

2015

Proactive palliative care in the intensive care units of an academic hospital

<https://hdl.handle.net/2144/16070>

"Downloaded from OpenBU. Boston University's institutional repository."

BOSTON UNIVERSITY
SCHOOL OF MEDICINE

Thesis

**PROACTIVE PALLIATIVE CARE IN THE INTENSIVE CARE UNITS OF AN
ACADEMIC HOSPITAL**

by

JONATHAN WU

B.S., University of California, Irvine, 2012

Submitted in partial fulfillment of the
requirements for the degree of
Master of Science

2015

© 2015 by
JONATHAN WU
All rights reserved

Approved by

First Reader

Theresa A. Davies, Ph.D.
Assistant Professor of Medical Sciences & Education
Director, M.S. Oral Health Sciences Program

Second Reader

Solomon Liao, M.D.
Clinical Professor of Medicine
Director of Palliative Care Service
University of California Irvine Medical Center

ACKNOWLEDGMENTS

First and foremost, I would like to thank the program director, Dr. Gwynneth Offner, for all her hard work and dedication in making this Master's program in Medical Sciences such a prestigious and well-respected one.

Secondly, I would like to thank my advisor, Dr. Theresa Davies, for all her help and support throughout the program. Her advice on both school and my career have been priceless and extremely helpful. More importantly, I am a better student and individual because of her mentorship and guidance.

I would also like to express my appreciation to my supervisor, Dr. Solomon Liao, the Director of Palliative Care Service at the University of California Irvine Medical Center, as he has been a tremendous mentor for me. Without his help, I would not have this opportunity to work on this research project for my thesis. Additionally, I would also like to thank other palliative care physicians in the same department: Dr. Capasso, Dr. Dabral, and Dr. Skavinski, for making this study possible.

Last but not least, I want to express my most sincere and heartfelt appreciation and thanks to my family. I cannot express how grateful I am to have such a strong support system. With their continuous encouragement and inspiration, I was able to complete the program and learn so much more about what I'm passionate about. More importantly, I have become a more mature individual because of them.

**PROACTIVE PALLIATIVE CARE IN THE INTENSIVE CARE UNITS OF AN
ACADEMIC HOSPITAL**

JONATHAN WU

ABSTRACT

Palliative care (PC) is a specialty that improves the quality of care often for terminally ill patients and their family members by providing physical, psychosocial, and spiritual pain and symptom management. PC assists patients in decision making about their goals of care. These goals of care discussions help the treating physicians to better plan more appropriate treatment options specifically tailored for each patient based on their preferences. Due to the illness severity of the patients, approximately 20% of all hospital deaths occur in the intensive care unit (ICU). Recognition of and advocacy for integrating PC in the ICU have increased in the last decade following many studies which have shown the positive effects of PC for critically ill patients and their family members.

This was a single-center retrospective study conducted at an academic hospital that examined the effects of a proactive PC intervention and the clinical outcomes on patients who died in the medical and neurological ICUs (MICU and NICU), since the majority of ICU deaths occurred in these two units. This study was a quality improvement project that examined only patients who died, in order to make a similar comparison between patients who ultimately had the same clinical outcome. This pre-intervention (phase 1) and post-intervention three phase analysis measured the effectiveness of a screening tool (phase 2), and a daily ICU huddle (phase 3) compared to the pre-intervention phase. The study analyzed the impact the interventions had on

clinical measurable outcomes such as 1) day of PC consultation after ICU admission and after meeting criteria, 2) day of meeting criteria for PC based on a screening tool, 3) hospital and ICU lengths of stay, 4) direct cost per discharge, and 5) the average number of PC consultations per month. Electronic database review of all MICU and NICU patients who died from July 2010 to December 2011 and April 2013 to October 2014 were performed. Comparisons were made between patients who received a PC consultation and those who received usual care, from both pre-intervention and post-intervention phases.

A total of 888 patients were included and analyzed in this study. The intervention reduced the average day of PC consultation after ICU admission from 9.55 in phase 1 to 4.95 in phase 2 and to 4.75 in phase 3 after the addition of the daily huddle. The average day of PC consultation after meeting criteria in the ICU was also reduced from 8.0 to 3.08 then to 2.18, respectively. The average number of PC consultations per month increased from 10.6 to 12.8 to 17.7 in the three respective phases. The cost per discharge was not significantly different from patients who received a PC consultation and for patients who received usual care. PC service did not reduce the length of stay for patients when compared to patients who received usual care. The sensitivity and specificity of the screening tool in phase 2 were 66.2% and 70.8%, respectively. The sensitivity and specificity of the screening tool with daily huddle in phase 3 were 65.7% and 62.5%, respectively.

Proactive screening for PC eligibility and discussion of that eligibility with the critical care team improves access to PC in the ICU. The screening tool and daily ICU

huddle helped critical care physicians identify the group of patients most appropriate for PC consultation. The analysis suggests that the critical care physicians were able to accurately discriminate which end-of-life patients they could manage on their own. However, the low sensitivity and specificity of the screening tool suggests that there is still significant room for refinement in order for the screening tool to be more discriminatory and effective. Further research is needed to confirm these findings.

TABLE OF CONTENTS

| | |
|--|------|
| TITLE..... | i |
| COPYRIGHT PAGE..... | ii |
| READER APPROVAL PAGE..... | iii |
| ACKNOWLEDGMENTS | iv |
| ABSTRACT..... | v |
| TABLE OF CONTENTS..... | viii |
| LIST OF TABLES | x |
| LIST OF FIGURES | xi |
| LIST OF ABBREVIATIONS..... | xii |
| INTRODUCTION | 1 |
| METHODS | 12 |
| Pre-Intervention Phase | 12 |
| Pre-Intervention Screening Criteria | 13 |
| Post-Intervention Phase | 13 |
| Post-Intervention Trigger Screening Tool | 15 |
| Stand-Alone Criteria – Patient meets one of the following:..... | 15 |
| Collateral Criteria – Patient meets 2 or more of the following:..... | 16 |
| Data Collection | 18 |

| | |
|---------------------------|----|
| Analytical Sample..... | 18 |
| Statistical Analysis..... | 19 |
| RESULTS | 20 |
| DISCUSSION..... | 34 |
| REFERENCES | 41 |
| CURRICULUM VITAE..... | 47 |

