Title
The effects of a palliative care team on mortality, utilization, and cost in a large non-profit teaching hospital.

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The effects of an inpatient palliative care team on mortality, utilization, and cost in a large non-profit teaching hospital.

by

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DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

NURSING

in the

[redacted]

DEDICATION

This body of work is dedicated to my family, spanning two coasts and 2500 miles. First, to Abby, my partner and best friend, without whose patience, love and devotion I could not have completed this volume. Second, to my parents, without whom I would not exist. You gave me a nurturing, intellectually stimulating, and loving environment in which to grow and learn, allowing me to become the person I am today. Third to my "second mom", Mary Hilliard, who was an inspiration as she helped raise me, helping to instill in me a sense of honesty, decency, and hard work. Finally, I dedicate this to the three grandparents I watched pass away from this world, Norman Aizer, Rachel Aizer, and Helen Brody. In addition to the love and compassion they provided me as a child, it was the unevenness of care that they received at the end of life that sparked my curiosity in palliative care. It is because of them and their experiences that I want to make my life's work to change how we provide care for our fellow human beings at the end of life.

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ABSTRACT

Overview: Over the past five years the number of inpatient palliative care teams (PCTs) has grown drastically in the United States. However, 70% of U.S. hospitals continue to provide end-of-life healthcare services in the absence of a PCT. While studies have shown that PCTs contribute to improved quality of life, patient satisfaction, and short-term utilization and costs, few have examined whether these consultations have long-term effects.

Methods: This study utilized a matched cohort design to examine mortality, cost, and utilization up to one year after an initial PCT consultation. Patients admitted to a large non-profit hospital between June 2004 and December 2007 were included. Patients seen by the PCT during that time were matched to 'usual care' patients based on age, risk of mortality, prior year hospitalized days, and disease. Utilization and cost measures were abstracted from hospital administrative claims and cost accounting data; mortality data were collected from the social security death index. Analyses were performed using summary statistics, chi square analysis, regression models, Kaplan-Meier survival analysis, and Cox proportional hazard models.

Results: A total of 361 intervention subjects were matched to a total of 361 usual care subjects. Results revealed patients receiving a PCT consultation were associated with a 2.5 times greater likelihood of dying during the follow-up period, most of which was likely caused by decreased intervention in the first 60 days post consultation. No differences were found in inpatient mortality. Decreases were found in the likelihood of hospitalization at 12 months (OR 0.68, $p<.01$) and overall length of stay (OR 0.65, $p<.05$) over the follow-up period when subjects were initially seen by the PCT. Additionally, patients receiving an initial PCT consultation had lower costs to the hospital over the follow-up period ($4433, $p<.0001$), saving approximately $1.6 million among the study population.

Conclusion: These findings suggest that use of inpatient PCTs decreases hospital utilization and costs of a vulnerable end-of-life population, having no effect on inpatient mortality rates. Therefore, the implementation and maintenance of inpatient PCTs has the possibility to improve hospital net income while also improving the quality of patient care for those at the end-of-life.

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CHAPTER ONE

THE STUDY PROBLEM

Over the past 25 years, the outcries in the United States for quality end-of-life care and patient self-determination have led to a major paradigm shift in the field of hospice and palliative care (PC). The convergence of these two movements has led to the creation of the hospice benefit, palliative care teams (PCTs) in major hospitals, and education for both new and experienced clinicians in multiple disciplines. Although a dramatic increase in PC has occurred during the past quarter century, evidence showing its effectiveness has not followed at a similar pace.

Although studies have shown that hospice and PC providers can improve the quality of symptom management (London, McSkimming, Drew, Quinn, & Carney, 2005), advance care planning (Lilly, Sonna, Haley, & Massaro, 2003), and family/patient satisfaction (Casarett et al., 2008), few studies have examined the effects of PC on hospital utilization and costs. Additionally, to the author's knowledge, no studies have examined the long-term effects of inpatient PCTs. This study, therefore, will examine how intervention by an inpatient PCT affects utilization and costs over a one-year follow-up period.

An Introduction to Palliative Care

The World Health Organization defines PC as follows:

> 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. (World Health Organization, 2007)

PC, a field that has developed gradually worldwide over the past 20 years, has now matured as an interdisciplinary specialty focusing on the physical symptoms of advanced disease and the psychosocial and decision-making aspects of care. By incorporating these aspects into a holistic practice, PC programs have enjoyed high satisfaction rates among patients and their families (Wilkinson et al., 1999).

Because of the success of PC programs in improving patient satisfaction with end-of-life issues and the recognition of the improved patient care provided by PCTs, the number of PC inpatient teams in the United States has expanded rapidly. Over the past 5 years, according to the American Hospital Association Annual Survey, the number of inpatient PC programs has grown by 96%, and PC programs now exist in 30% of all U.S. hospitals and in 70% of U.S. hospitals with more than 250 beds (Supportive Care Coalition, 2007). Although the use of PCTs is increasing, many hospitals are still having difficulty creating and maintaining a PC program for several reasons, ranging from the fears of increased mortality of hospital executives and clinicians to institutional budgetary considerations. This situation persists despite evidence that PCTs decrease intensive care unit (ICU) mortality, cause no change in hospital mortality rates, and save hospitals money by decreasing utilization (Ciemins, Blum, Nunley, Lasher, & Newman, 2007; Elsayem et al., 2006; Elsayem et al., 2004).

PCTs in hospitals take many different forms. Some function as a traditional medical consult service in which a physician or advance practice nurse provides consultative services and recommendations to the primary care service and bills insurance companies like other consult services. These teams usually, but not always, include other disciplines, such as pharmacy, nursing, chaplaincy, case management, and social work that assist the medical team in decision support. These PCTs require a formal request from a patient's attending physician to perform a consultation. Although this protocol allows for billing, it also restricts which patients can be seen because some attending physicians may not advocate PC, and other disciplines, such as nursing, cannot refer patients. Other PCTs are not structured as medical consultation services and do not bill for services but often include the same disciplines except for physicians or advance practice nurses. These teams provide consultations at the request of any care-team member but sometimes alienate attending physicians who do not want their services. Consequently, the teams' recommendations carry less weight. To achieve the best balance, hospitals use these PCT models as the "politics" and needs of their institutions dictate.

Financing Palliative Care

Although the rate of PC programs has increased dramatically, they are still underimplemented in the United States because of several significant financial barriers. Unlike hospice care, which is a defined benefit under government and private insurance plans, PC remains unfunded or underfunded in most instances. Although physicians and other providers, such as nurse practitioners, can bill for PC visits under the hospital consultation or outpatient evaluation and management visit codes, reimbursement for these time-intensive consultations is usually inadequate compared with the cost of services. Other providers, such as nurses, social workers, and chaplains have no reimbursement mechanisms; their services are bundled into the payment a hospital receives for each hospital admission.

Most insurers, including Medicare, Medicaid, and private insurance companies, reimburse hospitals through the diagnosis-related group (DRG) payment system. A capitated payment model, the DRG system reimburses hospitals based on case-mix and a patient's DRG, regardless of the quantity of care provided or how long he or she remains in the hospital. Thus, a hospital's goal is to provide the minimum amount of care necessary to stabilize and to discharge a patient to a lower level of care. Such an economic incentive is a major obstacle to implementing PC in the acute setting and often leads to the discontinuation of PC programs. This study, therefore, will examine if inpatient PCTs can improve a hospital's profitability by decreasing care-intensive hospital stays by extremely ill and dying patients.

Aims and Hypotheses

Although the implementation of hospital-based PC has increased substantially over the past 5 years, few studies have examined inpatient costs and utilization, and no studies were identified that examined lasting outcomes related to inpatient PC, such as decreased utilization or costs over a one-year period. Thus, this study's aim was to evaluate the relationship between an inpatient PCT and hospital utilization and costs over a one-year period. The study analyzed longitudinal secondary data from a 1,200 bed, nonprofit, community teaching hospital. Selected for inclusion in the study were all patients initially seen by the inpatient PCT from July 2004 to December 2006 and a matching cohort of patients from the same hospital.

During the period under study, the PCT consisted of two physicians qualified in PC and one geriatric nurse practitioner certified in PC. On many cases, a health psychologist, social workers, and chaplains also worked with the team. The PCT not only provided consultations to acute care patients who had been referred by their attending physician but also served as the attending service on a medicine unit's acute PC subunit.

The PCT interacted with and provided consultations to patients in three distinct ways. First, some attending physicians would ask for recommendations about pain and symptom management, family conference and decision support, advance directive writing and implementation, discharge planning and other services. Second, other attending physicians would ask the PCT to write orders for patients and take care of all the needs involved with the above tasks. Third, the PCT provided a mix of recommendations (e.g., medication management) with execution (e.g., advance care planning). And at times the PCT would admit patients to a unit and direct their care explicitly for symptom management. In this study, all three of these methods of providing care were used, although the first two were more common than the last.

This case-controlled matching study examined utilization, finances, and mortality at the patient level. The variables in this study were drawn from two, separate, proprietary, data systems used by the hospital to store financial and demographic information about their patients and from the Social Security Death Index (SSDI). The specific aims of this research were as follows:

Aim 1: To examine whether patients seen by the PCT have similar mortality rates to those not seen by the PCT up to one year after the index hospital admission and whether they are more likely to die in the hospital.

Aim 2: To examine the effects of an inpatient PCT on utilization rates up to one year after the index hospital admission.

Aim 3: To examine the effects of an inpatient PCT on patient costs within the hospital system up to one year after the index hospital admission.

The following directional hypotheses were evaluated in this study:

Aim 1

Hypothesis 1: Patients who have received an initial PCT consultation will have a statistically similar mortality rate compared to those who were not seen by the PCT.

Hypothesis 2: Patients who have received an initial PCT consultation will have a statistically similar hospital mortality rate compared to those who were not seen by the PCT over the one-year follow-up period.

Aim 2

Hypothesis 3: Patients who received an initial PCT consultation will have significantly fewer hospital admissions at 1, 3, 6, and 12 months and will spend fewer days in the hospital.

Hypothesis 4: Patients who received an initial PCT consultation will have fewer emergency department visits.

Hypothesis 5: Patients who received an initial PCT consultation will spend fewer days in the ICU.

Aim 3

Hypothesis 6: Patients who received an initial PCT consultation and who were readmitted for subsequent hospital stays will have lower total costs, pharmaceutical costs, direct costs, laboratory costs, and radiology costs.

Hypothesis 7: Patients who received an initial PCT consultation will have lower total emergency department costs.

Hypothesis 8: The hospital will have higher average net revenue from patients seen by the PCT than those who were not.

CHAPTER TWO

LITERATURE REVIEW

Method of Review

A review of the MEDLINE and CINAHL databases was performed in February of 2008 to identify studies of mortality, cost and resource utilization associated with inpatient PC. Conducted using the MeSH terms *palliative care*, and *mortality, utilization*, or *costs,* the search was limited to those studies written in English that involved adult patients. Studies were included in this investigation if they were a clinical trial, a retrospective analysis, a descriptive study, or a meta-analysis written within the past 10 years. Editorials and literature reviews were excluded. The articles retrieved were examined for relevance, and other relevant studies were found in their reference lists.

General Findings

The literature search identified 472 articles, most of which concerned outpatient care. Only 13 studies examined mortality, utilization, or cost outcomes of inpatient PC programs in the United States, and an additional 11 studies examined these outcomes in other settings. Although decreased inpatient mortality, utilization, and costs; increased patient satisfaction; and better symptom control have been shown to occur in multiple well-designed studies, these studies were conducted primarily in home- and community-based PC programs in the United States (Brumley et al., 2007; Ciemins, Stuart, Gerber, Newman, & Bauman, 2006) and abroad (Ahlner-Elmqvist, Jordhoy, Jannert, Fayers, & Kaasa, 2004; Axelsson & Christensen, 1998; Bruera et al., 2000; Gomez-Batiste et al., 2006). Few studies have been conducted in inpatient settings in the United States that have focused on mortality, utilization, and costs, and many have methodological problems. The 24 studies selected for this review will be discussed in depth in the next section and were used to inform choice of subject selection, outcomes design, and analysis, which is discussed in the Methods Section of this paper. Although many of the studies included in the literature review focused on cancer patients, one study examined inpatient PC for geriatric patients, a specialized subset of patients with their own needs and issues. This study examined the differences in geriatric patients receiving PC, demonstrating that age played a key role in patient disposition, length of stay (LOS) before PC referral, and the types of recommendations made (Evers, Meier, & Morrison, 2002).

A Comparative Review of Palliative Care in Different Settings

The Effect of Palliative Care on Mortality

Eleven studies examined the effect of PC on mortality rates: four based in the inpatient setting, four based in the outpatient setting, and three based in a combined inpatient-outpatient setting.

Palliative care in the inpatient setting. Of the fours studies examining the effects of PC on mortality, one was a prospective study examining intensive communication and three were descriptive studies examining the effects of PC in individual hospitals.

The sole prospective study examined the effects of performing an intensive, multidisciplinary, communication intervention with the families of patients in an ICU (Lilly, Sonna, Haley, & Massaro, 2003). This study used a pre-post design to examine the sustainability of the intervention and the mortality rate in the ICU following the intervention. Before the intervention, 31% of patients died in the ICU compared with 18% after the intervention.

Of the three descriptive studies, the one with the most impact, by Elsayem et al. (2004), was a retrospective descriptive study that examined the records of 256 patients admitted to a comprehensive cancer center's inpatient PC unit in the first 8 months of 2002. The researchers found that the hospital's mortality rate did not increase as a result of patient deaths (23%) in the PC unit.

Evers et al. (2002) conducted a descriptive study in an academic teaching hospital to examine all PCT referrals over a 38-month period. The study found that there was no difference in the site of death between younger and older subjects.

Davis et al. (2002), investigated inpatient mortality on a PC unit. It found that death rates on the PC unit remained between 16% and 20% over a 2-year study period, suggesting that a PC unit is not just a place to die but a portal to other services. This study, however, provided little information about the sample or what the hospital's total mortality rate was during this time.

These studies are important, as they show that the risk of inpatient mortality does not increase when a PCT is involved, an important factor considering the current hospital report card systems. In fact, the study by Lilly et al. (2003) even showed a decrease in ICU mortality, which is an important benchmark in many hospitals currently. Additionally, Elsayem et al. (2006) finding that there was no change in hospital mortality, and Davis et al (2002) finding that many patients in a PC unit do not actually die in the hospital lend credence to the ability of inpatient PCTs to improve care while not having effects on inpatient mortality. While these studies provide some insight into the immediate effects on mortality of inpatient PCTs, they do not however provide mortality information on what happens on those who released from the hospital, a significant gap in the literature.

Palliative care in the outpatient setting. Of the three studies reviewed that examined mortality as it relates exclusively to outpatient PC services, one was a randomized controlled trial, one was an unrandomized controlled trial, and one was a retrospective matched cohort study.

One study, a randomized controlled trial examining mortality and PC interventions at home, included individuals with a life expectancy of less than 12 months who were part of a closed-panel health maintenance organization (Brumley et al., 2007). The participants were randomized to traditional home care (N = 152) or in-home PC (N = 145). The study found no differences in survival and that patients enrolled in the PC intervention were 2.2 times more likely to die at home than those receiving usual care. However, this study raises ethical questions because it randomized patients without giving them the option of receiving PC on request.

Another study, by Ahlner-Elmqvist et al. (2004), examined place of death when cognitively intact cancer patients in Sweden received PC management at home instead of conventional home care. The participants in this nonrandomized prospective trial were assigned to groups based on their preference for PC or traditional home care. Of the 119 patients in the intervention group, the study found that 45% died at home compared with only 10% of the 178 patients in the control group. Additionally, 22% of the PC participants died in the hospital compared with 63% of those in the control group.

However, because patients chose which treatment group to join, and there was no controlling for disease severity, there was an inherent bias in this study, and the results are difficult to interpret.

A final study that examined the effects of an outpatient PC intervention on mortality was a matched cohort retrospective study of cancer patients who had received care from a single PC nurse rather than usual care from a single hospital in Sweden (Axelsson & Christensen, 1998). To be included, subjects had to have a symptomatic incurable cancer, live within 40 km of the hospital, have a wish to stay at home, and have a primary caregiver. They were matched with a control population who had died of cancer during the same time period and then randomly matched to the intervention cohort. The sample included 41 control and 41 intervention patients. Additionally, a reference group of 15 subjects was created who met the criteria for inclusion in the study but lived outside of the 40 km catchment area. This study found that the control group lived almost twice as long as the PC group who in turn lived twice as long as the reference group ($p = .043$). And, this study found no difference in the place of death between groups. The methods used for matching subjects in this study did not include any measure of severity of illness. Thus, the reliability of its findings must be questioned. Additionally, the sample selection process was extremely specific in its exclusion criteria, making its generalizability to a larger population difficult.

Overall, these three studies in the outpatient setting provide us with some insight into the effects of outpatient PC. Regardless of methodologic or ethical issues related to the studies, they consistently found that outpatient PC services decrease inpatient mortality, while simultaneously decreasing life expectancy. This is likely due to the decrease in advanced interventions provided to a terminally ill population.

Palliative care in a combined inpatient-outpatient setting. Four studies examined the effect of a mixed model inpatient-outpatient palliative care program. One of the studies was a randomized controlled trial, one a retrospective matched cohort study, and two retrospective pre-post studies.

