICUs or emergency rooms. Primary palliative care is essential in treating patients' basic palliative care needs and can be provided by the attending physician, whereas specialty palliative care typically focuses on patients with complex illnesses and symptoms that are difficult to manage and require medical attention of palliative care specialists. Studies that focus on the use and attributes of primary palliative care may provide valuable insights for health care administrators about the relative performance of primary and specialty palliative care.

Fourth, this study evaluated how the presence of palliative care services was associated with care received by patients most likely to benefit from these services. It was unclear whether or to what extend the patients in the sample received palliative care services. Future research could focus on comparing differences in outcomes for patients who actually received palliative care services and those who did not. However, this patient information is currently not collected and available on a larger scale. Alternatively, future research could apply a different method for identifying patients who are most likely to use and benefit from palliative care. For example, the diagnosis-related groups (DRG) or all-patient refined DRGs (APR-DRG), developed by 3M Health Information Systems, are patient classification approaches with groups of patients who are similar in terms of resource usage and clinical attributes. These classification schemes may be valuable alternatives to select appropriate patient populations in the context of palliative care. Another possibility to approximate actual palliative care utilization without available data on which patients received palliative care services during hospitalization is to compare the effects of hospital-based palliative care services on outcomes between patients with primary diagnoses most likely to benefit from palliative care services (e.g., COPD patients) and patients with primary diagnoses not likely to utilize palliative care during hospitalization (e.g., patients admitted for normal pregnancies). Considering the former patient group the intervention group and the latter the control group, it may be expected that hospital-based palliative care services affect the outcomes of the former patient group only. This approach may be used to gauge whether the presence of hospital-based palliative care services is synonymous with palliative care utilization among patients who are most likely to use and benefit from palliative care services. Future research may also evaluate the impact of two advance care planning CPT (Current Procedural Terminology) billing codes introduced by CMS in early 2016 (Centers for Medicare and Medicaid Services, 2015a). This change in reimbursement may incentivize palliative care adoption among hospitals, as palliative care consultations become more profitable. At the patient level, designated billing codes to reimburse advance care planning may also provide an opportunity to identify patients who received advance care planning and evaluate the impact of such services on patient outcomes more accurately using large databases, such as the SID files. The systematic documentation of patients who received palliative care services is currently not possible, as no billable CPT codes exist. Common, billable ICD-9-CM and ICD-10-

CM codes used by palliative care physicians are related to the symptoms they treat, such as delirium, depression, shortness of breath, weight loss, and pain (EPEC Project, 1999). Although these codes are available through the HCUP SID, they are not unique to palliative care services and are thus not meaningful in identifying palliative care patients. Note that one ICD-9-CM code, *V66.7,* indicates whether a patient had a palliative care encounter during hospitalization and is used as a patient control variable in the analytical models to address research questions two and three. It was introduced in 1996 and belongs to a supplementary list of ICD-9-CM codes, which may be used to further describe health care services provided to a hospital patient. However, research has demonstrated infrequent use of this code among palliative care patients in the hospital setting (Kroch, Johnson, Martin, & Duan, 2010). It is also likely that palliative care encounters under this code occur when death is imminent. Cassel et al. (2010a) noted that *V66.7* "appears to be geared toward end-of-life care (only) and not concurrent management of pain and symptoms." (p. 921) Some palliative care providers primarily use the *V66.7* code to flag patients to be excluded from a hospital's mortality rate calculation (L. Blackhall, personal communication, January 6, 2015). Hence, this code was deemed unsuitable for use as a key explanatory variable to evaluate the effects of palliative care services on the study's outcomes as proposed under research questions two and three and, instead, was used as a control variable.

Finally, this study limited its sample to hospitals located in six states, namely Arizona, California, Florida, Maryland, New Jersey, and New York and which were in operation from 2007 until 2011. Additional future studies could be conducted with hospitals located in different states and evaluate different time periods to explore whether the study findings are generalizable to other health care markets and time periods.

Conclusion

This study used organizational theories to explore three research questions. First, research question one employed a two-level hierarchical generalized linear model to examine the organizational and environmental factors associated with the provision of hospital-based palliative care services. This study found that hospital size was significantly associated with a higher probability of hospital-based palliative care provision, whereas the presence of palliative care services through a hospital’s health system, network, or joint venture was associated with a lower probability of hospital-based palliative care provision.

Research questions two and three investigated whether hospitals that provide palliative care services have improved organizational and patient outcomes compared to those not providing such services; and whether a hospital’s experience in providing palliative care services is associated with improved organizational and patient outcomes. This study found that hospitals with an IPAL or HOSPC incurred lower hospital costs than hospitals that do not provide such services; hospitals with PAL incurred higher hospital costs than hospitals without such services.

Among survivors and decedents, the 1-year effects of IPAL were associated with shorter lengths of stay, whereas the remaining year effects of IPAL were associated with longer lengths of stay. Among decedents, while the 1-year effect of PAL was associated with longer lengths of stay, the fifth year effect was associated with shorter lengths of stay. In addition, the 1-year effect of PAL was not significantly associated with length of stay among survivors but the remaining year effects were associated with shorter lengths of stay. Finally, survivors treated in hospitals with HOSPC had longer lengths of stay. The presence of HOSPC was not significantly associated with length of stay among decedents.

All year effects of PAL and HOSPC were associated with lower odds of in-hospital mortality. The 1-year effect of IPAL was associated with lower odds of in-hospital mortality but the effects of the third through fifth year indicated higher odds of in-hospital mortality.

While the 1-year effect of PAL was associated with higher odds of hospice transfer, the annual effects of the second through fifth year indicated incrementally lower odds of transfer to hospice. In addition, all year effects of IPAL suggested lower odds of hospice transfer. Finally, the first two year effects of HOSPC were associated with lower odds of hospice transfer, whereas the fifth year effect of HOSPC was associated with higher odds of hospice transfer.

Several sensitivity analyses were conducted to examine the robustness of these associations. In general, findings corresponding to research questions two and three were robust across model specifications. Further research is necessary to fully understand the association between hospital and environmental factors and the presence of individual palliative care services.

Although this study has several limitations, the study findings are relevant to hospital administrators and policy makers. Hospital administrators who plan to provide or expand hospital-based palliative care services may use the study findings to assist them in deciding which palliative care services are most appropriate for their patient population. Similarly, policy makers can use the study findings as a guidance for structuring incentive programs aiming to promote outcome-related quality measures that can be addressed effectively by palliative care. As the prevalence of hospital-based palliative care has been growing steadily since the beginning of the 21st century, an understanding of drivers of hospital provision of palliative care services and subsequent care outcomes offers valuable guidance for future efforts to assure access to palliative care and high quality of such services for patients with palliative care needs.

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Vita

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