LIST OF TABLES

| Table | Title | Page |
|-------|--|------|
| 1 | Pre-Intervention Screening Criteria | 13 |
| 2 | Post-Intervention Screening Tool Using Stand-Alone Criteria | 15 |
| 3 | Post-Intervention Screening Tool Using Collateral Criteria | 16 |
| 4 | Demographics Data for Patients from All Three Cohorts | 22 |
| 5 | Patients Who Met Criteria and Received a PC Consultation in Phase 2 | 23 |
| 6 | Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for the Screening Tool in Phase 2 | 23 |
| 7 | Patients Who Met Criteria and Received a PC Consultation in Phase 3 | 24 |
| 8 | Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for the Screening Tool and Daily Huddle in Phase 3 | 24 |
| 9 | Patients Who Met Criteria and Received a PC Consultation in the Post-intervention Phases Combined (Phase 2 and Phase 3) | 25 |
| 10 | Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for Both Post-intervention Phases | 25 |
| 11 | Comparisons of Day of PC Consultation After Meeting Criteria in the ICU and Following ICU Admission Between All Three Phases | 27 |
| 12 | Comparisons of Hospital and ICU Lengths of Stay and Day of Meeting Criteria After Hospital Admission for Patients Who Died from the Three Phases | 30 |

LIST OF FIGURES

| Figure | Title | Page |
|--------|---|------|
| 1 | Distribution of Deaths Amongst the ICUs at the University of California Irvine Medical Center in 2013 | 14 |
| 2 | Flowchart of the Pre-intervention and Post-intervention Phases | 17 |
| 3 | Flowchart of Patients Analyzed | 21 |
| 4 | Average Number of PC Consultations and Total Deaths Per Month Among 3 Phases | 32 |
| 5 | Direct Cost Comparison Between Patients With and Without PC Consultation | 33 |

LIST OF ABBREVIATIONS

| | |
|--------------|---|
| CAPC | Center to Advance Palliative Care |
| CMS | Center for Medicare and Medicaid Services |
| ICU..... | Intensive Care Unit |
| MICU | Medical Intensive Care Unit |
| NHPCO..... | National Hospice and Palliative Care Organization |
| NICU..... | Neurological Intensive Care Unit |
| PC..... | Palliative Care |
| POLST | Physician Orders for Life-Sustaining Treatment |
| SAH..... | Subarachnoid Hemorrhage |
| SUPPORT..... | Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments |
| UC..... | University of California |
| WHO..... | World Health Organization |

INTRODUCTION

The development of modern palliative care (PC) initially began with Dame Cecily Saunders, a British nurse and social worker from the 20th century who volunteered in St. Luke's Home for the Dying Poor in England. It was through the clinical experiences she gained from working there that led to her decision to pursue a medical degree and become a physician in 1957 in hopes of achieving more of her PC goals and dedicating her professional life to care for the chronically and terminally ill (Lutz *et al.*, 2011). In 1963, Dr. Saunders gave a lecture at Yale University where she thoroughly presented the details of the evolvement of terminal care to PC, which applied holistic principles that helped with controlling the symptoms of critically ill patients during the terminal stages of their lives (Lutz *et al.*, 2011; Clark and Graham, 2011). Her lecture, which was presented to medical students, nurses, social workers, and chaplains, consisted of photos of terminally ill patients and their family members that showed the dramatic differences before and after the pain and symptom management care was implemented (National Hospice and Palliative Care Organization, n.d.). During this lecture, she introduced the major tenets used for the specialized care of terminally ill patients now used worldwide, including:

- 1) the concept of "total pain" including physical, psychological, and spiritual discomfort
- 2) appropriate use of opioids for patients with physical pain

- 3) attention to the needs of family members and loved ones who provide care for the dying patients

This lecture marked the beginning of the development and foundation of hospice and PC in the United States. She is widely recognized both for playing a predominant role in developing the tenets and for developing the first modern hospice in London, known as St. Christopher's Hospice, in 1967 (Richmond, 2005).

PC is a dedicated specialty intended to alleviate suffering and pain in addition to improving the quality of life of patients with life-threatening and often terminal diseases (Sepulveda *et al.*, 2002). It helps patients and their family members in addressing questions regarding the full spectrum of the physical, psychological, and spiritual health of patients. In addition, it also helps with understanding and clarifying the goals of care in order for physicians to better assist in appropriate planning of various treatment options best tailored for the patients as their disease progresses (Wilkinson *et al.*, 1999).

According to the World Health Organization (WHO), PC 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.”

Initially, PC was most commonly associated with end-of-life care and is frequently the preference after all life-prolonging interventions or treatments have been tried. However, there is a national movement to encourage PC sooner after hospital admission so the patients can receive the appropriate care at an earlier time (Norton *et al.*,

2007). Discussing goals of care as well as advance directives beforehand with a physician is essential in order to document the patients' wishes regarding the medical treatments towards the end of life. Otherwise, management frequently defaults to the most aggressive option, which can cause harm from inappropriate or unwanted interventions and treatments (Walling *et al.*, 2010). Some of the difficulties with communication regarding end-of-life decision making includes the lack of information, lack of access to providers, and lack of family inclusion in the decision making process (Kayser-Jones, 1995).

The term PC was first used by Canadian surgeon Balfour Mount in 1975 after visiting Dr. Saunders at St. Christopher's Hospice in London. Following the visit, Dr. Mount decided to create a hospice-like ward within the Royal Victoria Hospital in Montreal, one of the leading teaching hospitals in Canada. The hospital ward he created featured a ward for the dying, a consultation team that works with other hospital wards, a home-care outreach service, and bereavement emotional support service with teaching and research. Because the term "hospice" was not allowed in French speaking Quebec due to the poor reputation, Dr. Mount became the first to use the term "palliative care" (Brooksbank, 2009).