The strongest of these studies (Jordhoy et al., 2000) was a randomized controlled trial that involved 707 subjects who had been referred to a combined inpatient-outpatient PCT. Four hundred thirty-four of these patients were included in the study and were randomized into two groups, one receiving usual care, the other the combined PC intervention. The study found a median survival of 99 days among the latter and 127 days among those receiving usual care; it also found that a similar number of participants in each group died in the hospital (67% vs. 65%). In addition, the study found that patients in the intervention group were more likely to die at home (21% vs. 9%, $p < .05$), while those in the control group were more likely to die in a nursing home (16% vs. 25%, $p < .05$). Additionally, those in the intervention group who died in the hospital did so on the PC unit, whereas all those in the control group died on other hospital units. The researchers found that those living with a spouse were 1.78 times more likely to die at home. One glaring ethical concern is raised by this study: The researchers randomized the participants to receive PC or not, when all had been referred for PC. This raises the question of where to draw the line when examining PC treatments and access to care in clinical trials. However, this issue is beyond the scope of this paper.

A second study by Bruera and colleagues (2000) conducted a retrospective pre-post study that examined mortality rates of patients cared for by combined inpatient-outpatient

PCTs. In this study they examined the admission of cancer patients before the implementation of a comprehensive PC program in Edmonton, Canada and after the program was fully instituted. The study found that there were significantly fewer deaths in the acute care setting after PC program implementation than before (63% vs. 32%, $p < .0001$). The study, however, has one major weakness: A 3-year hiatus occurred between the end of the pre-group and beginning of the post-group, and other effects could have caused some of the changes exhibited in the mortality rate.

A third study examined the effects of inpatient and outpatient palliative case management in a Veterans Affairs (VA) patient population (Back, Li, & Sales, 2005). A total of 82 PC subjects and a matched cohort of 183 usual care subjects were included in this retrospective review of all subjects who had died of cancer during a one-year period. The study found that the group that received the PC intervention was more likely to die outside of the hospital than the group that did not (79% vs. 61%, $p < .05$). The study's weaknesses were twofold: It included only VA patients who had cancer, and no multivariate analysis of hospital deaths was reported to account for extraneous factors.

The fourth and final study in this section, by Gomez-Batiste et al. (2006) examined the effects of comprehensive combined PC services for cancer patients in Spain. After performing a descriptive analysis of 395 subjects who had received the PC services, the researchers compared it to an 8-year old population-based study to ascertain differences in utilization and costs. In the study's discussion of mortality, they found that those who received PC services had a median survival time of 6 weeks and that only 25% lived for more than 12 weeks past the initial visit. Survival times were longer for those seen in an outpatient clinic (11 weeks) than for those receiving palliative home care (7 weeks), for hospitalized patients (5 weeks), and for those on PC units (3 weeks). The researchers also found that 42% of the subjects died at home, 41% in a traditional inpatient unit and 17% in an inpatient PC unit. Because no comparison of mortality data was provided, the effects of the PC service on mortality are unknown.

These studies examining combined inpatient-outpatient PCT were consistent in their findings that patients seen by the PCT had reduced inpatient mortality and were more likely to have increased overall mortality over time. While the evidence was consistent in these findings, only one of the studies, by Jordhoy et al. (2000) was designed in a way to firmly draw this conclusion, and because the study was conducted in Norway, its generalizability to a strikingly more complex U.S. health marker limited.

Overall, the studies in this section regarding PCTs and their effects on mortality were also consistent. They found that while PCTs in general decrease inpatient and ICU mortality but also decrease life overall life expectancy. Whether these findings are interpreted as positive or negative outcomes is another question. While some might state that PCTs decrease life expectancy and thus their services should not be utilized, others might state that a majority of Americans prefer to die at home, and the PCT helps to assist in making this wish a reality (Pritchard et al, 1998). Several questions must be asked however. First, does the PCT decrease life expectancy because its interventions or harmful or because patients prefer to forgo more intensive life sustaining measures? Based on the study by Lilly et al (2003), it appears that it is because of the latter. Second, what is the quality of life those patients have at home and is it improved over the care they would receive in a hospital or other institutional setting? This question is harder to answer, relying on both personal preference and the type of care provided in those settings (Hales, Zimmermann & Rodin 2008), and is beyond the scope of this review. This notwithstanding, it does appear that the PCT has an important role in reducing inpatient mortality and in preventing excessive, unnecessary, and expensive care, as will be confirmed in the following sections on utilization and cost.

The Effect of Palliative Care on Utilization

As studies have found that many patients receive unnecessary, invasive and unwanted medical care towards the end of life (Rady & Johnson, 2004), it is important to understand whether the PCT can decrease the amount of this care provided. This literature review found evidence that PCTs decrease utilization of healthcare services in multiple settings, although much of the data only examined short-term outcomes. Data on the longer-term effects of the PCT on utilization are lacking. The findings of the review as it relates to utilization will be discussed in this section. Seventeen studies were identified that examined the effects of PC on utilization, 7 of which were based in the inpatient setting, 5 in the home setting, 1 in the outpatient setting, and 4 that consisted of at least two different settings.

Palliative care in the inpatient setting. Seven studies were found in this review that examine the effects of inpatient PC interventions on utilization. Two of these studies were randomized controlled trials, one a mixed method retrospective review, two were case control studies, one a pre-post retrospective review, and one was purely descriptive in nature.

Of the two randomized controlled trials, one found positive effects and one found no effects of an inpatient PCT as it related to utilization. The first study, by Lilly et al.

(2003) which was previously discussed in the Mortality Section, found that after performing an intensive communication intervention that LOS in the ICU decreased by a day on average. This result shows that it is not only the PCT's medical knowledge but also its ability to communicate with families that can decrease ICU utilization.

A second randomized controlled trial, investigated the effects of a PCT in Britain (Hanks et al., 2002). Individuals who strongly desired to be seen by the PCT were excluded from the study because the researchers believed that it would be unethical to randomize such patients, although this decision likely led to some selection bias despite the randomization. Of those who were enrolled in the study, 173 received the intervention and 67 received PC services by telephone instead. The study found no difference between groups in LOS or in readmissions. But, the follow-up period was only 4 weeks, the control group did receive a telephone intervention, and there was likely not a large enough effect size considering the small sample. Additionally, the study found no difference in symptom control, which makes the results suspect considering the overwhelming data showing the positive effects PC teams have on symptom control (see Quality of Care Section).

A third study evaluated the subjects' LOS before and after an inpatient PC consultation and examined a subset of those subjects in a matched cohort analysis to determine the differences between receiving a PCT intervention or usual care (Ciemins, Blum, Nunley, Lasher, & Newman, 2007). The study found that LOS following PCT consultation decreased substantially. However, it found no difference in LOS in the matched cohort portion of the study, although significantly decreased utilization of the ICU was noted.

Two case control studies were found through the review of the literature. The first found unexpected differences when it examined the effects of an inpatient PCT in a community hospital (Cowan, 2004). The study matched participants (164 in the intervention cohort and 152 in the control cohort) based on DRGs, admission severity grade, and discharge disposition. The study found that there was no difference in median or mean LOS. The investigators postulate that the lack of difference in LOS between the groups stemmed from an incomplete matching process and the use of admission severity grade as one of the matching criteria. This is due to this marker only defining patient disease severity based on the first 3 days thus not detecting any subsequent events during hospitalization that could have an affect on the actual disease burden of the patient.

Another retrospective case control study, conducted at two VA medical centers, examined the differences in the utilization of inpatient services between patients seen by a PCT (*N* = 82) and those who received usual care (*N* = 232; (Penrod et al., 2006). The sample included all subjects who had died in the two hospitals during a one-year period. This study found that patients seen by the PCT were 42% less likely to be admitted to the ICU during hospital admission than those receiving usual care. The study, however, has a weakness: The subjects were not matched, and differences in diagnosis and comorbid conditions between the two groups could have led to bias.

One study performed a pre-post retrospective medical record abstraction of 77 patients who were seen by a PCT in the inpatient setting and who were insured by a managed care company compared their hospital admissions and emergency department utilization rates (O'Mahony, Blank, Zallman, & Selwyn, 2005). The study found that the utilization rates of the emergency department (20.8% vs. 9.15%) and hospital (42.95 vs.

35.1%) were significantly reduced after a PCT consultation occurred compared to before PCT consultation respectively. The study also found that the median inpatient LOS dropped from 12 to 9 days when the PCT referred patients to hospice and found decreased inter-unit transfers from 30% to 4% after PCT consultation. However, because the study lacked a control group and did not control for statistical differences in population factors, the attributable differences are unknown.

The final study in this section, by Elsayem et al. (2004), was a descriptive study that examined differences in the effects of an inpatient PCT on utilization (see Mortality Section). This study found that cancer subjects who were receiving care in an inpatient PC unit had a longer median LOS (7 days) than the hospital's median LOS (5 days). However, because this was just a descriptive study and it did not match subjects, the results are questionable.

Overall, this review shows that current studies are mixed in terms of the effects of an inpatient PCT on utilization. Because of differences and weaknesses in methodologies of these studies, it is difficult to create a conclusion as to whether the inpatient PCT does decrease utilization. With the exception of the study by Hanks et al. (2002), the studies reviewed here solely focused on the effects of the inpatient PCT on the immediate hospitalization. The one outcome that most of the studies discussed above found was that ICU utilization decreased when the inpatient PCT was involved. Thus, while some consistency can be found from these studies, significant questions still remain as to the effects of the inpatient PCT on utilization rates.

Palliative care in the home. Of the five studies that examined the relationship between home-based PCTs and utilization, four found decreased utilization when PCTs were used. Two of these studies were randomized controlled trials, one a non-randomized controlled trial, and two used a case control methodology.

The first, a randomized controlled trial by Brumley et al. (2007), whose methods were previously discussed, found that a PC intervention reduced the number of hospital days on average by 4.36 days (p = .02) and emergency department visits on average by .35 visits (p=.01) over the length of the study.

A second randomized controlled trial by Jordhoy et al., (2000), occurred in Norway and examined the effects of a home based PCT. This study, which is discussed in the Mortality Section as well, found that patients were slightly less likely to be admitted to a nursing home or the hospital in the last month of life when in the intervention group (52% vs. 59%, p=.06). However the study also found no difference in overall hospital admissions.

A non-randomized controlled trial, by Ahlner-Elmqvist et al. (2004), examined the effects of a home-based PC intervention. The study found that those patients who received the intervention spent 18% of their time in the hospital during the 2.5 year follow-up period compared with 31% for the usual-care group (p < .005). It also found that 32% of the control group spent the entire last month of life in the hospital compared with only 11% in the intervention group, although no statistical significance was provided.

One case control study by Axelsson and Christensen (1998) examined those patients near death who received a home-based PC intervention with a matched cohort. The study found that the intervention patients had a shorter LOS in the hospital than those in the control group (3 days vs. 10 days, p = .017). The study also found that those who received the intervention spent more time at home during their last 2 months (44 days vs. 38.5 days, $p < .01$) and that intervention subjects on average spent more days at home over their lifespan than the control group (50 days vs. 23 days, $p < .001$). However these results do not control for the longer survival rate of the control group.

A second case control study examined all cancer deaths in a town in Catalonia in 1998, analyzed the effects of a home-based PC intervention on utilization (Serra-Prat, Gallo, & Picaza, 2001). The study found that subjects who had not received PC ($N = 44$) were four times more likely to have a hospital admission ($p < .005$) and three times more likely to have an emergency department visit ($p < .005$) in the last month of life than those not receiving PC ($N = 111$). The study also found that those who received PC had a shorter hospital LOS (12.2 days vs. 8.3 days, $p < .005$).

Overall, this data shows that outpatient PCTs have an effect on decreasing utilization, particularly hospital admissions and LOS in the last month of life. However, the size of the effect, based on these studies, was quite variable, with results ranging from little change to an almost 50% reduction in time spent in the hospital. Thus, further studies are needed in this area to further elucidate the nature of the effect of home based PC.

Palliative care in the outpatient setting. Only one study in this review examined the sole effect of outpatient PC visits on utilization (Rabow, Dibble, Pantilat, & McPhee, 2004). A prospective controlled trial, this study assigned patients in General Medicine Group A who were referred by a provider as having an advanced illness ($N = 50$) to receive a PC outpatient appointment and comprehensive multidisciplinary services and those in Group B ($N = 40$) to receive usual care. The study found that those who received

PC made fewer visits to their primary care provider (10.6 vs. 7.5, $p = .03$) and fewer urgent care visits (0.6 vs. 0.3, $p = .04$). The study found no difference in emergency department visits and a slight but non-significant difference in hospital admissions and total hospital days. These two null results are likely due to the small sample size.

Palliative care in a combined inpatient-outpatient setting. Finally, four studies examined the effects of a combined inpatient-outpatient PC intervention on utilization. One of these studies used a matched cohort design, two a retrospective pre-post design, and one a purely descriptive design.

The first study, by Back et al. (2005), a matched cohort study whose methods are further described in the Mortality Section, found that the subjects who were enrolled in a combined inpatient-outpatient PC case management program had fewer hospital admissions (1.5 vs. 1.2, $p < .05$) in the last 60 days of life and died in larger numbers outside of the hospital than those who did not receive the case management services. However, the study did not find any differences in the number of ICU admissions.

The second study, also discussed in the Mortality Section, used a retrospective pre-post methodology to examine the effects of a combined inpatient-outpatient PC program intervention on utilization (Gomez-Batiste et al., 2006). It found that the mean hospital LOS decreased from 25.5 days before the start of the program to 19.2 days after the program's implementation ($p = .002$). The study also found significantly fewer hospital admissions (72% vs. 57.8%, $p < .001$) and a reduction in resource use throughout the health system (52% vs. 30.6%, $p < .001$). However, it is unknown how much of this effect is due to the implementation of PC and how much is due to outside factors.

A third combined inpatient-outpatient PC intervention study by Bruera et al. (2000), was a retrospective pre-post study whose methods are discussed in further depth the Mortality Section. The study found a significant decrease in total inpatient LOS after a combined inpatient-outpatient PC program was initiated (27 days vs. 15 days, $p < .0001$). This study, however, suffers from the same methodological issues as the study by Gomez-Batiste et al. (2006).

A fourth examined subjects who died of cancer between 1993 and March 2000 in the Edmonton and Calgary regions of Canada and were at least 18 years of age (Fassbender et al., 2005). This descriptive study found that referrals increased as the PC program aged, and admissions declined among the cohort from 95% to 83%. Additionally, the number of days in the hospital dropped from 39.1 to 27.3, before rebounding to 32.3 in the last several study years. Although this study provides some descriptive information about this program and shows that it takes time for PC programs to establish themselves, it does not provide information on the effects of the PC intervention on utilization.

While the four studies discussed in this section all found decreased utilization when a combined inpatient-outpatient PCT model was utilized, each of these studies had significant methodological issues. Thus further study is needed where stronger methods are used in order to understand the effect of combined PCTs on utilization.

The Effect of Palliative Care on Cost.

Because patients seen by a PCT use fewer resources than those who do not, it is also hypothesized that those patients will have lower costs and increase hospital net profits. This section will examine this hypothesis in further detail. The literature review found 16 studies that examined costs associated with a PC team: 9 were inpatient-based interventions, 3 were outpatient-based interventions, and 4 that were combined inpatient-outpatient interventions.

Palliative care in the inpatient setting. Nine studies were found that examine the effect of an inpatient PCT on costs. Five of those studies utilized a retrospective case control methodology, one a retrospective pre-post methodology, one a mixed matched cohort and pre-post methodology and two were purely descriptive.

In one retrospective case control study, by Elsayem et al. (2004), PC patients were compared with usual care patients in the inpatient setting. The researchers found that hospital charges for patients admitted to the PC unit were 38% lower than those on other hospital units and that the unit was reimbursed for 57% of its total charges, 75% among private insurers. Because all patients involved in this study were cancer patients, this finding is not generalizable to other populations. Further, although charges were lower, the study could not trace attributable costs, and it could have been affected by unexplained patient differences, such as disease severity. Finally, the study examined only charges and not actual costs; hospital charges tend to be grossly higher than actual costs and reimbursement rates. Additional studies help to elucidate these issues, however.

A second retrospective case control study discussed above, by Penrod et al. (2006), found statistically significant lower direct costs and ancillary costs, $239 per day and $98 per day respectively ($p < .0001$) when patients were seen by a PCT instead of receiving usual care. However, there was no difference in pharmaceutical costs, which one might expect to be lower because of the higher use of generic drugs and decreased utilization of drugs in the PC setting. The small sample size may have led to a Type II error in this regard.

Another relevant study on the costs of inpatient PC analyzed a PC program's hospital charges used a retrospective case-control methodology discussed above (Cowan, 2004). For the cost portion of this study, the authors stratified the LOS analysis into a 7-day, 14-day, or 21-day period and measured cost using mean daily charges. The study found that overall daily charges were $297 more per day ($p$ = .006) in the usual care group and that mean charges increased in the usual care group as LOS increased. It also found that mean daily charge savings after the PC intervention was $1,755 per day, that overall mean charge savings per patient was $1,214 per day, and that 82% of PC patients had savings identified. The study's major limitation, however, is that it used charges and not actual costs, thus confounding how much money was saved by the PCT. And, the match was incomplete because PC patients had a significantly longer LOS.

Two other retrospective case-control studies have been published that investigate outcomes in inpatient PC. One such study compared the costs of a PC unit with those of other units in an academic medical center. It found that patient costs in a PC unit decreased to $700 per day compared with $2,500 per day in the ICU and $1,000 per day in other units, although only descriptive statistics were performed and no reimbursement figures were provided (White, Stover, Cassel, & Smith, 2006). Another, by O'Mahony (2005), found that patients on ventilators who died during their hospital admission and who had been seen by a PCT had significantly lower laboratory services ($5,754 vs. $3,748) and diagnostic services ($2,482 vs. $1,787) than those patients on a ventilator who died but were not seen by the PCT. However, this study did not control for differences in severity of disease, diagnosis, age, or other possible contributing factors.

One retrospective pre-post study in an academic medical center examined the charges for 237 patients admitted over a 8-month period before and after their admittance to a PC unit (T. J. Smith et al., 2003). It found that patient charges were 66% lower and medication and diagnostic costs were 74% lower after their admission to a PC unit than before. The authors also performed a case-control study in which they compared 38 patients who died in the PC unit with patients who died outside of the unit; the groups were the same age and shared the same diagnosis. For patients in the PC unit, Smith and colleagues found that charges were lower by 60%, costs by 58%, and direct costs by 56%. These reductions include the initial non-PCU costs before transfer, making the results even more substantial. The study, however, has serious limitations: The number of cases in the case-control portion was small, and the method of matching did not account for severity of illness.

One large retrospective mixed method study of the effects of an inpatient PCT on economic concerns investigated costs before and after intervention in a large community teaching hospital (Ciemins, Blum, Nunley, Lasher, & Newman, 2007). The study found that there was a 33% decrease in mean costs per day after PCT consultation than before. There was also a decrease in cost variation, meaning that patients had a more predictable clinical and financial path once consulted. Finally, this portion of the study revealed significantly fewer ICU charges but more pharmacy, physical therapy, and occupational therapy charges ($p < .01$), although exact dollar figures were not provided.

In the above study, Ciemins and colleagues (2007) also performed a separate matched cohort study comparing oncology patients seen by the PCT with usual care patients. Patients were matched based on disposition, all-patient-refined-diagnosis-related-group (APRDRG) severity of illness, and APRDRG mortality risk (see Methods Chapter for details). Mean daily costs for PC patients were 14.5% lower and total costs per admission 19.2% lower than those who did not receive a PC consultation. The researchers estimated that the institution's average cost savings per year were $14 million.

Two descriptive studies examined the affects of the Cleveland Clinic's inpatient PC program (Davis et al., 2005; Davis et al., 2002). The first (Davis et al., 2005) found that costs were 27% lower for PC patients than similar patients at other hospitals based on APRDRGs, although the control patients were not necessarily PC patients. The second (Davis et al., 2002) described the PCU at the Cleveland Clinic, finding that the total costs of the patients did not exceed revenue.

Overall, the results discussed above were remarkably consistent. These studies found that there was significant savings both by PCTs and PC units over usual care. However, several distinguishing factors must be discussed regarding these studies. First, it is important to recognize that those studies that solely use hospital charges are going to be inaccurate in nature as hospital charges are quite inflated compared to actual costs. Second, none of these studies examined when subjects are discharged from the hospital, and thus a large gap in knowledge remains regarding overall financial implications.

Palliative care in the home. Three studies were reviewed that analyzed the costs associated with an outpatient PC intervention. Because all of them have been previously discussed, their methodologies will not be discussed here.

First, a randomized controlled trial by Brumley et al. (2007) found that subjects who received a home-based PC intervention cost 33% less than those receiving usual care (p = .03). The average daily costs for PC patients in this study were significantly lower than members of the usual care group ($95.30 vs. $212.80, p = .02). Second, a retrospective case control study by Axelsson and Christensen (1998) found that subjects who received a home-based PC intervention cost significantly less than those receiving usual care ($2,378/patient). This savings was equivalent to a reduction of 5.8 inpatient days/patient. Finally, another retrospective case control study, by Serra-Prat et al. (2001), found that the average cost per patient was at least 71% less among those who received a home-based PC intervention than those who received usual care. These three studies confirm that a home-based PC intervention can decrease costs from the perspective of the insurer.

Palliative care in a combined inpatient-outpatient setting. Finally, four studies were reviewed that analyzed the costs associated with a combined inpatient-outpatient PC intervention.

The first by Fassbender et al. (2005) used a retrospective pre-post design, finding that the total amount spent on acute care declined from 83% to 68% as the implementation of PC programs in Edmonton and Calgary Canada progressed. However, as noted above, understanding the effects of the PC program is difficult because the study did not use a control group.

A second retrospective pre-post study, by Bruera et al. (2000), found that a regional PC program realized a total cost savings of 1.65 million Canadian dollars per year. Again, the pre-post methodology brings into question what effects could be attributed to the PC program.

A third study, by Gomez-Batiste et al. (2006), also used a retrospective pre-post methodology. It found that patients who received PC services had a 61% reduction in costs over the last 6 weeks of life. Like the previous two studies, the pre-post model used cannot attribute what percentage of the reduction, if any, was due to the PC program and what was due to extraneous factors.

Finally, another study by the same authors examining the Catalonia WHO Palliative Care Demonstration Project found savings of € 8 million per year when PC is used in Spain (Gomez-Batiste et al., 2006). However, the analytical methods of this study are unclear, and little can be drawn from the outcome because of this. Thus, while these four studies are consistent in their findings, their methodological shortcomings make it difficult to decipher how much of the cost savings is actually due to the effects of the PC intervention. Thus, further studies are needed to elucidate these effects.

Overall, the studies reviewed in this section that examine the effects of various PC interventions were successful in showing that they save substantial amounts of money, whether for an individual hospital, an insurer, or a healthcare system as a whole. One area that has not been explored however is whether inpatient PCTs have any effects on patients after an individual hospitalization. Whether the inpatient PCT save money from the hospital in the long run by reducing unnecessary or high intensity loss producing hospitalizations was not examined in these studies and warrants further review.

The Effect of Palliative Care on Quality of Care.

Several studies have examined the improvements in quality of care that inpatient PCTs provide. Although this study did not examine the quality of care provided, nonetheless the effects on quality as they related to utilization, costs, and quality of death must be understood. Admittedly this section is not a comprehensive review of the literature, but it does suggest the improved quality of care that a PCT can offer patients. O'Mahoney et al. (2005) found that over 90% of a PCT's recommendations were accepted by the primary care provider. They also found that pain and symptom control improved by 87% after PC consultation, and that 95% of caregivers and 90% of providers reported positive experiences with the service. Ciemins et al. (2007) discovered that patients had significant decreases in pain, dyspnea, and secretion scores after receiving a PC consultation. T.J. Smith et al. (2003) found that all patients in a PC unit had a chaplain visit compared with one third of usual care patients, reflecting the improved spiritual care provided in this setting, and all patients in the PCU had pain scores recorded compared with two thirds of usual care patients,.

Gaps in the Research

Taken collectively, the studies reviewed here show some evidence that inpatient PC has positive effects on quality of care: improving symptom control and decreasing LOS, utilization of the ICU, and death in the hospital. They also found significant cost benefits for hospitals, insurers, and the health care system when examining individual hospital admissions. However, significant gaps in the literature exist. What happens when patients seen by an inpatient PCT leave the hospital was scarcely addressed. And, the effects of PCT consultation on long-term rates of mortality, utilization and costs are unknown.

CHAPTER THREE

THEORETICAL FRAMEWORK

The theoretical and conceptual underpinnings of this study are based on two theoretical models used in the field of health services research: Donabedian's structure-process-outcome model (Donabedian, 1966) and economic theory (Folland, Goodman, & Stano, 2004; McConnell & Brue, 2005). These frameworks suit the study aims and have also been used in PC studies (Boni-Saenz, Dranove, Emanuel, & Lo Sasso, 2005; Davis et al., 2005; Morita et al., 2004).

Donabedian's Theory

Donabedian created a conceptual framework to examine outcomes in medical care (Donabedian, 1966). His chief concern was to determine whether an outcome is a relative measure of quality of care, and if relevant, whether other factors affect that outcome. Three major areas must be addressed when examining quality of care: the structure of the setting, the process of care, and the outcome itself. Each of these, according to Donabedian, plays an important role in the evaluation process. If one area is omitted, the picture remains incomplete, thus affecting an accurate appraisal of quality.

Variables of Donabedian's Model

Structure variables, according to Donabedian (1966), influence the setting in which care takes place. This includes the administrative and related processes that support direct care, the adequacy of facilities and equipment, staff qualifications, the organization of staff, and administrative and operational structures. He posits that good medical care will be provided if the proper setting is provided, although he also qualifies this statement by noting that little research has shown a relationship between structure and process or structure and outcomes. Since Donabedian's initial work, studies (especially in hospitals) have provided credible support for the relationships between structure and process, process and outcomes, and structure and outcomes (Kunkel, Rosenqvist, & Westerling, 2007; Upenieks & Abelew, 2006). Donabedian's model has also been used in studies of outcomes in end-of-life care in the hospital setting (Morita et al., 2004).

In Donabedian's model, the process construct considers the application of medical care. Process includes the appropriateness and completeness of care, evidence of preventive management and care coordination, acceptability of care to the patient, and other factors. It is this appropriateness of care that distinguishes the PCT, as it strives to ensure that patient-family needs are met while decreasing inappropriate or ineffective treatments.

The primary limitations of process variables, according to Donabedian, are rooted in data collection. Most process variables must be collected through direct observation, creating the potential for two forms of bias: changes in the subject because of observation, and selective perception by the observer. These issues, particularly the second, can be overcome by using different methods, including multiple raters or multiple observations (Nunnally & Bernstein, 1994).

The final construct in Donabedian's (1966) framework is the outcome of care provided. A fairly straightforward construct, Donabedian defines outcomes as the maintenance or restoration of a patient's condition or functionality. Outcomes can be either positive or negative, for example, surgical fatality rates or the reintegration of hospitalized psychiatric residents into the community. The major limitation of outcome variables is data collection. Clinical records can be problematic because of inaccessibility, inadequacy of documentation, and accuracy of documentation.

Modifications to Donabedian's Model

Donabedian's (1966) conceptual framework was initially intended for research evaluating the quality of curative medical care provided to individuals in a medical environment (e.g., hospital or a physician's office). Thus, over the years, the framework has been modified to fit other settings as necessary, such as end-of-life care (Stewart, Teno, Patrick, & Lynn, 1999), nursing home care (Unruh & Wan, 2004), or personal assistance services (Anderson, Wiener, & Khatutsky, 2006).

Integration of Donabedian's Theory

In this study, Donabedian's model was used to examine quality of care outcomes in a single, overarching, process variable, PC consultations, in the hospital setting. The intervention in this study, PCT involvement, is considered a process variable in Donabedian's model. However, the study does not evaluate the quality of the process directly, only the outcomes achieved by implementing this process. Although multiple processes can be performed with this variable, it was beyond the scope of this study to examine individual processes, such as the effectiveness of symptom control, advance care planning, or family conferences, and it is one of the limitations of this study's design. These outcomes and the processes that lead to them have been examined in other studies, however (Nelson, Mulkerin, Adams, & Pronovost, 2006). Nelson and colleagues found that they could create a prototype measurement bundle for examining and improving the quality of PC by performing an iterative process of examining PC processes in an ICU.

Thus, although this study evaluated the outcomes of this individual process variable, it did not evaluate the figurative "black box" that the intervention is considered in this study. It did, however, examine the efficacy of using PCTs to prevent further hospital admission, to decrease LOS, and other utilization and costs factors. The study examined whether PC consultations lead to changes in outcome variables associated with mortality, utilization, and costs, as discussed in other chapters.

Economic Theory

Classical and Keynesian Economic Theories

The current U.S. system of economics traces its origins to 1776 when Adam Smith posited that government should adopt a laissez-faire approach to the economy, allowing for a market-based economy (McConnell & Brue, 2005). He believed that full employment and the proper balance of goods and services would be the norm in a free market economy, and thus, market forces rather than government policy should be allowed to drive the economy. Although exceptions were made for special circumstances like weather, war, and political upheaval, the belief was that the market would eventually recalibrate and return to full employment and balance. Much of classical economics was based on Say's law, proposed by the French economist J.B. Say in the 19th century that stated when goods are produced, regardless of the circumstances, an equal amount of income will be generated to equal the value of the goods produced.

Smith believed that society benefits when there is competition without interference and that such competition rewards the investors who profit and the individuals who buy goods at lower prices (McConnell & Brue, 2005). Smith warned, however, that should a monopoly occur prices can be raised without losing customers. This is compatible with the rest of his economic theory because Smith based the system on “perfect competition,” that is, a market in which a buyer or seller is so insignificant compared to the entire market that any action has no effect on market price.

Smith’s economic theory lasted until the Great Depression of the 1930s, during which time a drop of 40% in the U.S. gross domestic product (GDP) and similar drops in other nations, coupled with increasing but uncorrecting unemployment, led to the reexamination of classical economics (McConnell & Brue, 2005). At this point, John Maynard Keynes, a British economist, posited that cyclical unemployment could occur in a market economy and that Say’s law was flawed. Using the example of the Great Depression and by contradicting Say’s law, Keynes showed that income produced in one period need not be spent or invested in the same period. Thus, Keynesian economics was born, a theory that holds if spending, and in particular investment, does not meet a necessary level, the accumulation of unsold goods will cause decreases in output and thus increases in unemployment. Further, he stated that recessions and depressions will generally not correct themselves but will require the government to play an active role in improving the economy.

Supply and Demand

Supply and demand, commonly referred to as *supply-side economics*, was derived from Say’s law. As espoused by classical economists, this model holds that an increase in supply leads to a corresponding increase in demand (Folland, Goodman, & Stano, 2004). And, this model presumes that purchasers are well-informed, optimize their spending and make rational purchases. In this setting, an ideal market is created and equilibrium occurs when supply meets demand (see Figure 1). However, this is a presumption that does not hold true for the health care market where few laymen understand clinical medicine.

Consumer demand changes based on a number of factors (McConnell & Brue, 2005). These factors and examples of how they affect supply and demand in the hospital setting at the end-of-life are listed below:

1. Consumer preferences. Many consumers prefer to die at home (Pritchard et al., 1998).
2. The number of buyers. The proportion of older Americans is increasing and the demand for health care is thus rising (Brock & Foley, 1998).
3. Changes in income. Those who are financially secure can pay for in-home aides, assisted living, or continuing care facilities, making it less likely that they will need admission to a hospital or an institution after a hospital admission has occurred (Beland et al., 2006; Frank, 2001).
4. Lack of consumer knowledge. Patients and families have little understanding of medicine and the health care delivery system. Because health insurance often pays the bulk of their health care expenses, patients tend to make decisions based on personal wishes rather than cost of care.

In a similar way, changes in supply are affected by the following:

1. The price and availability of resources. These are required to produce the product, such as the availability and costs for registered nurses (RNs) and licensed vocational nurses (LVNs) (Oulton, 2006);

2. Technology changes. Technology has the potential to increase patient flow through a hospital, and to create improvements in efficiency, as described by several studies (Breslin, Greskovich, & Turisco, 2004; Proudlove & Boaden, 2005).
3. Number of sellers. Where bed supply is higher more hospital admissions occur (Hwang, 2007).

Several other issues not mentioned above also affect the supply of and demand for PC in the United States, for example, reimbursement. The implementation of PC programs lags in the United States because there is no mechanism to reimburse them for their costs, except physician expenses in some cases.

Classical and Keynesian economics differ in their approaches to supply and demand (McConnell & Brue, 2005). In the classical view, aggregate demand will remain stable as long as there is a constant supply of money. Even if there is an initial decline in the output curve, however, the resulting shift in equilibrium is vertical, meaning that a change in demand can lead to a decrease in price but does not lead to changes in output once equilibrium is reached. Because there is no decrease in output, while wages may decrease, no jobs will be lost. On the other hand, Keynesian economics employs a horizontal aggregate curve; thus, price will be maintained but output, and therefore employment levels, will decrease (see Figure 1).

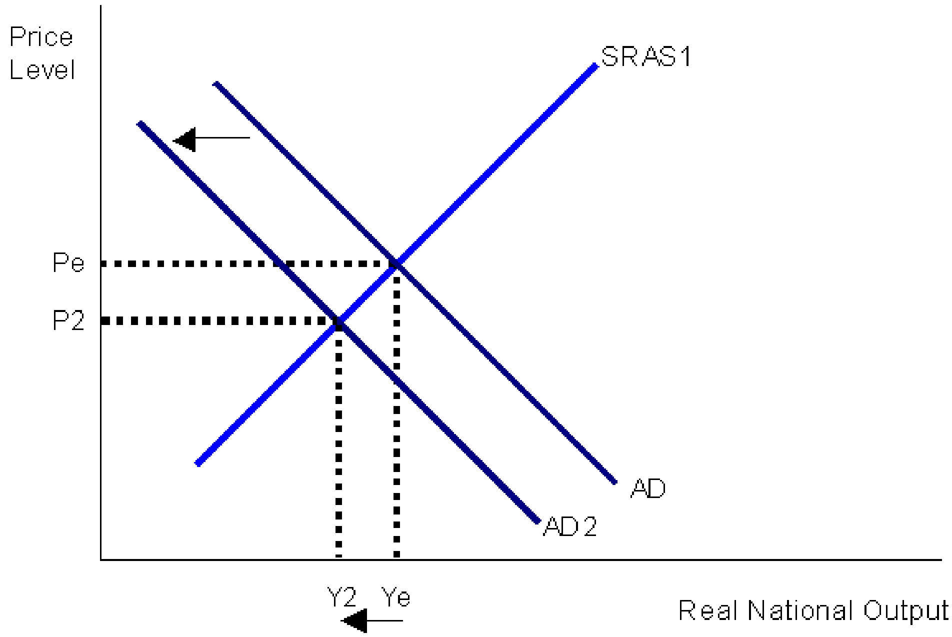


Figure 1. Classical versus Keynesian views of the macroeconomy. In this diagram, supply (SRAS 1) meets aggregate demand (AD) at a point where the ideal market is created. If however there is a decrease in AD, a change in vertical demand is noted by the move from where Pe intersects AD to where Ye intersect AD2. This model is believed to occur by classical economic theory. A change in horizontal demand is noted where Pe first intersects AD and then Intersects AD2, the model that is believed to occur by Keynesian economic theory. (Tutor2u, 2007)

Although theories of supply and demand may have several practical applications in the inpatient setting, the applications may vary widely depending on which model, Classical or Keynesian, is espoused. For instance, if the demand for hospital beds drops because states adopt policies supporting home- and community-based programs, the aggregate demand for hospitals beds will decrease. If one were to follow Classical economic theory, the price of hospital beds would decrease. However, most hospitals operate on a tight budget and have few areas of “waste” to cut. Many hospital costs are set and not arbitrary. For instance, supplies are often only provided by maybe one or two vendors and the ability to cut supply costs are limited. Also, conditions such as labor shortages in skilled fields precludes cutting staff wages for fear of undermining future staff recruitment, and certain staff have required minimum staffing levels for patient care thus limiting the types of staff that can be laid off. Thus, because of the reduced income, hospitals would have to adjust by cutting ancillary staff since they cannot cut wages or more skilled high wage earning staff, which falls under the Keynesian theory.