As physicians, it is important to provide patients with the best treatment plan by maximizing benefits while minimizing potential risks (Brimblecombe *et al.*, 2014). However, PC physicians have tended to see patients very late in their illness trajectories. In fact, the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT) reported that 50% of all hospitalized conscious patients died

with unrelieved pain (SUPPORT Principal Investigators, 1995). In addition, it has been shown that critically ill patients have many untreated symptoms, higher caregiver burden, and poorer quality of life along with lower family satisfaction regarding the patient's medical care (Teno *et al.*, 2004). This is especially compelling in ICUs, where the need for pain and symptom management is frequent and deaths are commonly seen, due to the severe life-threatening conditions many patients are admitted for. In fact, most of the ICU deaths occur after an alteration in the patients' goals of care or after the patients or their families decide to withdraw treatment (Curtis and Rubenfeld, 2005). In order to respond to the needs of severely ill patients, it is crucial to expand PC services in hospitals so the quality of end-of-life care may potentially be improved while reducing hospital costs, especially in the ICU where approximately 20% of all hospital deaths in the United States occur. This percentage translates to about half a million Americans annually (Angus *et al.*, 2004). The first ICU was developed in the U.S. approximately 50 years ago. The first ICUs were equipped with mechanical ventilators in the 1950s in response to poliomyelitis victims and other patients with neuromuscular diseases (Ikaria, 2014; Luce and White, 2009). In 1958, Johns Hopkins Bayview Medical Center in Baltimore became the first hospital to establish a multidisciplinary ICU (Ikaria, 2014). A year later, UCLA and University of Pittsburgh created the first modern critical care units that are marked by advanced monitoring systems which facilitated intervention for septic shock and multi-organ failure. By 1969, most hospitals in the U.S. have at least one ICU. The U.S. now has approximately 6,000 critical care facilities that are divided based on different specialties. In the intervening decades, as medical technology improved and the use of

ventilators increased, the medical care for critically ill patients gradually shifted to sustaining and prolonging life through artificial life support. Because patients in the ICU have more complex and life-threatening diseases, many ethical issues arise. Although artificial life support may prolong the patients' life expectancy, it may not always be the best treatment option. For many patients, the use of mechanical ventilation only prolonged the dying process, which bears a significant burden on both the patients and the family members as well as a substantial increase in hospital resources. The decision of whether or not the mechanical ventilation should be used ultimately led to the same clinical outcome: death. This suggests that it may not be the most effective or efficient treatment option. In many cases, it may even be more burdensome to the patient and their family members due to an extended period of pain and suffering. A previous case report suggested that continuing artificial life support in many ways may actually harm both the patients and their family members because of the physically and emotionally draining process. Moreover, artificial life support often diminishes the death acceptance by the patients' families and loved ones (Liao and Ito, 2010). The case report also stated the importance of keeping risk management involved early in the decision process. This prolonged process of medical care in the ICU led to 34% of the total hospital budget coming from ICU expenditures and \$62 billion in health care costs in 1998 (Multz *et al.*, 1998). In response to the emotional, physical, and financial burden, advance directives were created to avoid unwanted medical interventions, which allowed patient autonomy in order for them to make their own end-of-life decisions based on their own preferences (Wilkinson *et al.*, 2007). Advance directives, which is a part of the PC service, refers to

medical treatment preferences and who the surrogate decision maker would be in the event that the patient becomes unable to make their own medical decisions as their illness progresses towards the end-of-life. It was first developed in the U.S. in the late 1960s.

Advance directives generally fall within three categories:

- 1) living will
- 2) power of attorney
- 3) health care proxy

These are all legal documents that either specify what type of medical treatments are preferred should the patient become unable to make their own decision or designate another person to make health care decisions on the patient's behalf (Harvard Medical School Special Report, n.d.). As of today, all fifty states in the U.S. have passed laws to legalize the three categories of advance directives through the 1991 Patient Self-Determination Act (Hecht, 2015). Although advance directives have been used as the primary tool to communicate patients' end-of-life care wishes with healthcare professionals since the mid-1970s (Sabatino, 2007), it was reported that many physicians were reluctant to initiate discussion about them (Bedell and Delbanco, 1984). Despite the increasing advocacy and recognition of PC services in the nation's hospitals and the growing body of literature showing the physical and emotional burdens critically ill patients have on family members (Desbiens *et al.*, 1999; Covinsky *et al.*, 1994), use of PC service by physicians remain low (Kelley and Meier, 2010). In fact, a previous study in 1987 reported that only 9% of the patients in the United States had completed advance

directives (Steiber, 1987). Additionally, a previous survey found that less than 10% of surgery residents reported receiving adequate training in PC (Klaristenfeld *et al.*, 2007). Moreover, there have been other studies which reported that residents were not prepared to confidently and effectively deliver PC to patients and their family members, even though the majority of the residents strongly agreed through a survey that formal training in PC is crucial in the care of critically ill patients (Kamel *et al.*, 2014; Meo *et al.*, 2011). As a result, the reluctance to use PC service is partly due to inadequate training. Therefore, it is important for the vast majority of Americans to discuss their goals of care when they arrive in the ICU in order for patients to receive the most appropriate care and treatments.

Because questions regarding whether a more flexible and proactive approach for physicians to initiate discussion with the patients regarding their end-of-life goals and various treatment options remain, an additional step was introduced for advanced care planning in order to bridge the gap between patients' wishes and the actual plan of care embodied in physician's orders (Sabatino, 2007). Physician Orders for Life-Sustaining Treatment (POLST), which originated in the early 1990s in Oregon, is a form that chronically and terminally ill patients complete and have signed by the physicians in order to honor the patients' wishes for their end-of-life treatment (Tolle *et al.*, 1998). This subsequently spread to other states, with New York, Pennsylvania, Washington, West Virginia, and Wisconsin to be among the first states to develop the POLST form (POLST, n.d.). This spread encouraged physicians from across the nation to discuss with both the patients and their family members about their medical care towards the end-of-

life and to propose a plan best tailored to each specific patient while keeping patient autonomy. It is important to understand that POLST, however, is not an advance directive. Instead, it is a tool used by physicians that reflects the patient's end-of-life medical decisions. It builds on advance directive, but also serves a purpose even without it through a surrogate if the patient becomes incapable of making their own decisions towards the end of their life (Sabatino, 2007).