Another application might involve reimbursement for hospice care. If the government were to change its guidelines for hospice care to allow for curative efforts, the aggregate demand for hospice would increase in response to the change in the reimbursement policy. Although this increase in demand would increase output and thus create more jobs, the reimbursement received would not increase because of government control of reimbursement rates.

These examples illustrate that health care is not a truly competitive market because of government regulations and subsidies. Given this situation, results by definition are skewed to the Keynesian approach. Although Keynes is the forefather of government intrusion into the economy and its processes, others have also been critical of allowing market forces to control crucial functions, such as health care. Light, for example, has examined and criticized the allowance of market forces in health care (Light, 2000, , 2001). He first notes Adam Smith's belief that the goal of the economy is to amass wealth and not contain costs; thus, the privatization of health care does not serve patients but entrepreneurs. Extending Light's hypothesis to hospitals, costs and insufficient care must be monitored because if an institution's goal is profit, cutting the most costs or increasing reimbursement to provide the maximum profits may explain in part poor care processes or outcomes. It could also lead to an increase in unnecessary yet profitable care (Zimmerman et al., 2001). This fits Donabedian's structure because institutional ownership is one of the facility characteristics that affects structure, and it has been shown to affect care in the hospital setting (Shen, 2002).

Marginalism

Given the state of the health care market place, economic marginalism offers the best model to understand the economic effect of PC. It has been used successfully in several studies of inpatient PC (Boni-Saenz, Dranove, Emanuel, & Lo Sasso, 2005; Davis et al., 2005).

Marginal analysis weighs the benefits of a policy change with its costs, commonly referred to as *cost-benefit analysis* (McConnell & Brue, 2005). For example, consider the chief executive officer of a hospital who is considering the elimination a PC program. Although this might reduce staffing costs and increase profits or stem losses, it is also possible that the risk to care processes and outcomes could lead to increased costs, citations, or actions by surveyors and regulators. In their study, McConnell and Bruce investigated whether a hospital would benefit from the cost savings achieved by eliminating its PC program.

Integration of Economic Theory

Central to this study's purpose is whether there are long-term cost implications for PC practice. Although the literature has quantified substantial short-term savings, as discussed in the literature review, scant literature has shown whether these savings are transient or whether they have longer-term effects on patient costs. Such information could better inform decision makers about the positive or negative economic effects of

PC in hospitals.

If PC is an economically viable option, more hospitals may be willing to continue their PC programs and others may become motivated to create one. To that end, this study examined the attributable costs of PC on net revenues to determine if the study hospital realized more profit when using a PC consultation service. It also identified where cost savings occurred to understand better how inpatient PCTs affect the economic conditions of various components of a hospital stay.

In applying economic theory to this issue, this study's single site design is a weakness; it limits the examination of overarching market forces or differences based on regional structural components. These constants will make it difficult to generalize the study's findings to other facilities that may have different market pressures, including different occupancy rates, competition levels, and other market variables. This analysis, however, will be valid for the site examined, and can likely be extended to similar facilities in high occupancy markets. This study thus provides a good base for future research in this area.

CHAPTER FOUR

METHODS

Dependent Variables

This study examined three sets of dependent variables: mortality, utilization, and costs. In the following sections, each is discussed in detail, including why they were included and how they were calculated. Then, the actual methods for this study will be discussed, including sample, intervention variable, control variables, and statistical analysis.

Mortality Rate

Aim 1: To examine whether patients seen by the PCT have similar mortality rates to those not seen by the PC team up to one year post index hospital admission and whether they are more likely to die in the hospital.

Mortality rate may not seem like an important indicator when comparing severely ill and dying patients. However, its re-emergence as a quality indicator in the hospital industry has created a situation in which palliative care can affect hospital revenue and publicly released outcome data on "hospital report cards" (Holloway & Quill, 2007). Because mortality rate is also used as a benchmark for hospital executive performance, hospital administrators are acutely concerned if PC programs increase the number of inpatient deaths, thus jeopardizing hospital accreditation by the Joint Commission on the Accreditation of Healthcare Organizations or fostering legal action. Additionally, referring providers have viewed PC as a profession of "Grim Reapers" or "Dr. Deaths." The message must be clear: Palliative care is more than just providing care in the last hours or days of life (Rodriguez, Barnato, & Arnold, 2007).

Consequently, determining if PC patients are more likely to die in the hospital when seen by the PCT is critically important. Although several studies have shown similar inpatient mortality rates (Elsayem et al., 2006; Evers, Meier, & Morrison, 2002), none have shown the rate of inpatient mortality or overall difference in mortality over a one year period. Mortality was examined in several ways in this study. First, two study groups were compared using the number of days their members lived over a one year follow-up period. Second, the number of deaths in the two groups that occurred in the inpatient setting were compared. Finally, the numbers of subjects in each group still living at 1, 3, 6, and 12 months were compared. By examining the trajectory of deaths in the two groups, the researcher hoped to better understand when subjects were more likely to die. The examination of these measures was based on data from two databases: the SSDI, a public index of reported deaths in the United States and the computerized utilization records of the hospital used in this study.

Utilization

Aim 2: To examine the effects of an inpatient PCT on utilization rates up to one year post index hospital admission.

This study examined hospital utilization levels because decreased utilization by very sick, but unprofitable, patients allows hospitals to use those beds and resources more efficiently (Taheri, Butz, & Greenfield, 1999). Decreased utilization can also mean that patients spend more time outside of the hospital, a primary goal for many patients (A. G. Smith et al., 2004), providers, and payers. Although it is beyond the scope of this study to investigate whether a hospital can use existing resources more efficiently, it will consider whether subjects spend fewer days in the hospital over a one year period when they have been evaluated and treated by an inpatient PCT.

As illustrated in Table 1, utilization was measured by several variables: (a) the total number of hospital admissions at 1, 3, 6, and 12 months, (b) the total number of days spent in the hospital during the follow-up period, (c) the number of visits to the emergency department, and (d) the number of days patients spent in the ICU. Measures *b* and *c* are useful not only in measuring utilization of services but also in assessing quality of care, because patients who have better support and symptom management have been shown to have fewer hospital admissions and emergency department visits (Afifi, Morisky, Kominski, & Kotlerman, 2007; Barbera, Paszat, & Chartier, 2006). Measure *d* is important because the number of ICU days indicates the intensity of treatment and affects the costs and invasiveness of care. Utilization data was obtained from, the utilization records database of the study hospital.

Table 1

Utilization Dependent Variables and How They are Calculated

Dependent Variables	Description	Type of Input	Hypothesis of Relationship to PC	Statistical Analysis
Hospital admissions at 1, 3, 6, and 12 months	Number of hospital admissions at time point post initial hospital admission.	Continuous	Fewer admissions	Cox Proportional Hazard Model
Total number of hospitalized days at 12 months	Total number of days a patient spent in the hospital over the 1-year follow-up period.	Continuous	Fewer days	Cox Proportional Hazard Model
Emergency department visits	Number of ED visits post initial hospital admission over 1- year follow-up period.	Continuous	Fewer visits	Cox Proportional Hazard Model
ICU days	Total ICU days post initial hospital admission over 1-year follow-up period.	Continuous	Fewer ICU days	Cox Proportional Hazard Model
Days alive	Number of days alive after initial hospital .admission	Continuous	No change	Cox Proportional Hazard Model

Note: PC = palliative care; ICU= intensive care unit

Costs

Aim 3: To examine the effects of an inpatient PCT on patients costs within the hospital system up to one year post index hospital admission.

One of this study's major aims was to assess the financial viability of PC in an inpatient setting because it strongly influences hospital administrators to sustain and market PC programs. Although the financial viability of PC in hospitals has been the focus of recent attention, including by the lay and business press (Naik, 2004), and some reliable data show cost savings on individual hospital admissions, no apparent evidence exists to show cost savings after an initial hospital admission. Thus, this study examined two primary financial outcome variables: costs and net profit (see Table 2). These variables were extracted from data in the hospital's accounting department that identify the actual costs (rather than charges) of patient services and that have been used in a prior study showing the cost efficacy of the PC team on an individual hospital stay (Ciemins, Blum, Nunley, Lasher, & Newman, 2007).

Table 2

Cost-Dependent Variables

Dependent Variable	Description	Type of Input	Hypothesis of Relationship to PC
Total costs	Total costs for all inpatient and ED care	Continuous	Lower costs
Total direct costs	Total direct costs over 1-year follow-up period	Continuous	Lower costs
Total indirect costs	Total indirect costs over 1-year follow-up period	Continuous	Lower costs
Total laboratory costs	Total laboratory costs over 1-year follow-up period	Continuous	Lower costs
Total radiology costs	Total radiology costs over 1-year follow-up period	Continuous	Lower costs
Total pharmaceutical costs	Total pharmaceutical costs over 1-year follow-up period	Continuous	Lower costs
Total therapy costs	Total PT/OT/ST costs over 1-year follow-up period	Continuous	Lower costs
Total critical care costs	Total critical care costs over 1-year follow-up period	Continuous	Lower costs
Emergency department costs	Total ED costs over 1- year follow-up period	Continuous	Lower costs
Net patient revenues	Total net profit (loss) over 1-year follow-up period	Continuous	Higher net revenues

Note: PC = palliative care; PT=physical therapy; OT=occupational therapy; ST=speech therapy; ED=emergency department.

Besides measuring total inpatient costs over the 1-year follow-up period, this study measured its components: direct costs, indirect costs, laboratory costs, radiology costs, pharmaceutical costs, therapy costs, and critical care costs. Direct costs consisted of all costs attributed directly to a patient, including the salary of necessary employees (e.g., nurses and x-ray technologists), materials, equipment, supplies, laboratory and radiologic tests, and pharmaceutical costs. Indirect costs consisted of all other costs: administrative costs, capital costs, mortgage payments, facility maintenance, and utilities. Laboratory, pharmacy, radiology, therapy, and critical care costs were subsets of direct costs. Emergency department costs consisted of all direct costs that occurred solely within that department. These indicators have typically been used in other studies of PCTs (Davis et al., 2002; Penrod et al., 2006) and show where cost savings were achieved.

Net patient revenue was also measured to determine the difference between what the hospital received in payments per patient and the total costs incurred for the care provided. Net patient revenue was calculated by subtracting the total costs of a patient's hospital stay from the actual payment and was used to evaluate the overall financial viability of the inpatient PCT. This variable was also used to examine if there was an overall net cost saving to the hospital because of the inpatient PCT. Cost data were obtained using TRENDSTAR, the cost-accounting database system of the study hospital.

Intervention Variable

The only intervention variable analyzed in this study was the PCT's interaction with patients on their initial hospital admission. Patients who were referred to the PCT and at a minimum, each patient in the intervention group received at least one visit from either the PCT's nurse practitioner or physician. Patients were referred by a formal request from the attending physician for that patient. Follow-up visits and types of interventions varied based on the PCT's evaluation of patient-family needs. These needs included but were not limited to assistance with symptom management, advance care planning, facilitation of patient/family discussions regarding goals of care, and discharge planning. In addition to being seen by either the PCT physician or nurse practitioner, team members also often included a chaplain, case manager, social worker, nurse, and health psychologist.

The intervention variable is a dichotomous yes/no variable that states whether the patient was seen at least once by a member of the medical consult team. Studies have used this variable to examine the effects of inpatient PCTs on mortality (Elsayem et al., 2006; Evers, Meier, & Morrison, 2002), utilization (Brumley et al., 2007; Penrod et al., 2006), and costs (Davis et al., 2002; T. J. Smith et al., 2003), although none have examined these outcomes over a 1-year follow-up period. The intervention variable was obtained from MIDAS, the utilization records database of the study hospital.

Control Variables

As discussed above, many variables exist that could have substantial effects on the data (see Table 3). This section will discuss the variables that may mediate the effect of PC based on prior research. The variables discussed below were controlled for in all statistical models.

Table 3

Covariables

Covariable	Description	Type of Input
Diagnosis	17 categories classified from the AHRQ CCS system	Categorical
Disease severity	From the APR-DRG	Ordinal
Mortality risk	From the APR-DRG	Ordinal
Age	Age of the patient on day after discharge from initial hospital admission	Continuous
Gender	Men = 0, women = 1	Nominal
Ethnicity	White = 0, Asian = 1, African American = 2, Non-White Hispanic = 3, Other = 4	Categorical
Marital status	Married = 0, single = 1, divorced = 2, widowed = 3	Categorical
Days living past initial hospital admission	Days living starting on day after discharge from initial hospital admission	Continuous
Insurance type	Public = 0, private = 1, self-pay = 2	Categorical
Residency in San Francisco	Yes = 0, no = 1	Nominal
Prior hospitalized days	The number of prior hospitalized days in past year starting from day prior to initial hospital admission	Continuous

Note: AHRQ CCS = Agency for Healthcare Research and Quality, Clinical Classifications Software; APR-DRG = All Patient Refined Diagnosis Related Groups.

First and foremost, this study controlled for diagnosis because diseases have different trajectories, mortality rates, associated comorbidities, symptoms, psychosocial components, and costs (Hogan, Lunney, Gabel, & Lynn, 2001; Lunney, Lynn, & Hogan, 2002). Diagnoses were grouped together using the U.S. Agency for Healthcare Research and Quality's (AHRQ) Clinical Classifications Software (CCS), a tool created specifically for health services research. The CCS groups similar diagnoses into 13 categories. This method has been used in several other studies and has been shown to reliably categorize diagnoses (Ash et al., 2003; Bynum et al., 2004; Yu, Ravelo, Wagner, & Barnett, 2004).

Second, because disease severity and mortality risk affect the care provided, the study controlled for disease severity and risk of mortality on the initial hospital admission. Disease severity and mortality risk were obtained by using the APR-DRG classification system. Created by the 3M Corporation, the APR-DRG is an extended DRG-based tool to help institutions understand their patient population; it includes a case-mix index and other clinical factors. The APR-DRG has been found to be a more sensitive method of tabulating case mix than admission severity grade or case mix (Lagman, Walsh, Davis, & Young, 2007) and has been used successfully for matching patients in several studies of palliative care (Ciemins, Blum, Nunley, Lasher, & Newman, 2007; Davis et al., 2005).

Third, this study controlled for age, gender, ethnicity, and marital status because these variables have been shown to affect cost and utilization (Hansen, Tolle, & Martin, 2002; Hogan, Lunney, Gabel, & Lynn, 2001).

Fourth, the study controlled for “days-alive” after the initial hospital admission because the time a patient has left to live directly affects costs and utilization of health care. The cost and utilization of services are directly proportional to how long a patient lives. Because this study only examined data for a 1-year follow-up period, this variable had a maximum of 365 days. This method has been commonly used in studies in other fields to control for the *left censoring* of data that occurs because of earlier hospital admissions (Ellis et al., 1996; Porell & Carter, 2005).

Fifth, the study controlled for type of insurance (Medicare, Medicaid, and private insurance) because insurance reimbursement can substantially affect patient charges and hospital revenue.

Sixth, this study controlled for residency in San Francisco because that might affect a patient’s choice for emergency department visits or subsequent hospital admissions;

patients from out of the area might not use the study hospital for minor health care problems or emergency use, but those within the city limits would be more likely to do so.

Finally, this study controlled for the number of days spent in the hospital in the previous year because this has been shown to be a significant factor in the cost of subsequent hospital admissions (Cline, Broms, Willenheimer, Israelsson, & Erhardt, 1996; Lamers & van Vliet, 1996). Data for the controlled variables were obtained from MIDAS, the utilization records database of the study hospital.

Study Design

Sample

This study's sample included all patients seen by the PCT in the study hospital from July 2004 to December 2006 and an individually matched cohort of patients who were inpatients during the same period but who were not seen by the PCT at any point during their initial and all subsequent follow-up stays. Following the method of similar studies, patients were matched based on CCS disease category, APR-DRG mortality, age, and days hospitalized in the year prior to the index hospital admission (Axelsson & Christensen, 1998; Ciemins, Blum, Nunley, Lasher, & Newman, 2007).

Initially, patients were also matched on APR-DRG severity score; however this variable did not provide any additional consistency to the matching process and was dropped in order to allow more patients to be matched. The process for matching was as follows. First, the control patients were matched with the PC patients based on CCS category and APR-DRG mortality category. Those control subjects who met both criteria were retained and matched based on age plus or minus 5 years. Finally, the patients who remained in the subset, based on the three criteria above, were matched based on total hospitalized days in the prior year plus or minus 5 days. The patient with the closest number of total hospitalized days in that subset was then chosen as a match. If two or more subjects were equal, one was randomly chosen based on a random number generator. After each iteration, patients who had been matched on a previous iteration were deleted. This matching process was used in part to control for left censoring of hospital admissions because studies have shown that days hospitalized is an independent predictor of utilization (Fleishman et al., 2008; Reuben et al., 2002).

Patients were matched using a 1:1 ratio of patients seen by the PCT to patients receiving usual care. Patients were excluded if they had died during the index hospitalization, were younger than 18, or had an initial hospital LOS of less than 2 days. They were also excluded if they resided outside of the five San Francisco Bay Area counties that represent the major catchment area for the study hospital. Residency in one of these counties was based on United States Postal Service ZIP Code. Study subjects were then followed for 1 year from their index hospital admission.