The three things that POLST aims to accomplish include:

- 1) requiring a health care professional to initiate a discussion with the patient or their authorized surrogate about the different treatment options towards the end of their life
- 2) incorporating patient's preferences into medical orders or with the patient if they live at home
- 3) making sure that the patient has the POLST form with them wherever they move to in order to continue the decision making process and to ensure that it is readily available to a health care professional when needed

It has been shown that the implementation of POLST led to positive outcomes in preventing unwanted resuscitations, encouraging discussion about various treatment options, and making each patient's end-of-life preferences known and respected (Hickman *et al.*, 2004; Schmidt *et al.*, 2004).

Because one fifth of all hospital deaths occur in the ICU, the concept of integrating PC into the ICU has been increasingly advocated and has emerged over the past decade (Truog *et al.*, 2008; Lanken *et al.*, 2008; Selecky *et al.*, 2005). Providing not

only physical, but also psychosocial and emotional support to both the patient and their family members is essential, as this lays a foundation for family adjustment and support (Rome *et al.*, 2011). Thus, providing PC for patients who are severely sick is important, as the majority of critically ill patients and their family members require PC needs including end-of-life discussion about goals of care and each patient's values and preferences as their disease progresses (Mosenthal *et al.*, 2012). In fact, the need for hospice and PC has significantly grown, especially for developed countries, as evidenced by the 78 million American "Baby Boomers" who are beginning to reach the stage in their lives that are associated with many various life-threatening and chronic illnesses (Lutz, 2011). Approximately 1.5 million patients received hospice services in 2013. Additionally, cancer diagnoses now account for 36.5% of all hospice admissions while the majority primary diagnosis includes non-cancer diagnoses such as dementia, heart disease, and lung disease (NHPCO, n.d.). Previous studies have shown the positive effects of integrating PC in the care of terminally ill patients, as it was able to improve the communication between physicians and patients and their family members as well as improve the quality of care and mood of patients, which ultimately improves patient care and family outcomes. Additionally, patients receiving PC also reported having less aggressive care towards the end of life (Temel *et al.*, 2010; Truog *et al.*, 2008). A study that examined the barriers from patients receiving advance directives reported that the main reason many patients were not able to complete their arrangements was due to the physicians' failure to address and initiate end-of-life goals, values, and preferences (Emanuel *et al.*, 1991). By providing PC for critically and terminally ill patients in the

ICU, communication about goals of care, symptom distress, and most importantly patient and family preferences may be improved (Clark and Graham, 2011).

Although numerous previous studies analyzing the impact of PC consultations have appeared in several literatures, data on how effective PC consultations is still limited (Schneiderman *et al.*, 2000). In order to respond to the needs of severely ill patients, it is crucial to expand PC services in hospitals so the quality of end-of-life care may potentially be improved while reducing hospital costs and unwanted burden. In fact, the number of inpatient PC services have grown across academic hospitals in the United States, from 632 programs in 2000 to 1,027 in 2003 and to over 1700 in 2012 (Morrison *et al.*, 2005; Center to Advance Palliative Care, n.d.). The growth of PC service is primarily due to previous studies that reported the difficulties in providing the appropriate pain and symptom management as well as the inconsistency in both communication and the decision making progress between clinicians and the patients along with their family members (Norton *et al.*, 2007). In addition, the growth in the number of PC programs may also be in response to the increasing evidence and recognition from previous studies showing the beneficial effects on clinical outcomes (Morrison *et al.*, 2005). This significant growth in the number of PC programs suggests that they are indeed effective in improving pain and symptom management as well as increasing the quality of life and satisfaction for both the patients and their family members (Radwany *et al.*, 2009). Moreover, a study that examined the effects of introducing PC early in patients with metastatic non-small-cell lung cancer also reported better quality of life, less depressive symptoms, and less aggressive care at the end-of-life while being able to maintain a

longer life expectancy (Temel *et al.*, 2010). In fact, a recent study reported that almost all (96%) physicians stated that they would request a PC consultation in the future, as this process is valuable to the patients' medical care in more aspects than one (LaPuma *et al.*, 1988).

In order to further examine the effects on clinical outcomes and cost of PC for patients in the ICU, our study assessed the effectiveness of an intervention to promote early proactive PC consultation for patients admitted to an academic hospital's ICU by using a trigger screening tool and implementing a 15 minute daily ICU huddle with the multidisciplinary team. This study was a quality improvement project, seeking to increase access to PC in the ICU as well as reducing the time between ICU admission and after meeting criteria in the ICU and when patients actually received a PC consultation. We hypothesize that the intervention would reduce the number of days for the PC team to see the patient for a consultation, better determine who should receive a PC consultation, and reduce both the total hospital and ICU lengths of stay. The research questions were as follows:

1. Since by definition, every patient in the ICU could qualify for or be eligible for PC, how does the health system or the referring clinician determine which patients would benefit?
2. Would a screening tool and a daily multidisciplinary huddle be an effective and efficient approach to determining which ICU patients would benefit most from a PC consultation?

METHODS

This single-center, retrospective cohort study was conducted at the University of California, Irvine Medical Center's intensive care units (ICUs). The study was a quality improvement project that analyzed two phases, pre-intervention and post-intervention, with the post-intervention phase divided into two phases from two different time periods. The decision was made to analyze only patients who died in the hospital, in order to make an appropriate comparison between the patients who ultimately had the same clinical outcome. The patients who died in the ICUs typically had diagnoses such as stroke or other neurological diseases, cardiac arrest, heart failure, cancer, respiratory failure, kidney failure, liver failure, sepsis, or trauma. Patients were included in the study if:

- 1) they were greater than 18 years of age
- 2) died in the hospital
- 3) had 1 or more days of stay in the ICU

There were no additional exclusion criteria.

Pre-Intervention Phase

The pre-intervention phase (phase 1) included all patients who died in the hospital from July 2010 to December 2011. In this phase, all ICU patients were retrospectively analyzed using a screening criteria developed by the University of California (UC) through a consensus process between its five medical centers (UC Davis, UC Irvine, UC Los Angeles, UC San Diego, UC San Francisco). This criteria list was developed as part

of a palliative care (PC) grant application to the Center for Medicare and Medicaid Services (CMS). Only data for patients who met criteria were collected in the pre-intervention phase. These patients were dichotomized into those who received a PC consultation and those who received usual care.

Pre-Intervention Screening Criteria

Patients must meet one of the criteria shown in Table 1 (University of California, 2014).

| Table 1: Pre-Intervention Screening Criteria |
|---|
| <ul style="list-style-type: none">• Admitted from extended care facility with activities of daily living (ADL) dependence or chronic care need• More than 1 hospitalization within last 30 days• Mechanical ventilation for more than 7 days• Dementia – difficulty with speech, ambulation or aspiration• Metastatic cancer• Advance cardiac disease – i.e. congestive heart failure (CHF), coronary artery disease (CAD), left ventricular ejection fraction (LVEF) of less than 25% |

Post-Intervention Phase

The post-intervention phase was divided into two phases (phase 2 and phase 3) and included all patients who died in the hospital from April 2013 to October 2014. The intervention was a screening process that helped identify patients who could benefit most from a PC consultation. This intervention first began with a trigger screening tool that was developed from a consensus report by the Center to Advance Palliative Care (CAPC). Since the University of California did not obtain the CMS grant, the decision was made to use a more nationally accepted instrument. The trigger screening tool from

the CAPC was therefore adapted for local use. In phase 2 from April 2013 to September 2013, only the screening tool intervention was implemented. The decision was made to include only the medical intensive care unit (MICU) and neurological intensive care unit (NICU), since the majority of ICU deaths occurred in these two units, as shown in Figure 1.

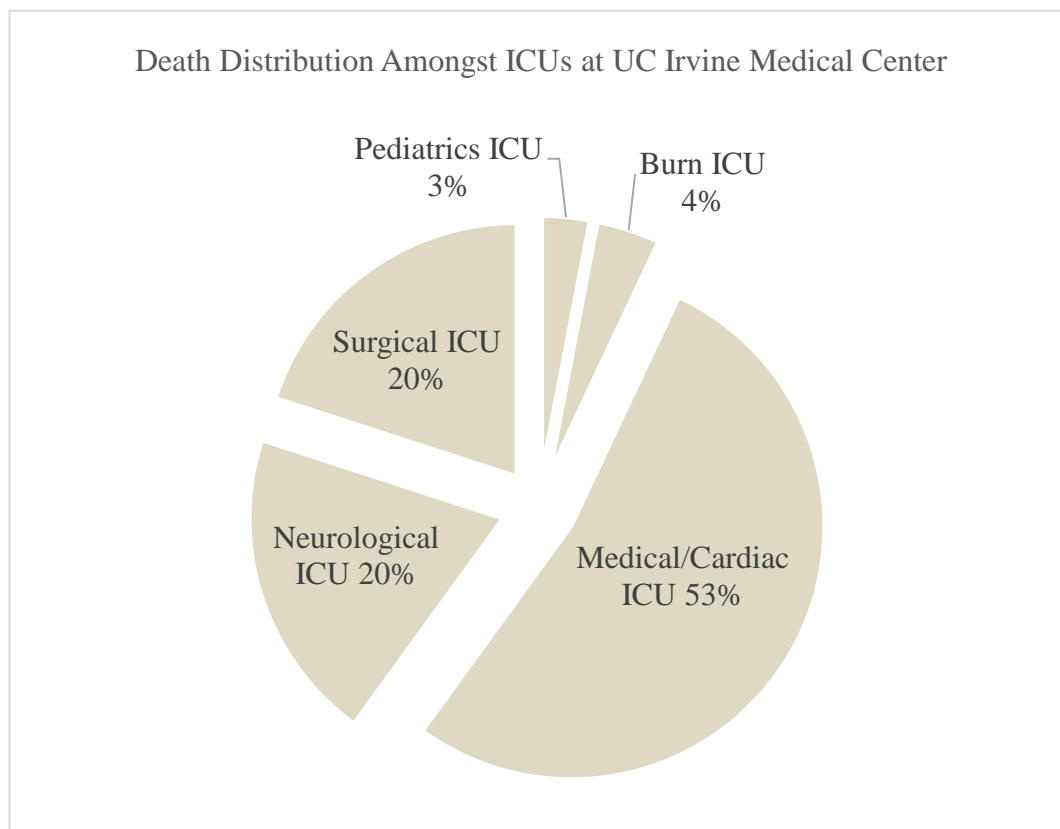


Figure 1. Distribution of Deaths Amongst the ICUs at the University of California Irvine Medical Center in 2013.

The patients were screened with the trigger tool upon ICU admission in order to determine if criteria was met for a PC consultation. If the patient did not meet criteria upon admission, they were screened daily until they met criteria or until they were

discharged. In contrast to the pre-intervention phase where only data for patients who met criteria were collected, data for both patients who met criteria and those who did not meet criteria were collected in the post-intervention phases. The measurable variables collected in the post-intervention phase were the same as those collected in the pre-intervention phase. The post-intervention patients screened positive if they met any one of the listed stand-alone criteria or two or more of the collateral criteria.