Data Sources

Data were extracted from three databases, two proprietary and one governmental, and linked together. The former consist of the study hospital's patient utilization database, MIDAS, and cost-accounting database, TRENDSTAR. MIDAS was used to extract patient clinical data (demographics and utilization records), and Trendstar was used to extract patient financial data (costs and revenue). The third database, the SSDI, lists most people who have died in the United States. Although some deaths are not reported, the SSDI remains the most accurate source of information on deaths in the country. Approval for this study was obtained from the study hospital's institutional review board and the University of California, San Francisco's Committee on Human Research.

Power Analysis

Researchers perform power analysis to ensure enough subjects are retained in a study to obtain a statistically significant difference in outcomes (Chmura & Thiemann, 1987). Power analysis estimates how many subjects are needed based on the type of statistical analysis performed, the number of predictor variables, the expected effect size, power, and alpha level.

Depending on the hypothesis, this study had as many as 10 predictor variables during analysis. And, based on other studies, this study expected to have a moderate effect size between comparison groups (Ciemins, Blum, Nunley, Lasher, & Newman, 2007; Cowan, 2004). The study used the standard alpha of 0.05 and the power of .90 (Ahlner-Elmqvist, Jordhoy, Jannert, Fayers, & Kaasa, 2004). To calculate power, G*Power, a computer program designed for power analysis was used (Faul, Erdfelder, Lang, & Buchner, 2007). When performing multiple regression for expenditures, days, and logistic outcomes with G*Power, the researcher found that a sample size of 73 per group (intervention and control groups) was necessary to achieve a significant outcome should all other factors within the conceptual design be accounted for.

Data Management

Linking Data Sources

The three data sources discussed above were linked in two separate ways. TRENDSTAR and MIDAS were linked using medical record numbers, names, and dates of birth. They were then linked to the SSDI using social security numbers and dates of birth. Because patients are sometimes listed under their spouse's social security number, a random group of patients with no linkage to the SSDI was also searched by name to ensure that no meaningful cases were missed in the matching process.

Missing Data

Often when using data extracted from existing databases, missing data occurs. Thus the database was reviewed in order to ensure the consistency of the data. First, the databases were reviewed to ensure that there were no duplicate records. Second, the files were examined to ensure that records were complete. No records were found to have missing data for the dependent variables. Records without social security numbers were deleted because they could not be linked to death records. On descriptive analysis, those records that were deleted were similar to those maintained in the final sample.

Those records with missing data that involved one of the covariables were coded as *unknown* and examined to ensure no bias occurred. Less than 1% of covariables were missing in this study.

Data Analysis

Descriptive Statistics

Using SAS/STAT® version 9.1.3 (SAS Institute Inc., 2007), the analysis began by performing simple univariate statistics including mean, median, mode, and ranges and evaluating frequency distributions of predictor and outcome variables of continuous variables. Because of the study's matched cohort methodology, the non-parametric Wilcoxon test was used to measure the statistical significance of continuous variables. Categorical variables were examined by performing chi-square tables. This analysis was used to confirm that a reliable matching process had occurred and to analyze the descriptive outcomes. Kaplan-Meier survival analysis was performed to examine the unadjusted survival curves of the matched cohorts.

Because cost variables were skewed or otherwise abnormally distributed, it was necessary to perform base-10 log transformations of variables to obtain a better fit when performing regressions (Cohen, Cohen, West, & Aiken, 2003). This is due to the assumption in regression that variables must be normally distributed; when this assumption is not met, it can lead to a poor overall fit. Second, Pearson product-moment correlation coefficients were performed to determine if multicollinearity existed between any of the covariables. No covariables were found to have a multicollinearity of 0.8 or greater; thus, there was no need to center or eliminate them from the regression models (Glantz & Slinker, 2001).

Multivariate Modeling

In this study, several multivariate modeling methods were used to examine the hypotheses discussed below, including generalized linear modeling, and Cox proportional hazard modeling. Modeling was performed using manual backwards step-down deletion, keeping only variables that were statistically significant in the model to a level of $p<.10$

or greater (Glantz & Slinker, 2001).

As suggested by Glantz & Slinker (2001), the models described below may not have been the correct models to measure the phenomena of interest. Although the models were based on a thorough review of the literature presented earlier and carefully considered based on available knowledge, errors could still have occurred. These errors could be due to underspecification of independent variables, a situation in which important independent variables are not included or errors in data reliability, such as the numerical accuracy of hospital admissions because patients may have used other hospitals during the study period.

Consequently, post-modeling analysis tests were performed to determine the fit of the data. For regressions, tolerance tests and variance inflation factor tests were done. Poor fit was also examined for cross validation and residual plots were performed. Moreover, because of possible errors in the data, outlier analysis was performed using visual detection on scatterplot matrices and by examining leverage, discrepancy, and influence regression diagnostic statistics (Cohen, Cohen, West, & Aiken, 2003). The remainder of this section will be organized by hypothesis, examining the equations and necessary circumstances to perform the statistical analysis.

Aim 1

Hypothesis 1. To examine the relationship between mortality rates and initial PC consultation, Kaplan-Meier survival analysis was initially performed. This provided overall survival curves for the two groups, although it does not control for covariates. Second, Cox proportional hazard modeling was performed to control for the following covariates: diagnostic classification based on CCS, disease severity, APR-DRG mortality risk score, age, gender, ethnicity, marital status, insurance status, and prior days hospitalized. The analysis was first performed for patients without death information and then run again excluding them. This was done as the inability to know whether the patients had deceased but not yet entered into the database, or whether they were still alive. In the second analysis, patients without a date of death were included in the model as *censored*, which causes the modeling to separate them from those with known dates of death (Singer & Willett, 2003). Additionally, interactions were performed between palliative care and days alive.

Hypothesis 2. The second hypothesis examined the relationship between the intervention and in-hospital mortality rates over the 1-year follow-up period. Because the outcome was a binary variable (yes-no), this relationship was examined by performing a logistic regression. The analysis was performed controlling for the total number of days alive during the follow-up year, residency in San Francisco, diagnostic classification based on the CCS, APR-DRG mortality and severity scales, age, marital status, ethnicity, insurance status, and prior year hospital admissions.

Aim 2

Hypothesis 3. The third hypothesis addressed the relationship between the number of hospital admissions (a continuous variable) at four set time points and patients who have received a PCT consultation to examine if the intervention had any lasting effects. To analyze this data, Cox proportional hazard modeling was performed. In this model, the study controlled for diagnosis, disease severity, age, gender, ethnicity, marital status, days living past the initial hospital admission, insurance type, residency in San Francisco, and prior hospitalized days (Glantz & Slinker, 2001; Singer & Willett, 2003).

Hypothesis 4. The fourth hypothesis examined the relationship between the PCT intervention and the number of emergency department visits a patient made. This was examined using Cox proportional hazard modeling, controlling for diagnosis, disease severity, age, gender, ethnicity, marital status, insurance type, residency in San Francisco, days alive, and number of prior hospitalized days.

Hypothesis 5. The fifth hypothesis analyzed the relationship between the initial PCT consultation and the total number of days a patient was in the hospital in the following year. This analysis was performed using Cox proportional hazard modeling. This model controlled for diagnosis, disease severity, age, gender, ethnicity, marital status, days living past the initial hospital admission, insurance type, location before admission, residency in San Francisco, and prior hospitalized days.

Aim 3

Hypothesis 6. This hypothesis evaluated the relationship between the PCT intervention and several hospital costs: inpatient costs, pharmaceutical costs, direct costs, indirect costs, laboratory costs, and radiology costs. The costs attributed to PCT consultation were found by performing generalized linear modeling (GLM), a form of regression analysis, and then back-solving separately for the intervention and control equations as described here (Dubberke, Reske, Olsen, McDonald, & Fraser, 2008). These models controlled for disease severity, age, gender, ethnicity, marital status, insurance type, and residency in San Francisco, prior hospitalized days, initial discharge disposition, and days alive past the initial hospital admission. Because the cost variables were non-normally distributed, they were base-10 log-transformed and then retransformed after regression. The multiple regression equation for these cost variables is as follows:

$$BXCX_{\underline{costX}} = \beta_0 + x_{PCintervention}\beta_1 + x_{gender}\beta_2 + x_{ethnicity}\beta_3 + x_{age}\beta_4 + x_{maritalstatus}\beta_5 + x_{dcdispo}\,\beta_5 + x_{insurancestatus}\beta_6 + x_{DX}\beta_7 + xDzSeverity\beta_8 + x_{APR\text{-}DRGmort}\beta_9 + x_{daysalive}\beta_{10} + x_{priorhosp}\beta_{11} + x_{livesSF}\beta_{12}$$

Hypothesis 7. This hypothesis addressed the relationship between the PC intervention and total emergency department costs using the same process as in Hypothesis 6. The GLM regression controlled for disease severity and mortality, age, gender, ethnicity, marital status, days living past the initial hospital admission, insurance type, initial discharge disposition, residency in San Francisco, and prior hospitalized days. The equation for this GLM regression was

$$BXCX_{\underline{TotalERCosts}} = \beta_0 + x_{PCintervention}\beta_1 + x_{gender}\beta_2 + x_{ethnicity}\beta_3 + x_{age}\beta_4 + x_{maritalstatus}\beta_5 + x_{dcdispo}\,\beta_5 + x_{insurancestatus}\beta_6 + x_{DX}\beta_7 + xDzSeverity\beta_8 + x_{APR\text{-}DRGmort}\beta_9 + x_{daysalive}\beta_{10} + x_{priorhosp}\beta_{11} + x_{livesSF}\beta_{12}$$

Hypothesis 8. This hypothesis analyzed potential differences between net profit and net loss. In the case of profit and loss, the variable was normally distributed; thus, no transformation was performed. A GLM regression was performed controlling for disease severity and mortality, age, gender, ethnicity, marital status, days living the past initial hospital admission, insurance type, initial discharge disposition, residency in San Francisco, and prior hospitalized days. The equation for this GLM regression was

$$\text{Inetrevenue} = \beta 0 + x\text{PCintervention}\beta 1 + x\text{gender}\beta 2 + x\text{ethnicity}\beta 3 + x\text{age}\beta 4 + x\text{maritalstatus}\beta 5 + x\text{dcdispo}\ \beta 5 + x\text{insurancestatus}\beta 6 + x\text{DX}\beta 7 + x\text{DzSeverity}\beta 8 + x\text{APR-DRGmort}\beta 9 + x\text{daysalive}\beta 10 + x\text{priorhosp}\beta 11 + x\text{livesSF}\beta 12$$

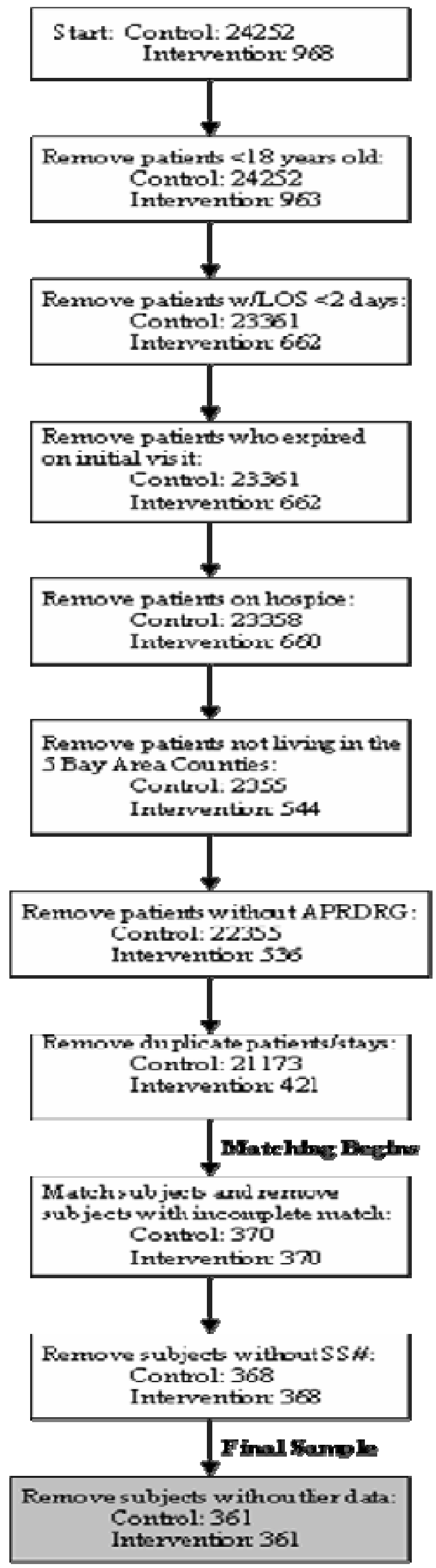
CHAPTER FIVE

RESULTS

Sample

The initial sample comprised 25,815 control and 1,060 intervention subjects. After removing those who did not meet the study criteria, 21,173 control and 421 intervention subjects remained (see Figure 2). After matching subjects based on the above criteria, 51 more intervention subjects were removed due to incomplete matching. And, two intervention subjects without social security numbers were also removed. Finally, after removing intervention subjects who had an outlying initial LOS based on scatterplot analysis, the final pool was formed: 361 control and 361 intervention subjects. Overall, patients in the general hospital population were significantly more likely to be discharged home, had longer initial lengths of stay, and had more severe illnesses as measured both by APRDRG severity and mortality scores than those who were retained in the matched cohort.

Figure 2: Map of sample selection process.



Descriptive Data

Compared to examining the full cohorts, the differences between the groups narrowed significantly after matching the subjects. However, the difference between being discharged to home and discharged to a facility after the initial hospital admission continued to have clinically and statistically significant differences (see Table 4). Patients seen by the PCT were discharged to home only 36.6% of the time compared with 62.9% for the usual care group ($p < .0001$). This indicates that the intervention group was either sicker than the control group or had fewer support structures for home-based care. Consequently, a perfect match was not obtained. This was shown when a descriptive analysis of death rate was performed (see Mortality Results Section). And, marital status was statistically different between the groups, although the clinical significance is debatable because the control group was only slightly more likely to be married than the intervention group (44.3% vs. 34.9%, $p < .05$).

Table 4

Descriptive Statistics of Usual Care and Palliative Care Groups

Variable		Usual Care (N = 361)	Palliative Care (N = 361)
Age (years)		68.7	68.5
LOS (days)*		9.3	10.6
Prior year hospitalized days		10.4	11.2
Female *n* (%)		184 (51.0%)	177 (49.0%)
Ethnicity *n* (%)			
	White	251 (69.5%)	251 (69.5%)
	Asian	64 (17.7%)	68 (18.8%)
	African American	37 (10.3%)	33 (9.1%)
	Other/unknown	8 (2.2%)	12 (3.3%)
APR-DRG severity of illness n (percent)			
	1	11 (3.1%)	12 (3.3%)
	2	105 (29.1%)	104 (28.8%)
	3	190 (52.6%)	187 (51.8%)
	4	55 (15.2%)	58 (16.1%)
APR-DRG risk of mortality n (percent)			
	1	39 (10.8%)	40 (11.1%)
	2	132 (36.6%)	132 (36.6%)
	3	141 (39.1%)	140 (38.8%)
	4	49 (13.6%)	49 (13.6%)
Insurance *n* (percent)			
	Medicare	197 (54.6%)	186 (51.5%)
	Medicaid	13 (3.6%)	25 (6.9%)
	Private	151 (41.8%)	150 (41.6%)
Discharge to *n* (percent):*			
	Other hospital	11 (3.1%)	14 (3.9%)
	Home	227 (62.9%)	132 (36.6%)
	Other facility	123 (34.1%)	215 (59.6%)
Marital status *n* (percent)**			
	Single	133 (36.8%)	136 (37.7%)
	Married	160 (44.3%)	126 (34.9%)
	Widowed	55 (15.2%)	79 (21.8%)
	Unknown	13 (3.6%)	20 (5.5%)
Disease classification *n* (percent)			
	Infectious and parasitic diseases	27 (7.5%)	29 (7.4%)
	Neoplasms	131 (36.3%)	132 (33.7%)
	Diseases of the circulatory system	39 (10.8%)	44 (11.2%)
	Diseases of the respiratory system	24 (6.7%)	26 (6.6%)
	Diseases of the digestive system	29 (8.0%)	33 (8.4%)
	Injury and poisoning	25 (6.9%)	25 (6.9%)
	Symptoms, signs, and ill-defined conditions	29 (8.0%)	29 (8.0%)
	Other	57 (15.8%)	57 (15.8%)

Note: LOS = length of stay; APR-DRG = All Patient Refined Diagnosis Related Groups.

*$p < .001$; ** $p < .05$.

Mortality Results

Aim 1: To examine whether patients seen by the PCT have similar mortality rates to those not seen by the PC team up to 1-year post index hospital admission and whether they are more likely to die in the hospital.

To meet the goals of Aim 1, this study first analyzed descriptive statistics of unadjusted mortality and inpatient death rates of the matched patient cohorts. Of those subjects who died in the first year, the findings showed that those in the intervention group lived 109 fewer days on average than those in the control group (see Table 5). The usual care group had 13.6% more deaths in the hospital over the 1-year follow-up period than those in the palliative care group ($p < .01$).