Post-Intervention Trigger Screening Tool

Stand-Alone Criteria – Patient meets one of the following:

Patients must meet one of the stand-alone criteria shown in Table 2 (University of California, 2014).

| Table 2: Post-Intervention Screening Tool Using Stand-Alone Criteria |
|--|
| <ul style="list-style-type: none"> ● Stage IV malignancy (i.e.: cancer with metastasis to bone, liver, brain, lung) ● Status Post cardiopulmonary arrest during current hospitalization ● Tracheostomy and/or G-Tube placement being considered ● Intra-cerebral hemorrhage or subarachnoid hemorrhage (SAH) requiring mechanical ventilation ● Actively dying or withdrawal of life support ● Patient/family or nurse has needs, concerns or needs help with complex decision-making, establishing goals of care ● Readmission to the intensive care unit (ICU) during the same hospitalization ● Dementia with dysphagia ● Presence of 2 or more organ failures (i.e.: end stage renal disease, heart or respiratory failure refractory to treatment) ● Prior hospice admission ● Admit to ICU after recent (last 30 days) discharge from a previous hospitalization (not transfer) |

Collateral Criteria – Patient meets 2 or more of the following:

Patients must meet two or more of the collateral criteria shown in Table 3 (University of California, 2014).

Table 3: Post-Intervention Screening Tool Using Collateral Criteria

- Frequent systemic infections with advanced stage disease
- Nutritional complications with albumin < 2.5 mg/dl
- Pain and other symptom distress not resolved by current treatment plan
- Resides in a skilled nursing facility
- Multiple re-admissions to the hospital for same problem (>2 in the past six months)
- More than 1 hospitalization in the last 30 days

In phase 3 from October 2013 to October 2014, a daily ICU huddle was implemented in addition to utilizing the screening tool. A list of the patients who screened positive and met criteria was printed every day from Monday through Friday. A multidisciplinary huddle consisting of the critical care attending physician and the PC physician, social worker, case manager, and charge nurse, met for 15 minutes each morning to review the list on each critical care unit. During this huddle discussion, the critical care physician decided which patients needed a PC consultation. Data for three time periods were collected and compared: pre-intervention (phase 1: July 2010 to December 2011), screening tool only (phase 2: April 2013 to September 2013), and daily huddle (phase 3: October 2013 to October 2014).

Patients who met the inclusion criteria for the study were further dichotomized into those who met PC criteria with the screening tool and those who did not meet

screening tool criteria. The patients who met PC criteria and those who did not were each further dichotomized into those who received a PC consultation and those who received usual care (Figure 2).

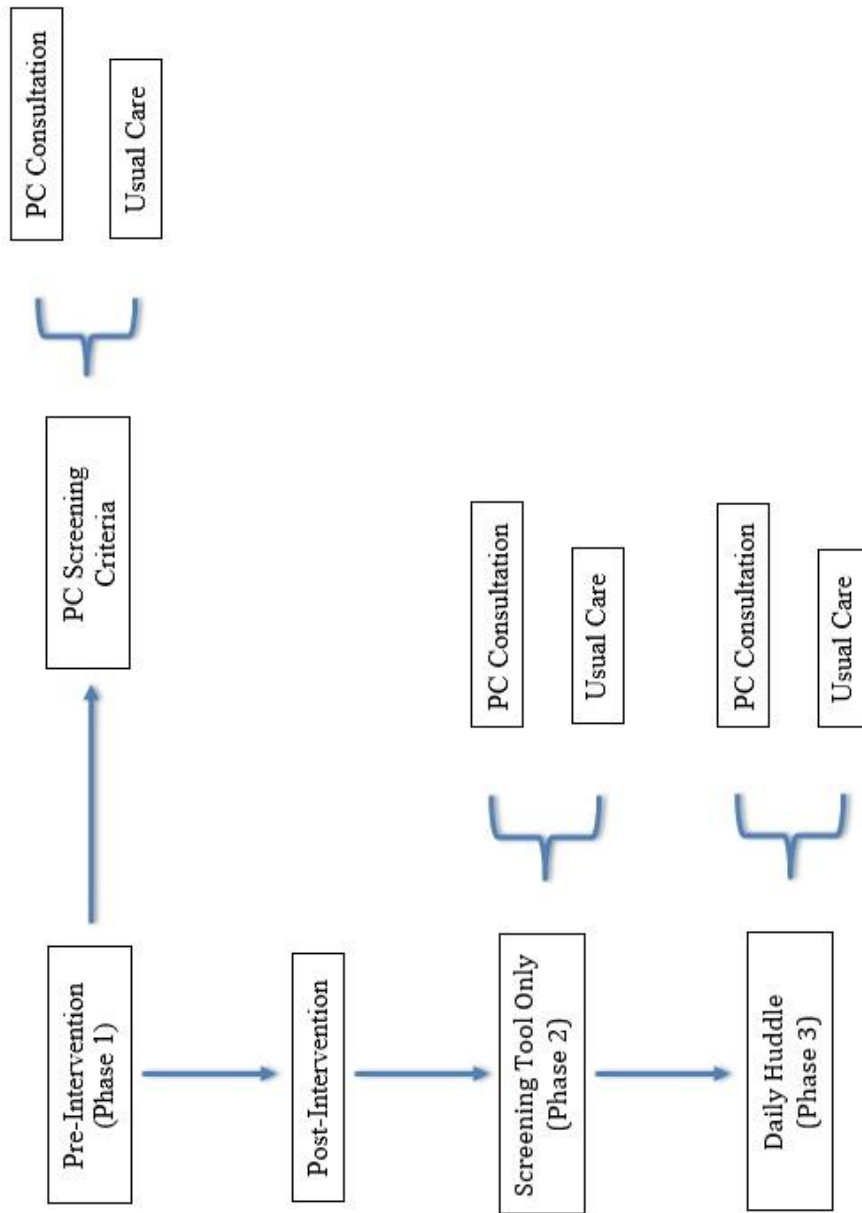


Figure 2. Flowchart of the Pre-intervention and Post-intervention Phases.

Data Collection

The study data were collected from the hospital's electronic medical record. Demographic data such as age, gender, race, diagnoses, cause of death, death location, and language were collected in the pre-intervention and post-intervention phases. In addition, continuous variables including the total hospital length of stay, ICU length of stay, day of meeting criteria after hospital admission, day of PC consultation after ICU admission, and the day of PC consultation after meeting criteria in the ICU were also collected in the pre-intervention and post-intervention phases. Direct hospitalization costs between those who received a PC consultation and those who received usual care were compared between all patients who met criteria in the post-intervention phase.