Table 5

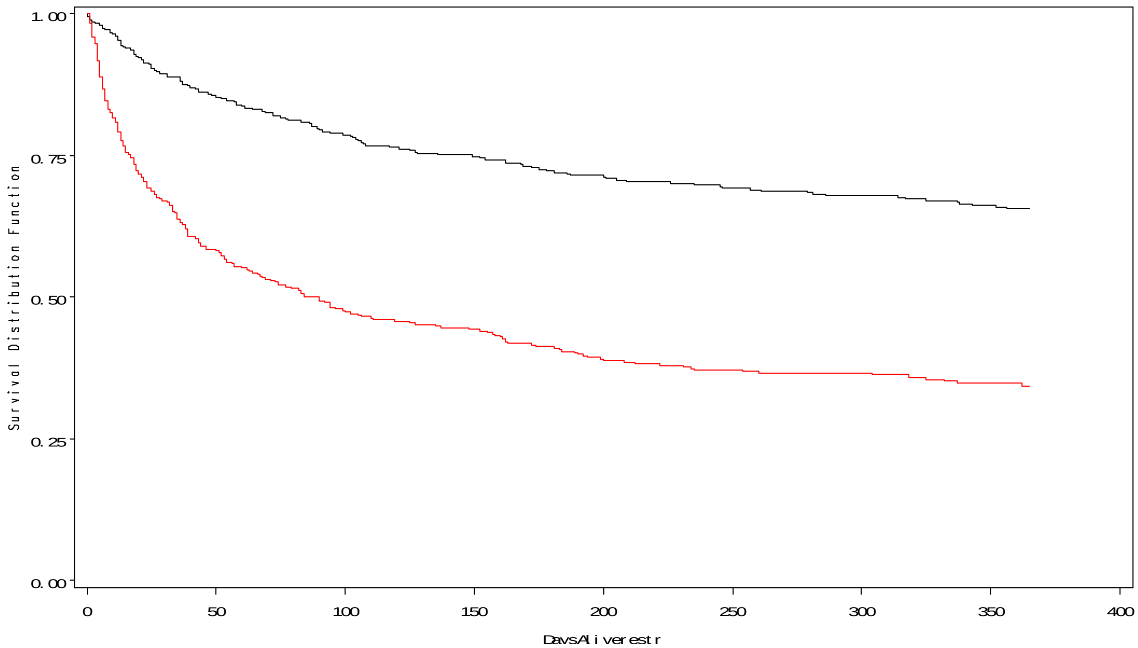
Mortality Descriptive Mean Outcome Statistics of Usual Care and Palliative Care Groups

Variable	Usual Care (N = 361)	Palliative Care (N = 361)
Percentage alive at 1 month**	89.5%	67.0%
Percentage alive at 3 months**	79.5%	49.3%
Percentage alive at 6 months**	72.3%	41.3%
Percentage alive at 12 months**	65.7%	34.3%
Mean number of days alive at 12 months**	275	166
Inpatient hospital deaths over 1 year††	37	29

Note: Significance: ** $p < .0001$; †† $p < .01$.

Kaplan-Meier survival analysis was then performed to examine unadjusted mortality rates of the matched cohort (see Figure 3). As shown, subjects in the intervention group (pcconsult = 1) had a significantly steeper initial mortality rate, which leveled off over time so that death rates had a relatively constant slope after the first 60 days.

Figure 3:KAPLAN–MEIER Unadjsted Survival Curve



PCT Consult Received -----------   Usual Care -----------------

Cox proportional hazard modeling was then performed to examine the effects of PCT consultation on mortality, while controlling for extraneous factors. This modeling found that subjects who received a PCT consultation were associated with a 2.5 times greater likelihood of dying within the 12-month follow-up period that those receiving usual care (see Table 6). This model also found that the APR-DRG risk of mortality score was an independent predictor of mortality; the higher the score on the initial admission the more likely patients were to die. Also of interest, female subjects were roughly two thirds less likely to die during the study period than male subjects. The model also found that subjects with neoplasms were 2.3 times as likely and those with infectious diseases and 1.6 times as likely to die during the year than those with cardiovascular illnesses. Finally, subjects who were discharged to a nursing facility were 1.4 times more likely to die during the 1-year follow-up period than those discharged to home. This likely plays a large role in the differences between the two groups because the usual care group had a larger proportion of subjects discharged to home than the PC group, as noted above. APR-DRG severity, prior year hospitalized days, gender, ethnicity, marital status, and insurance status were not significant in the model.

Several interaction terms were also run to examine whether any of the predictor variables interacted with receiving a palliative care consultation as it relates to mortality. The analysis found that discharge disposition, APRDRG mortality, and age, were not significant in these interaction models.

Table 6

Cox Proportional Hazards Model: Risk of Death Within One Year After Initial Hospital Admission, N = 722

Variable		Hazard Ratio (95% Confidence Limits)	*p* value
Palliative care consultation received		2.534 (2.052-3.129)	<.0001
Age		1.016 (1.008-1.025)	<.0001
Length of stay		NS	NS
Prior year hospital admissions		NS	NS
APR-DRG risk of mortality			
	1	1.0 [Reference]	
	2	2.310 (1.374-3.885)	<.001
	3	3.377 (1.959-5.822)	<.0001
	4	4.423 (2.274-8.600)	<.0001
APR-DRG severity index		NS	NS
Female		.685 (.554-.848)	<.001
Ethnicity		NS	NS
Insurance type		NS	NS
Marital status		NS	NS
Discharge to:			
	Home	1.0 [Reference]	
	Other hospital	1.739 (1.032-2.930)	<.01
	Other facility	1.433 (1.146-1.792)	<.05
Disease classification			
	Infectious and parasitic diseases	1.654 (1.028-2.662)	<.05
	Neoplasms	2.282 (1.611-3.232)	<.0001
	Diseases of the respiratory system	NS	NS
	Diseases of the digestive system	NS	NS
	Injury and poisoning	NS	NS
	Symptoms; signs; and ill-defined conditions	1.769 (1.080-2.897)	<.05
	Other	NS	NS
	Diseases of the circulatory system	1.0 [Reference]	
Model -2LL		5014.006	<.0001

Note: APR-DRG = All Patient Refined Diagnosis Related Groups.

Utilization Results

Aim 2: To examine the effects of an inpatient PCT on utilization rates up to 1-year post index hospital admission.

To examine the outcomes related to Aim 2, descriptive statistics of utilization were first performed to determine the unadjusted differences of the matched patient cohorts.

When examining descriptive data, significant differences in utilization were found in all categories; although some had small effect sizes (see Table 7). Utilization was decreased across the board among patients initially seen by the PCT. Of particular significance was the large decrease in admissions at 6 months and one year, at which times the usual care group had over twice as many admissions as the palliative care group, the likely reason for which was the decreased lifespan of the palliative care group. Slight decreases were found in hospital admissions of the intervention subjects at 1 and 3 months. Finally, there was a 38% decrease in the total number of days spent in the hospital at 1-year among the intervention group.

Table 7

Utilization Descriptive Mean Outcome Statistics of Usual Care and Palliative Care Groups

Variable	Usual Care (N = 361)	Palliative Care (N = 361)
Days in hospital at 12 months**	14.3	8.9
Hospital admissions at 12 months**	1.3	0.6
Hospital admissions at 6 months**	0.9	0.4
Hospital admissions at 3 months**	0.7	0.3
Hospital admissions at 1 month††	0.3	0.2
Emergency department visits at 12 months**	0.3	0.2
Total ICU days†	0.6	0.3

Note: ICU = intensive care unit.
Significance: ** $p < .0001$; †† $p < .01$; † $p < .001$

Cox proportional hazards modeling was performed to assess the effects that the initial PCT consultation had on utilization, while controlling for external factors. Modeling was performed examining the rates of hospital readmission independently at 1, 3, 6, and 12 months and total hospitalized days at 12 months from the index hospital admission. Modeling was significant at all time periods and for total hospitalized days.

Results from these models show that at 1, 3, 6, and 12 months, patients who had received a PCT consultation were associated with decreased readmissions to the hospital (see Table 8). However, emergency department visits and total ICU days were insignificant, likely due to lack of incidence in the sample population.

When running the hazard models for hospital admissions at 1, 3, 6, and 12 months, the intervention, prior year hospitalized days, and days alive were statistically significant. Results found that subjects in the intervention group were associated with a 21.9% less likelihood of being admitted to the hospital within 1 month, 27.5% less likely at 3 months, 29% less likely at 6 months, and 31.8% less likely at 12 months. Age, gender, ethnicity, initial LOS, APR-DRG severity and mortality scores, diagnostic class, discharge disposition, and residency in San Francisco were not significant in the model.

Hazard modeling was then performed to determine the effect of the intervention on total number of hospital days at 12 months after the initial hospital admission (see Table 8). Prior year hospitalized days, days alive, initial hospital admission LOS, and discharge disposition were found to be statistically significant in this model. Results from this model found that subjects in the intervention group were associated with a 35% greater likelihood of having fewer hospitalized days than those in the control group. Subjects who were discharged to a nursing facility rather than to home on their initial hospital admission were associated with a 31.9% greater likelihood of spending fewer days in the hospital. This is to be expected because patients who go to a facility are more likely to have 24-hour professional care providers to prevent transferring back to the hospital compared to those who go home with informal caregivers or part-time formal caregivers.

Several interaction terms were also run to examine whether any of the predictor variables interacted with receiving a palliative care consultation as it relates to mortality. The analysis found that discharge disposition, APRDRG mortality, APRDRG severity and age, were not significant in these interaction models.

Table 8. Cox Proportional Hazards Model: Risk of Hospital Readmission (*N* = 722)

Variable	Readmission to the hospital at 1 Month		Readmission to the hospital at 3 Months		Readmission to the hospital at 6 Months		Readmission to the hospital at 12 Months		Total Hospital Days at 12 Months	
	Hazard Ratio (95% CI)	*p* Value	Hazard Ratio (95% CI)	*p* Value	Hazard Ratio (95% CI)	*p* Value	Hazard Ratio (95% CI)	*p* Value	Hazard Ratio (95% CI)	*p* Value
Palliative care consultation received	.781 (.626-.976)	0.03	.725 (.580-.906)	0.005	.710 (.567-.888)	0.004	.682 (.543-.856)	0.001	.650 (.518-.816)	0.0002
Age	1.012 (1.003-1.021)	0.006	1.013 (1.004-1.022)	0.004	1.013 (1.004-1.021)	0.003	1.014 (1.005-1.022)	0.002	1.012 (1.003-1.021)	0.007
Days alive at 1 year	.996 (.995-.997)	<.0001	.996 (.995-.997)	<.0001	.995 (.994-.996)	<.0001	.995 (.994-.995)	<.0001	.994 (.993-.995)	<.0001
Length of stay on initial hospital admission	NS	NS	NS	NS	NS	NS	NS	NS	.984 (.971-.998)	0.0009
Prior year total days in hospital	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Discharge to:										
Home	NS	NS	NS	NS	NS	NS	NS	NS	1.0 [reference]	
Other hospital	NS	NS	NS	NS	NS	NS	NS	NS	.501 (.299-.838)	0.009
Other facility	NS	NS	NS	NS	NS	NS	NS	NS	.681 (.542-.856)	0.001
APR-DRG severity grade	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
APR-DRG risk of mortality	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Female gender	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ethnicity	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Insurance	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Marital status	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Residency in San Francisco	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Disease category	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Model -2LL	5024.989	<.0001	5087.195	<.0001	4846.146	<.0001	4762.639	<.0001	4542.7	<.0001

Note: APR-DRG = All Patient Refined Diagnosis Related Groups

Net Cost Results

Aim 3: To examine the effects of an inpatient PCT on patients costs within the hospital system up to 1-year post index hospital admission.

To analyze the outcomes of Aim 3, descriptive statistics of utilization were first performed to examine the unadjusted differences of costs of the matched patient cohorts (see Table 9). Descriptive statistics showed that costs were decreased across the board, and the hospital actually averaged a $225 net profit per intervention patient versus a $5,198 net loss per usual care patient, although this was not statistically significant due to high variability.

Table 9

Cost Descriptive Mean Outcome Statistics of Usual Care and Palliative Care Groups

Variable	*Usual Care (N = 361)*	*Palliative Care (N = 361)*
Net profit (loss)	($5,198)	$225
Net revenue**	$23,144	$20,446
Total costs††	$45,676	$39,459
Direct costs†	$27,318	$21,755
Indirect costs††	$18,358	$17,702
Critical care costs††	$3,709	$3,122
Emergency Department costs**	$514	$273
Laboratory costs**	$873	$845
Radiology costs**	$828	$449
Pharmacy costs†	$3,902	$2,197
PT/OT/ST costs††	$1,303	$773

Note: PT = physical therapy; OT = occupational therapy; ST = speech therapy.

Significance: ** $p < .0001$; †† $p < .01$; † $p < .001$

Multiple regression modeling was then performed to determine the costs attributable to the intervention (see Table 10). Significantly, the multiple regression examining net profit and loss found an associated increase in net profit of approximately

$4,433 per PC subject over the 1-year period, regardless of insurance status. In this regression, days alive, age, discharge disposition, and insurance status were significant. The final equation for this model was:

$\underline{I_{netrevenue}} = 512586 + x_{PCintervention} (-5500) + x_{age} (-188.6) + x_{dcdispo} (11192) + x_{insurancestatus} (-7786) + x_{daysalive} (-14.66)$

Interestingly, in addition to this model, a model was run individually performing interactions between receiving a PCT consultation and APRDRG risk of mortality, APRDRG severity, discharge disposition, and a dichotomized geriatric dummy variable where the dividing line was patients older than 65. The former three were not significant. However, the latter was, finding that patients who were younger than 65 and received a PCT consultation had a significantly higher degree of savings than those who were older than 65 and received a PCT consultation ($p<.01$).

Regression models were also performed to associate attributable costs (costs that are attributed to the PCT of various cost categories and total revenue. Although intervention subjects were associated with a slight decrease in attributed revenue of $66, the intervention population was associated with a significant cost savings across the board for expense line items. Attributable cost savings per subject per annum were as follows: $9,163 in total costs, $2,841 in indirect costs, $4,578 in critical care costs, $1,231 in laboratory costs, and $669 in pharmacy costs. Note that the subcategory costs do not add up to the total attributable costs. This is due to each individual line item being regressed separately and is to be expected.

Table 10

Log-Transformed Regression Models:

Attributable Savings of Inpatient Palliative Care per Patient per Year

	Attributable Costs	*Significance*
Net profit (loss)	$4,433.53	$p < .0001$
Revenue	-$66.07	$p < .0001$
Total costs	-$9,162.75	$p < .0001$
Direct costs	-$172.82	$p < .0001$
Indirect costs	-$2,841.77	$p < .0001$
Critical care costs	-$4,577.89	$p < .0001$
Emergency Department costs	-$42.35	$p < .0001$
Laboratory costs	-$1,230.66	$p < .0001$
Radiology costs	-$43.64	$p < .0001$
Pharmacy costs	-$668.61	$p < .0001$
PT/OT/ST costs	-$20.13	$p < .0001$

Note: PT = physical therapy; OT = occupational therapy; ST = speech therapy.

CHAPTER SIX

DISCUSSION AND LIMITATIONS

To the author's knowledge, this is the first study to examine the effects of an initial PCT consultation on subsequent mortality, utilization, and cost over a 12-month period. Several studies have examined the immediate effect of PCT consultation on mortality (Elsayem et al., 2006), utilization (Penrod et al., 2006), and costs (Ciemins, Blum, Nunley, Lasher, & Newman, 2007), finding no change in inpatient mortality and reductions in utilization and costs. This study, however, found that the effects of an inpatient PCT last beyond the immediate hospital stay and that mortality does change over the long-term, albeit only by about 3 months.

Mortality

In this study, patients seen by the PCT were associated with a decreased average lifespan after discharge, an unexplained effect. Because most of the difference in mortality rate occurred in the first 60 days after the initial hospital admission, the two most plausible reasons for this decreased lifespan are that (a) the intervention cohort was sicker initially than the control cohort or (b) more intensive care was provided by the hospital before the initial discharge, allowing the subject to return to a more stable state. While both hypotheses appear to play some role, considering the findings of several earlier studies in the severely ill population, the latter hypothesis likely played a larger role has considerable traction. One, by Ciemins et al., (2007) found that subjects were more likely to have less intensive medical care after the PCT became involved in their case. A second study found that patients in an ICU who had life sustaining treatments withheld were twice as likely to die within 60 days than those who received treatment

(50.5% vs. 25.8%, p<.001; Chen, Connors, & Garland, 2008).

The two diagnoses with higher mortality hazard rates, neoplasms and infectious diseases, would be expected to be higher once the PCT intervention began because these diseases are high-utilization disease classifications. The PCT's involvement would likely lead to reduced intervention and the patients' removal from the ICU. Two likely scenarios follow.

In the first scenario, a patient with an advanced cancer is receiving chemotherapy and radiation therapy. Following the intervention by the PCT, the patient opts to stop these treatments. Although a patient who continues chemotherapy, radiation, and intensive care may live longer, he or she will likely have a poor quality of life because these invasive therapies cause pain, nausea, alopecia, fatigue, delirium, and other negative symptoms. The PC patient will likely have a higher rate of mortality because cancer therapy will likely extend life.

In the second scenario, an elderly patient with dementia contracts aspiration pneumonia. If he or she should become septic or have decreased lung capacity, the patient might be sent to the ICU and placed on a ventilator. The patient might survive the pneumonia only to return later with another case of pneumonia, a broken hip, or some other debilitating injury or illness. If the PCT were to intervene, it could help the family to develop a plan of care that follows the patient's wishes, sending him or her home on oral antibiotics to treat the infection and morphine to treat the shortness of breath. With less intensive intervention, however, the patient would be less likely to recover. Nevertheless, the patient would likely be more comfortable during that period and would avoid future transfers to the hospital through advance care planning (D. E. Campbell, Lynn, Louis, & Shugarman, 2004).

These two patient scenarios in addition to the studies by Ciemins et al (2007) and Chen et al (2008) illustrate why while patients seen by the PCT had decreased survival, this may not have been a detrimental outcome but actually better hew to patient wishes and provide less futile and more comfortable care. Had the two patients received aggressive care, they might have lived longer, however at what expense?