Analytical Sample

From July 2010 to December 2011 and April 2013 to October 2014, a total of 1,126 patients died in the hospital. Among the 1,126 who died, 238 were excluded because they were either less than 18 years of age or had no ICU stay, which reduced the total number of patients enrolled and analyzed in our study to 888. From the 888 patients, 285 patients died in phase 1 between July 2010 and December 2011, 149 patients died in phase 2 between April 2013 and September 2013, and 454 patients died between October 2013 and October 2014 in phase 3.

Statistical Analysis

This analysis primarily focused on the comparison of clinical outcomes including length of stay, the average day criteria was met following hospital admission, the number of days between ICU admission or meeting criteria and when patients actually received PC consultation, and the average number of PC consultations per month between the pre-intervention and post-intervention phases. The statistical program, SAS version 9.4, was used to run the analyses. Chi-square tests were used to compare the demographics data between the patients from the three different time periods (pre-intervention, screening tool only, daily huddle). In addition, two sample t-test procedures were used to compute sample means for continuous variables including total hospital length of stay, ICU length of stay, and day of meeting criteria after hospital admission for patients who met criteria in all three phases. For patients who did not meet criteria, only the total hospital and ICU lengths of stay were computed using the two sample t-test. Furthermore, a two sample t-test procedure was also used to compare the day of PC consultation after ICU admission between patients in the three phases, with the pre-intervention phase as the control. The prevalence of patients who met criteria and received a PC consultation was also determined in order to observe the likelihood of receiving a referral for a PC consultation based on what the patients screened. The sensitivity, specificity, positive predictive value, and negative predictive value for patients in phase 2 and phase 3 were calculated as well. Statistical significance was set at $p \leq 0.05$.

RESULTS

Among the 888 patients that were included in this study, 285 were from the pre-intervention cohort (phase 1), 149 were from the screening tool only cohort (phase 2), and 454 patients were from the daily huddle cohort (phase 3). Out of the 285 patients from phase 1, 190 (67%) received a PC consultation and 95 (33%) received usual care. Out of the 149 patients from phase two, 77 (52%) received a PC consultation and 72 (48%) received usual care. Out of the 454 patients from phase three, 230 (51%) received a PC consultation and 224 (49%) received usual care (Figure 3).

The demographics of the 888 patients included in this study are listed in Table 4 and divided into three separate time periods. The study patients included in the analysis had an average age of 63.6. They were 58% men, 55% Caucasians, and died mostly from neurologically related diseases (29%) or cancer (25%). In addition, most of the patients ultimately died in the ICU (88%) and primarily spoke English (73%).

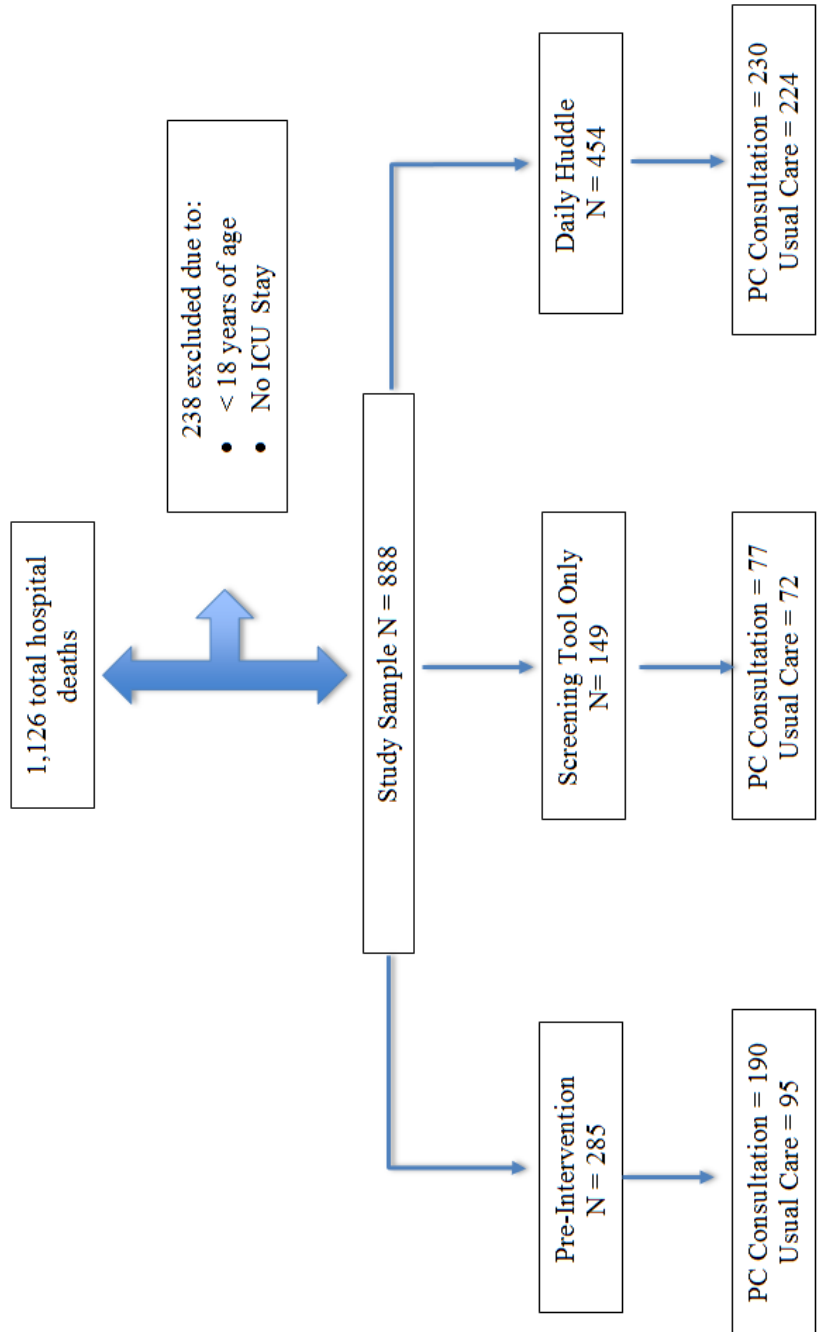


Figure 3. Flowchart of Patients Analyzed.