Several other studies have found that when palliative care is provided, mortality increases. One study, which used a matched cohort methodology in which inpatient and outpatient PC services were provided, showed a significant increase in mortality among the PC cohort (Jordhoy et al., 2000). In this study, subjects with malignant cancers and a life expectancy of 2 to 9 months were included. Jordhoy and colleagues found a difference in lifespan: 127 days in the usual care group versus 99 in the PC intervention group. Because the subjects in this study lived longer, the subjects in the study by Jordhoy and colleagues were probably sicker than those in the present study. Thus, the usual care subjects in this study had more time to receive further medical intervention, widening the gap between the usual care and PC groups. However, the added interventions received by usual care subjects in this study only increased survival by a little over 3 months on average compared with the intervention subjects.

Besides examining mortality from the perspective of time to death, this study also examined whether there was a difference in inpatient mortality rates. The study found a statistically significant decrease in inpatient mortality based on descriptive statistics. However, no significant difference in inpatient mortality rates was found when using Cox proportional modeling; this was probably due to the low incidence rate of in-hospital deaths among this population. Only 8.0% of the patients seen by the PCT and 10.2% of the matching population died in the inpatient setting. If the incidence inpatient mortality rate had been higher or if the sample size had been larger, the results likely would have been significant. Thus, it is possible that this study was underpowered for this particular outcome due to its small effect size.

Several studies have shown decreased inpatient mortality when an outpatient PCT followed patients (Ahlner-Elmqvist, Jordhoy, Jannert, Fayers, & Kaasa, 2004; Bruera et al., 2000), and, while not an exact match of the intervention in this study, they provide some grounding for this claim. Another study has shown large decreases in inpatient mortality when patients enter hospice (Chang et al., 2000). Although differences in discharges to hospice organizations were not measured in this study, it is likely that there were a larger number of PC subjects beginning hospice care than usual care subjects based on previous studies (Davis et al., 2002; Leong, Chong, & Gibson, 2006).

Utilization

The study found that PCT consultations are associated with substantial decreases in inpatient utilization over the long term. This was likely due to the patients' severe illnesses and high utilization of services when they were inpatients.

First and foremost, this study found an association between the PCT and decreased hospital admissions at each follow-up time point, suggesting that PCTs prevent hospital admissions. This finding is likely due to the advance care planning that PCTs provide. PCTs spend time with patients and their families discussing different situations following discharge and their care preferences. Often, patients who are seen by an inpatient PCT are discharged to a hospice. In one study, 37% of the patients discharged from a hospital who were seen by an inpatient PCT were discharged to a hospice (Dhillon et al., 2008). Several studies have also found that inpatient PCTs often recommend the implementation of advance directives that may decrease future hospital admissions (M. L. Campbell & Guzman, 2003; Leong, Chong, & Gibson, 2006). Thus, by decreasing hospital readmissions, PCTs can prevent unnecessary and possibly traumatic patient transfers (Mezey, Dubler, Mitty, & Brody, 2002; Purdy, 2002).

Besides decreasing the total number of hospital admissions, patients seen by PCTs were associated with spending fewer days in the hospital than those in the comparison group. This is likely due to two factors: First, the decrease in the total number of hospital admissions which would reduce the total days of patients stay. Second, the hospital readmissions of PC patients most likely involved specific interventions or the treatment of uncontrolled symptoms. The LOS for these types of admissions are usually shorter than more general hospital admissions (Lagman, Walsh, Davis, & Young, 2007).

Although emergency department visits and ICU days were decreased in descriptive analysis, they had lower than expected incidence rates throughout the study population. Thus, these outcomes may have been because of the small sample size, leading to their insignificance in hazard modeling. However, other studies have shown decreases in these rates (Ciemins, Blum, Nunley, Lasher, & Newman, 2007; Lilly, Sonna, Haley, & Massaro, 2003; O'Mahony, Blank, Zallman, & Selwyn, 2005). Considering the descriptive differences, it is likely that significant decreases in emergency department and ICU utilization would have been found had the incidence rates been higher.

Costs

This study found a substantial association between the PCT and decreases in costs and large increases in the hospital's net profit. This was likely due to the decreased utilization rates. Among the small 361-subject cohort in this study, a cost savings of roughly $1.65 million could be associated to those who received a PCT consultation. This is likely due to the capitated model of payment now used by most insurers. High-intensity high-acuity patients, such as those found in this study, erode a hospital's profit; any type of intervention that decreases utilization by this group can create substantial cost savings. Part of this impact though can be related to this hospital's high occupancy rates. Preventing patient stays when occupancy is high does not affect the bottom line, as other more profitable patients may be hospitalized instead. However, in other hospitals with lower occupancy rates a different effect on net revenue may be found and thus requires further study.

Beyond the difference in net profit attributed to the intervention, several cost categories were highly sensitive to the intervention and provide some insight into where savings were achieved. Of particular interest was the large decrease in critical care expenditures associated with the PCT. Although the study was underpowered to show differences in utilization in critical care, it was significantly powered to show a large difference in critical care costs, likely due to the larger effect size as critical care costs can be a large share of a hospital's total expenses (Studnicki et al., 1994). Thus, it appears that the intervention was able to decrease the intensity of care and the resulting costs that occur in the ICU. This finding echoes the literature, which has shown decreased ICU LOS when an intensive PCT communication intervention was used (Lilly, Sonna, Haley, & Massaro, 2003). In this study, the PCT was able to discuss care options with the patients or surrogate decision makers in the ICU and that once informed of all options and likely outcomes, patients or surrogates decided to stop invasive life sustaining treatments. This then had the effect of decreasing utilization and costs

In addition to overall decreases in utilization, substantial savings in laboratory and pharmacy costs were also associated with the PCT intervention, which could be used as a proxy for a decrease in additional diagnostic and pharmaceutical interventions. Other studies involving inpatient PCTs have shown mixed results in this regard: Some studies have shown decreased laboratory and radiology costs (Cowan, 2004; Davis et al., 2005), while one showed increased in pharmaceutical costs (Ciemins, Blum, Nunley, Lasher, & Newman, 2007), one a decrease in pharmaceutical costs (Davis et al., 2005), and one no change in pharmaceutical costs (Penrod et al., 2006). Why this variation has occurred is unknown.

This study hypothesized that the cost shifts are likely due to the transition from curative to palliative care, whose treatments tend to be significantly less expensive and intense. Pharmaceutical costs should be lower because patients are taken off of expensive curative medications, such as chemotherapeutic agents, and put on generic, symptom-control medications, such as morphine. Some symptom control medications, however, are more expensive and not available in generic form, such as actiq, a fentanyl lozenge for acute breakthrough pain. Diagnostic costs are expected to be lower because palliative management involves fewer tests. Finally, significant indirect cost savings were attributed to the intervention group because of decreased hospital admission rates; these are generally fixed costs per admission.

Finally, this study found that a substantial interaction occurred between PC and age dichotomized to those over 65 and those younger than 65 when examining net revenue.

The study found higher level of savings when younger patients were seen by the PCT compared to geriatric patients. This is likely due to the decreased cancer rates and increases in other chronic conditions among the elderly, as patients with cancer tend to have higher expenses and longer hospital stays (Evers et al, 2002).

Limitations

This study has several limitations. First, its matching process was imperfect. It appears from the descriptive statistic outcomes that the matching was incomplete; the subjects in the intervention group appeared to be sicker at the onset of their hospital admission. Contrary to expectations, the PC cohort had a higher percentage of subjects discharged to facilities. Subjects in the PC cohort were 2.3 times more likely to have died at 1 year than the usual care cohort. Although some of the discrepancy in mortality was likely due to the intervention, some of it may have been related to the matching process. One study controlled for the difference in discharge by matching patients on discharge disposition (Cowan, 2004). However, controlling by an outcome variable could have confounded this study. It may have been better to match subjects based on their location before admission (e.g., facility, other hospital, home), if that information had been available.

Although this study's method of matching was chosen based on its use and validation in previous studies, most of the matching protocols were only used to examine individual hospital stays, not long follow-up periods (Ciemins, Blum, Nunley, Lasher, & Newman, 2007; Davis et al., 2005). The APRDRG Mortality Scale was appropriate for the study and showed significant effects in the Cox models. However, it was only a single explanatory variable, APRDRG Severity scale showed no variability or predictive utility, and age and prior year hospital admissions showed little variability between subjects in our models. Future studies in which matching occurs at the outset of a long follow-up period should consider matching based on a patient's location before hospital admission. Because this hospital's administrative records do not provide this information, it could not be used as either a matching variable or a predictor variable.

Second, this study's sample size was small. Although the sample was adequate to show results of some of the outcomes, the small effect sizes of some of the variables combined with the small sample size to show no significant difference, as in the case of inpatient mortality and ICU utilization. Moreover, this study was restricted to a single hospital; thus, its generalizability to other types of hospitals is questionable.

Third, this study did not examine the PCT's care because it relied solely on administrative records. As a result, the study could not examine the quality of care provided by the PCT, what interventions were performed, how they were carried out, and what their effects were. A medical record audit may have provided a richer understanding of how the PCT affected patient care. Finally, the administrative data could not reliably identify which patients had advance directives (e.g., durable power of attorney for health care, do not resuscitate, do not intubate, or a living will) either before or after a PCT intervention, so it is unclear how the PCT helped in improving advance care planning. Despite these limitations, this study showed that PCTs can have substantial long-lasting effects on the utilization and costs of health care, while not increasing inpatient mortality. Thus, hospitals that do not have PCTs and insurers that do not reimburse for PC services should re-consider their potential to reduce utilization and costs.

Study Results and the Conceptual Framework

This study used two conceptual frameworks: Donabedian’s (1966) structure-process-outcome model and economic marginalism, otherwise known as cost-benefit analysis. This section will discuss how to view the study’s results in the light of these frameworks.

Traditionally, Donabedian’s model followed a linear concept, where outcomes did not did not feed back into the model and create changes. However, Donabedian’s model was adapted to allow for such feedback to effect change in the system (see Figure 4; (Mitchell, Ferketich, & Jennings, 1998). Thus, when an outcome is found that positively affects the quality of care, due to a specific experiment or new structure or process, the outcome then in turn pushes the system to change the process or structural elements in a more permanent nature. On the other hand, if an outcome is found that is deleterious, it will have an affect on the system, ensuring that a process or structure is improved upon in order to ensure better patient care.

In this instance, the positive outcomes created by the PCT intervention will be fed back into the system in two ways. First, the study hospital had a very high occupancy rate. Thus, by decreasing the utilization of high-cost high-utilization patients, the PCT allowed the hospital to admit more patients who were more profitable and had lower utilization rates. Additionally, the effects of the PCT intervention also positively affected patients, and patients and families provided positive feedback to the hospital and the PCT (not reported in this study). This has allowed the PCT in the past year to expand its scope, to take care of more patients, and to begin searching for more clinicians to increase capacity. Finally, because the intervention has been shown not to increase inpatient mortality, a key benchmark for the chief executive officers in this hospital, the intervention has engendered support among the administration, allowing it to continue thriving.

Figure 4: Quality health care outcomes model. From Mitchell, Ferketich, and Jennings, 1998.

Second, when viewed through the framework of economic marginalism, this study's results argue persuasively that the PCT should be maintained and expanded. Each PCT clinician "saves" the hospital more than he or she is paid in salary, and the PC program provides positive outcomes for the hospital. Between the immediate cost savings on hospital admissions found in an earlier study of PCTs (Ciemins, Blum, Nunley, Lasher, & Newman, 2007) and this study, which shows substantial cost savings to the hospital, the cost benefit analysis of the PCT intervention is evident and offers the hospital ample incentive to continue and expand its PC program.

Areas for Future Research

Although this study was successful in finding an association between PCT utilization and decreased hospital utilization and costs while not increasing inpatient mortality over the 1-year follow-up period, the long-term effects of inpatient PCTs remain unstudied. First, future studies should replicate the methods used here, including more hospitals and a larger sample size. They should also examine not only the patient factors but also structural factors related to mortality, utilization, and costs.

Second, future studies should examine what types of advance care directives are implemented and what other care planning events take place in these PCT interventions. While this is likely one of the greatest reasons for the results obtained in this study, it was unmeasured due to its limitations and therefore cannot be said with any certainty that this is the reason. This could be done in several ways, for example, an ethnographic study of the PCT, medical record abstraction, or patient-family interviews or questionnaires. One ethnography has examined the effects of death and dying in the inpatient setting, providing a rich view of how death occurs when usual care is provided; however, it did not examine PCT care (Kaufman, 2005). Another study has examined the satisfaction of bereaved families with PCTs finding high levels of satisfaction (Gelfman, Meier, & Morrison, 2008). However, the study did not look at what care processes led to the families satisfaction, just that they were overall satisfied.

Third, new studies should identify the types of facilities that patients are discharged to. Although this study was able to examine this descriptively, it could not examine what effects the PCT had on discharge status because it could not identify the subjects' location before hospital admission. To determine if patients are more likely to return to their current setting or to a higher (or lower) level of care after the PCT intervention, future studies should look at the difference between where a patient is admitted from and where they are discharged to. Additionally, whether patients are discharged on hospice or not, as this likely had a large affect on readmission rates.

Fourth, future studies should examine those patient costs not associated with the hospital to better understand insurers' concerns. Although subjects were less likely to be readmitted to the hospital, they may have been receiving less intense but longer-lasting home- or facility-based care that could have cost as much, if not more, than the additional hospital admissions over a 1-year period. Thus, teaming with Medicare and other insurers to examine their financial commitments would add value to the financial incentives for increasing inpatient PCTs. A previous study used insurance information to examine the effect of a home-based palliative care service and its effects on utilization, mortality, and costs over a 6-month period, finding that there was no change in mortality but fewer hospital admissions, emergency department visits, and costs to the insurer (Brumley et al., 2007). However, the study was based on an outpatient model and did not consider any inpatient PCT interventions.

Finally, a study that examines what patients experience during the initial PCT intervention and that monitors the quality of their care through the remainder of their lives might further elucidate the value of the PCT and why increased initial mortality, decreased utilization, and decreased costs occurred in this study. Such a study could answer some of the process questions that were not answered in this study. And, it could shed light on why the patient and family make certain decisions and what additional support PCTs provide to allow the patient to die as they wish.

Significance of Study

This study's several findings are significant. First, although subjects who receive inpatient PC were associated with a decreased mortality, much of it is attributable to the subjects' older age and highly intensive interventions that extend life only slightly, which prior studies surmise possibly worsens the quality of life (Earle et al., 2005; Teno, Gruneir, Schwartz, Nanda, & Wetle, 2007). Second, this study found no significant difference in the number of deaths occurring in the inpatient setting. Thus, the concerns of hospital administrators that PCTs increase mortality rates is unfounded, particularly when coupled with other studies showing similar outcomes (Elsayem et al., 2006; Lilly, Sonna, Haley, & Massaro, 2003). Third, this study found an association between PCT utilization and receipt of fewer inpatient hospital admissions and fewer days spent in the hospital, showing its success in reducing utilization.

Finally, when examining this study from a cost-benefit point of view, it adds to the growing body of literature that PCTs save money for an institution, in this case over $4,500/patient over the 1-year follow-up period. Thus, when administrators deliberate the fiscal consequences of implementing a PC program, they will find prior studies have shown that PCTs improve the quality of care and that this study has shown that they can save hospitals money over time. In financially lean times, hospitals administrators can refer to this work and justify the continuance of an inpatient PC program because of the cost savings it provides.

REFERENCES

Afifi, A. A., Morisky, D. E., Kominski, G. F., & Kotlerman, J. B. (2007). Impact of disease management on health care utilization: evidence from the "Florida: A Healthy State (FAHS)" Medicaid Program. *Preventive Medicine, 44*, 547-553.

Ahlner-Elmqvist, M., Jordhoy, M. S., Jannert, M., Fayers, P., & Kaasa, S. (2004). Place of death: hospital-based advanced home care versus conventional care. A prospective study in palliative cancer care. *Palliative Medicine, 18*, 585-593.

Anderson, W. L., Wiener, J. M., & Khatutsky, G. (2006). Workforce issues and consumer satisfaction in Medicaid personal assistance services. *Health Care Financing Review 28*, 87-101.

Ash, A. S., Posner, M. A., Speckman, J., Franco, S., Yacht, A. C., & Bramwell, L. (2003). Using claims data to examine mortality trends following hospitalization for heart attack in Medicare. *Health Services Research, 38*, 1253-1262.

Axelsson, B., & Christensen, S. B. (1998). Evaluation of a hospital-based palliative support service with particular regard to financial outcome measures. *Palliative Medicine, 12*, 41-49.

Back, A. L., Li, Y. F., & Sales, A. E. (2005). Impact of palliative care case management on resource use by patients dying of cancer at a Veterans Affairs medical center. *Journal of Palliative Medicine, 8*, 26-35.

Barbera, L., Paszat, L., & Chartier, C. (2006). Indicators of poor quality end-of-life cancer care in Ontario. *Journal of Palliative Care, 22*, 12-17.

Beland, F., Bergman, H., Lebel, P., Clarfield, A. M., Tousignant, P., Contandriopoulos, A. P., et al. (2006). A system of integrated care for older persons with disabilities in Canada: results from a randomized controlled trial. *Journals of Gerontology A Biological Sciences and Medical Sciences, 61*, 367-373.

Boni-Saenz, A. A., Dranove, D., Emanuel, L. L., & Lo Sasso, A. T. (2005). The price of palliative care: toward a complete accounting of costs and benefits. *Clinics in Geriatric Medicine, 21*, 147-163.

Breslin, S., Greskovich, W., & Turisco, F. (2004). Wireless technology improves nursing workflow and communications. *Computers, Informatics, Nursing, 22*, 275-281.

Brock, D. B., & Foley, D. J. (1998). Demography and epidemiology of dying in the U.S. with emphasis on deaths of older persons. *Hospice Journal, 13*, 49-60.

Bruera, E., Neumann, C. M., Gagnon, B., Brenneis, C., Quan, H., & Hanson, J. (2000). The impact of a regional palliative care program on the cost of palliative care delivery. *Journal of Palliative Medicine, 3*, 181-186.

Brumley, R., Enguidanos, S., Jamison, P., Seitz, R., Morgenstern, N., Saito, S., et al. (2007). Increased satisfaction with care and lower costs: results of a randomized trial of in-home palliative care. *Journal of the American Geriatrics Society, 55*, 993-1000.

Bynum, J. P., Rabins, P. V., Weller, W., Niefeld, M., Anderson, G. F., & Wu, A. W. (2004). The relationship between a dementia diagnosis, chronic illness, medicare expenditures, and hospital use. *Journal of the American Geriatrics Society, 52*, 187-194.

Campbell, D. E., Lynn, J., Louis, T. A., & Shugarman, L. R. (2004). Improving patient care. Medicare program expenditures associated with hospice use. *Annals of Internal Medicine., 140,* 269-277.

Campbell, M. L., & Guzman, J. A. (2003). Impact of a proactive approach to improve end-of-life care in a medical ICU. *Chest, 123,* 266-271.

Casarett, D., Pickard, A., Bailey, F. A., Ritchie, C., Furman, C., Rosenfeld, K., et al. (2008). Do palliative consultations improve patient outcomes? *Journal of the American Geriatrics Society, 56*, 593-599.

Chang, H. M., Gallagher, R., Vaillancourt, P. D., Balter, K., Cohen, M., Garvin, B., et al. (2000). Undergraduate medical education in pain medicine, end-of-life care, and palliative care. *Pain Medicine, 1*, 224.

Chen, Y. Y., Connors, A. F., Jr., & Garland, A. (2008). Effect of decisions to withhold life support on prolonged survival. *Chest*, *133*, 1312-1318.

Chmura, K., & Thiemann, S. (1987). *How many subjects? Statistical power analysis in research*. Newbury Park, CA: Sage.

Ciemins, E. L., Blum, L., Nunley, M., Lasher, A., & Newman, J. M. (2007). The economic and clinical impact of an inpatient palliative care consultation service: a multifaceted approach. *Journal of Palliative Medicine, 10,* 1347-1355.

Ciemins, E. L., Stuart, B., Gerber, R., Newman, J., & Bauman, M. (2006). An Evaluation of the Advanced Illness Management (AIM) Program: Increasing hospice utilization in the San Francisco Bay area. *Journal of Palliative Medicine, 9,* 1401-1411.

Cline, C. M., Broms, K., Willenheimer, R. B., Israelsson, B. A., & Erhardt, L. R. (1996). Hospitalization and Health Care Costs Due to Congestive Heart Failure in the Elderly. *American Journal of Geriatric Cardiology, 5,* 10-14.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Cowan, J. D. (2004). Hospital charges for a community inpatient palliative care program. *American Journal of Hospice and Palliative Care, 21*, 177-190.

Davis, M. P., Walsh, D., LeGrand, S. B., Lagman, R. L., Harrison, B., & Rybicki, L. (2005). The financial benefits of acute inpatient palliative medicine: an inter-institutional comparative analysis by all patient refined-diagnosis related group and case mix index. *Journal of Supportive Oncology, 3*, 313-316.

Davis, M. P., Walsh, D., Nelson, K. A., Konrad, D., LeGrand, S. B., & Rybicki, L. (2002). The business of palliative medicine--Part 2: The economics of acute inpatient palliative medicine. *American Journal of Hospice and Palliative Care, 19*, 89-95.

Dhillon, N., Kopetz, S., Pei, B. L., Fabbro, E. D., Zhang, T., & Bruera, E. (2008). Clinical findings of a palliative care consultation team at a comprehensive cancer center. *Journal of Palliative Medicine, 11*, 191-197.

Donabedian, A. (1966). Evaluating the quality of medical care. *Milbank Memorial Fund Quarterly, 44*(3), Suppl:166-206.

Dubberke, E. R., Reske, K. A., Olsen, M. A., McDonald, L. C., & Fraser, V. J. (2008). Short- and long-term attributable costs of Clostridium difficile-associated disease in nonsurgical inpatients. *Clinical Infectious Diseases, 46*, 497-504.

Earle, C. C., Neville, B. A., Landrum, M. B., Souza, J. M., Weeks, J. C., Block, S. D., et al. (2005). Evaluating claims-based indicators of the intensity of end-of-life cancer care. *International Journal of Quality in Health Care, 17*, 505-509.

Ellis, R. P., Pope, G. C., Iezzoni, L., Ayanian, J. Z., Bates, D. W., Burstin, H., et al. (1996). Diagnosis-based risk adjustment for Medicare capitation payments. *Health Care Financing Review, 17*, 101-128.

Elsayem, A., Smith, M. L., Parmley, L., Palmer, J. L., Jenkins, R., Reddy, S., et al. (2006). Impact of a palliative care service on in-hospital mortality in a comprehensive cancer center. *Journal of Palliative Medicine, 9*, 894-902.

Elsayem, A., Swint, K., Fisch, M. J., Palmer, J. L., Reddy, S., Walker, P., et al. (2004). Palliative care inpatient service in a comprehensive cancer center: clinical and financial outcomes. *Journal of Clinical Oncology, 22*, 2008-2014.

Evers, M. M., Meier, D. E., & Morrison, R. S. (2002). Assessing differences in care needs and service utilization in geriatric palliative care patients. *Journal of Pain and Symptom Management, 23*, 424-432.

Fassbender, K., Fainsinger, R., Brenneis, C., Brown, P., Braun, T., & Jacobs, P. (2005). Utilization and costs of the introduction of system-wide palliative care in Alberta, 1993-2000. *Palliative Medicine, 19*, 513-520.

Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). G*Power (Version 3.0.6). Dusseldorf, Germany: Heinrich Heine University.

Fleishman, J. A., Moore, R. D., Conviser, R., Lawrence, P. B., Korthuis, P. T., & Gebo, K. A. (2008). Associations between outpatient and inpatient service use among persons with HIV infection: a positive or negative relationship? *Health Services Research, 43*, 76-95.

Folland, S., Goodman, A., & Stano, M. (2004). *The Economics of Health and Health Care* (4 ed.). Upper Saddle Rive, NJ: Prentice Hall.

Frank, E. (2001). Aging and the market in the United States. *International Journal of Health Services, 31*, 133-146.

Gelfman, L. P., Meier, D. E., & Morrison, R. S. (2008). Does Palliative Care Improve Quality? A Survey of Bereaved Family Members. *Journal of Pain Symptom Management 36*, 22-28.

Glantz, S. A., & Slinker, B. K. (2001). *Primer of Applied Regression and Analysis of Variance* (2nd ed.). New York: McGraw-Hill.

Gomez-Batiste, X., Tuca, A., Corrales, E., Porta-Sales, J., Amor, M., Espinosa, J., et al. (2006). Resource consumption and costs of palliative care services in Spain: a multicenter prospective study. *Journal of Pain and Symptom Management, 31*, 522-532.

Hanks, G. W., Robbins, M., Sharp, D., Forbes, K., Done, K., Peters, T. J., et al. (2002). The imPaCT study: a randomised controlled trial to evaluate a hospital palliative care team. *British Journal of Cancer, 87*, 733-739.

Hansen, S. M., Tolle, S. W., & Martin, D. P. (2002). Factors associated with lower rates of in-hospital death. *Journal of Palliative Medicine, 5*, 677-685.

Hogan, C., Lunney, J., Gabel, J., & Lynn, J. (2001). Medicare beneficiaries' costs of care in the last year of life. *Health Aff (Millwood), 20*, 188-195.

Holloway, R. G., & Quill, T. E. (2007). Mortality as a measure of quality: implications for palliative and end-of-life care. *Journal of the American Medical Association, 298*, 802-804.

Hwang, J. I. (2007). Characteristics of patient and healthcare service utilization associated with inappropriate hospitalization days. *Journal of Advanced Nursing, 60*, 654-662.

Jordhoy, M. S., Fayers, P., Saltnes, T., Ahlner-Elmqvist, M., Jannert, M., & Kaasa, S. (2000). A palliative-care intervention and death at home: a cluster randomised trial. *Lancet, 356*, 888-893.

Kaufman, S. R. (2005). ...*And a time to die: How American hospital shape the end of life.* New York, NY: Scribner.

Kunkel, S., Rosenqvist, U., & Westerling, R. (2007). The structure of quality systems is important to the process and outcome, an empirical study of 386 hospital departments in Sweden. *BMC Health Services Research, 7*, 104.

Lagman, R. L., Walsh, D., Davis, M. P., & Young, B. (2007). All patient refined-diagnostic related group and case mix index in acute care palliative medicine. *Journal of Supportive Oncology, 5*, 145-149.

Lamers, L. M., & van Vliet, R. C. (1996). Multiyear diagnostic information from prior hospitalization as a risk-adjuster for capitation payments. *Medical Care, 34*, 549-561.

Leong, I. Y., Chong, M. S., & Gibson, S. J. (2006). The use of a self-reported pain measure, a nurse-reported pain measure and the PAINAD in nursing home residents with moderate and severe dementia: a validation study. *Age and Ageing, 35*, 252-256.

Light, D. W. (2000). The Sociological Character of Health-Care Markets. In G. L. Albrecht, R. Fitzpatrick & S. C. Scrimshaw (Eds.), *Handbook of Social Studies in Health & Medicine* (pp. 394-408). Thousand Oaks, CA: Sage.

Light, D. W. (2001). Cost containment and the backdraft of competition policies. *International Journal of Health Services, 31*, 681-708.

Lilly, C. M., Sonna, L. A., Haley, K. J., & Massaro, A. F. (2003). Intensive communication: four-year follow-up from a clinical practice study. *Critical Care Medicine, 31*(5 Suppl), S394-399.

London, M. R., McSkimming, S., Drew, N., Quinn, C., & Carney, B. (2005). Evaluation of a Comprehensive, Adaptable, Life- Affirming, Longitudinal (CALL) palliative care project. *Journal of Palliative Medicine, 8*, 1214-1225.

Lunney, J., Lynn, J., & Hogan, C. (2002). Profiles of Elderly Medicare Decedents. *Journal of the American Geriatrics Society, 50*, 1108-1112.

McConnell, C. R., & Brue, S. L. (2005). *Macroeconomics: Principles, Problems, and Policies*. Boston: McGraw-Hill.

Mezey, M. D., Dubler, N. N., Mitty, E., & Brody, A. A. (2002). What impact do setting and transitions have on the quality of life at the end of life and the quality of the dying process? *Gerontologist, 42*(Spec No 3), 54-67.

Mitchell, P. H., Ferketich, S., & Jennings, B. M. (1998). Quality health outcomes model. American Academy of Nursing Expert Panel on Quality Health Care. *Image Journal of Nursing Scholarship, 30*, 43-46.

Morita, T., Hirai, K., Sakaguchi, Y., Maeyama, E., Tsuneto, S., & Shima, Y. (2004). Measuring the quality of structure and process in end-of-life care from the bereaved family perspective. *Journal of Pain and Symptom Manage, 27*, 492-501.

Naik, G. (2004). Unlikely Way to Cut Hospital Costs: Comfort the Dying. *Wall Street Journal - Eastern Edition*, pp. A1-A12.

Nelson, J. E., Mulkerin, C. M., Adams, L. L., & Pronovost, P. J. (2006). Improving comfort and communication in the ICU: a practical new tool for palliative care performance measurement and feedback. *Quality and Safety in Health Care, 15*, 264-271.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed.). New York, NY: McGraw-Hill.

O'Mahony, S., Blank, A. E., Zallman, L., & Selwyn, P. A. (2005). The benefits of a hospital-based inpatient palliative care consultation service: preliminary outcome data. *Journal of Palliative Medicine, 8*, 1033-1039.

Oulton, J. A. (2006). The global nursing shortage: an overview of issues and actions. *Policy Politics and Nursing Practice, 7*(3 Suppl), 34S-39S.

Penrod, J. D., Deb, P., Luhrs, C., Dellenbaugh, C., Zhu, C. W., Hochman, T., et al. (2006). Cost and utilization outcomes of patients receiving hospital-based palliative care consultation. *Journal of Palliative Medicine, 9*(4), 855-860.

Porell, F. W., & Carter, M. (2005). Discretionary hospitalization of nursing home residents with and without Alzheimer's disease: a multilevel analysis. *Journal of Aging and Health, 17*, 207-238.

Pritchard, R. S., Fisher, E. S., Teno, J. M., Sharp, S. M., Reding, D. J., Knaus, W. A., et al. (1998). Influence of patient preferences and local health system characteristics on the place of death. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Risks and Outcomes of Treatment. *Journal of the American Geriatrics Society, 46*, 1242-1250.

Proudlove, N. C., & Boaden, R. (2005). Using operational information and information systems to improve in-patient flow in hospitals. *Journal of Health and Organizational Management, 19*, 466-477.

Purdy, W. (2002). Nursing home to emergency room? The troubling last transfer. *Hastings Center Report, 32*, 46-48.

Rabow, M. W., Dibble, S. L., Pantilat, S. Z., & McPhee, S. J. (2004). The comprehensive care team: a controlled trial of outpatient palliative medicine consultation. *Archives of Internal Medicine, 164*, 83-91.

Rady, M. Y., & Johnson, D. J. (2004). Admission to intensive care unit at the end-of-life: is it an informed decision? *Palliative Medicine, 18*(8), 705-711.

Reuben, D. B., Keeler, E., Seeman, T. E., Sewall, A., Hirsch, S. H., & Guralnik, J. M. (2002). Development of a method to identify seniors at high risk for high hospital utilization. *Medical Care, 40,* 782-793.

Rodriguez, K. L., Barnato, A. E., & Arnold, R. M. (2007). Perceptions and utilization of palliative care services in acute care hospitals. *Journal of Palliative Medicine, 10*, 99-110.

SAS Institute Inc. (2007). SAS/STATA Statistical Analysis Software (Version 9.1.3). Cary, NC: SAS Institute, Inc.,.

Serra-Prat, M., Gallo, P., & Picaza, J. M. (2001). Home palliative care as a cost-saving alternative: evidence from Catalonia. *Palliative Medicine, 15*, 271-278.

Shen, Y. C. (2002). The effect of hospital ownership choice on patient outcomes after treatment for acute myocardial infarction. *Journal of Health Economics, 21*, 901-922.

Singer, J. D., & Willett, J. B. (2003). *Applied Longitudinal Data Analysis. Modeling Change and Event occurrence.* New York: Oxford University Press.

Smith, A. G., Soutar, R. L., Schey, S., Andrews, C. D., Baister, E. R., Bilbrough, C., et al. (2004). Home care versus hospital care in patients with multiple myeloma treated with pamidronate. *International Journal Palliative Nursing, 10*, 144-149.

Smith, T. J., Coyne, P., Cassel, B., Penberthy, L., Hopson, A., & Hager, M. A. (2003). A high-volume specialist palliative care unit and team may reduce in-hospital end-of-life care costs. *Journal of Palliative Medicine, 6*, 699-705.

Stewart, A. L., Teno, J., Patrick, D. L., & Lynn, J. (1999). The concept of quality of life of dying persons in the context of health care. *Journal of Pain and Symptom Management, 17*, 93-108.

Studnicki, J., Schapira, D. V., Straumfjord, J. V., Clark, R. A., Marshburn, J., & Werner, D. C. (1994). A national profile of the use of intensive care by Medicare patients with cancer. *Cancer, 74*, 2366-2373.

Supportive Care Coalition. (2007). Hospital Palliative Care Programs Continue Rapid Growth. Retrieved August 6, 2007, from http://www.supportivecarecoalition.org/news/2006/Hospital+Palliative+Care+Programs+Continue+Rapid+Growth.htm

Taheri, P. A., Butz, D. A., & Greenfield, L. J. (1999). Paying a premium: how patient complexity affects costs and profit margins. *Annals of Surgery, 229*, 807-811; discussion 811-804.

Teno, J. M., Gruneir, A., Schwartz, Z., Nanda, A., & Wetle, T. (2007). Association between advance directives and quality of end-of-life care: a national study. *Journal of the American Geriatrics Society, 55*, 189-194.

Tutor2u. (2007). *Economic Quizes* (Vol. 2007).

Unruh, L., & Wan, T. T. (2004). A systems framework for evaluating nursing care quality in nursing homes. *J Med Syst, 28*(2), 197-214.

Upenieks, V. V., & Abelew, S. (2006). The magnet designation process: a qualitative approach using Donabedian's conceptual framework. *Health Care Management (Frederick), 25*, 243-253.

White, K. R., Stover, K. G., Cassel, J. B., & Smith, T. J. (2006). Nonclinical outcomes of hospital-based palliative care. *Journal of Healthcare Management, 51*, 260-273.

Wilkinson, E. K., Salisbury, C., Bosanquet, N., Franks, P. J., Kite, S., Lorentzon, M., et al. (1999). Patient and carer preference for, and satisfaction with, specialist models of palliative care: a systematic literature review. *Palliative Medicine, 13*, 197-216.

World Health Organization. (2007). WHO Definition of Paliative Care. Retrieved October 11, 2007, from http://www.who.int/cancer/palliative/definition/en/

Yu, W., Ravelo, A., Wagner, T. H., & Barnett, P. G. (2004). The relationships among age, chronic conditions, and healthcare costs. *American Journal of Managed*

Care, 10, 909-916.

Zimmerman, S. I., Sloane, P. D., Hanson, L., Churchill, L., Eckert, J. K., Magaziner, J., et al. (2001). *End-of-Life Care in Residential Care and Nursing Homes; Grant Application*.Unpublished manuscript.

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