Table 4. Demographics Data for Patients from All Three Cohorts.

| Demographics | Pre-Intervention | Post-Intervention | | Total (n=888) | P-Value |
|---|---|---|---|---|---------|
| | Pre-Trigger (n=285) | Screen Only (n=149) | Huddle (n=454) | | |
| Age, mean (SD) Range | 63.8 (16) 22-94 | 63.2 (18.1) 18-97 | 63.7 (17.7) 18-99 | 63.6 (17.2) 18-99 | 0.8389 |
| Gender, n (%) Female Male | 129 (45.2%) 156 (54.7%) | 65 (43.6%) 84 (56.4%) | 185 (40.8%) 269 (59.3%) | 334 (42.1%) 459 (57.9%) | 0.2847 |
| Race, n (%) African American Asian Caucasian Hispanic Other/Unknown | 10 (3.5%) 56 (19.7%) 168 (56%) 51 (17.9%) -- | 3 (2%) 31 (20.8%) 90 (60.4%) 12 (8.1%) 13 (8.7%) | 7 (1.5%) 95 (20.9%) 245 (54%) 62 (13.7%) 45 (9.9%) | 17 (2.1%) 169 (21.3%) 439 (55.4%) 74 (9.3%) 94 (11.9%) | <.0001* |
| Death Diagnosis, n (%) Neuro Heart failure Cancer Respiratory failure Kidney failure Liver failure Sepsis Trauma Other | 59 (20.7%) 29 (10.2%) 93 (32.6%) 13 (4.6%) 20 (7%) 13 (4.6%) 15 (5.3%) 14 (4.9%) 29 (10.2%) | 52 (34.9%) 26 (17.5%) 32 (21.5%) 7 (4.7%) 2 (1.3%) 1 (0.7%) 8 (5.4%) 9 (6%) 12 (8.1%) | 140 (30.8%) 93 (20.5%) 96 (21.2%) 55 (12.1%) 6 (1.3%) 5 (1.1%) 25 (5.5%) 1 (0.2%) 33 (7.3%) | 227 (28.6%) 135 (17%) 196 (24.7%) 69 (8.7%) 24 (3%) 12 (1.5%) 43 (5.4%) 19 (2.4%) 68 (8.6%) | <.0001* |
| Death Location, n (%) ICU Med Surg Step Down Unit Other | 241 (84.6%) 20 (7%) 24 (8.4%) -- | 129 (86.6%) 15 (10.1%) 4 (2.7%) 1 (0.7%) | 408 (90%) 31 (6.8%) 9 (2%) 6 (1.3%) | 698 (88%) 60 (7.6%) 28 (3.5%) 7 (0.9%) | <.0001* |
| Language, n (%) English Spanish Other | 230 (80.7%) 32 (11.2%) 23 (8.1%) | 118 (79.2%) 16 (10.7%) 15 (10.1%) | 317 (69.8%) 81 (17.8%) 56 (12.3%) | 582 (73.4%) 120 (15.1%) 91 (11.5%) | 0.0230* |

SD, standard deviation; ICU, intensive care unit.

* $p \leq 0.05$ = statistically significant. P-value is for demographics compared between pre-intervention and post-intervention (screening tool only and daily huddle).

Table 5 shows the number of patients who met criteria or did not meet criteria and whether they received a PC consultation or usual care in all patients in phase 2. For patients in this phase, the screening tool sensitivity was 66.2% and the specificity was 70.8%, as shown in Table 6. In addition, the positive predictive value was 70.8% and the negative predictive value was 66.2%.

Table 5. Patients Who Met Criteria and Received a PC Consultation in Phase 2.

| Phase 2: Screening Tool Only | PC Consultation | Usual Care | Total |
|---------------------------------|-----------------|------------|-------|
| Meet Criteria | 51 | 21 | 72 |
| Did Not Meet Criteria | 26 | 51 | 77 |
| Total | 77 | 72 | 149 |

Table 6. Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for the Screening Tool in Phase 2.

| Phase 2 – Screening Tool Only | |
|-------------------------------|-------|
| Sensitivity | 66.2% |
| Specificity | 70.8% |
| Positive Predictive Value | 70.8% |
| Negative Predictive Value | 66.2% |

Table 7 shows the number of patients who met criteria or did not meet criteria and whether they received a PC consultation or usual care in all patients in phase 3. For

patients in this phase, the screening tool plus daily huddle sensitivity was 65.7% and the specificity was 62.5%, as shown in Table 8. In addition, the positive predictive value was 64.3% and the negative predictive value was 63.9%.

Table 7. Patients Who Met Criteria and Received a PC Consultation in Phase 3.

| Phase 3: Daily Huddle | PC Consultation | Usual Care | Total |
|--------------------------|-----------------|------------|-------|
| Meet Criteria | 151 | 84 | 235 |
| Did Not Meet Criteria | 79 | 140 | 219 |
| Total | 230 | 224 | 454 |

Table 8. Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for the Screening Tool and Daily Huddle in Phase 3.

| Phase 3 – Screening Tool and Daily Huddle | |
|---|-------|
| Sensitivity | 65.7% |
| Specificity | 62.5% |
| Positive Predictive Value | 64.3% |
| Negative Predictive Value | 63.9% |

Table 9 shows the patients who met criteria or did not meet criteria and whether they received a PC consultation or usual care in all post-intervention phases (phase 2 and phase 3). For post-intervention patients, the sensitivity was 65.8% and the specificity was 64.5%, as shown in Table 10. In addition, the positive predictive value was 65.8% and

the negative predictive value was 64.5%. Patients who met criteria were more likely to receive a PC consultation compared to patients who did not meet criteria (65.8% vs 34.2%; $p < 0.0001$).

Table 9. Patients Who Met Criteria and Received a PC Consultation in the Post-intervention Phases Combined (Phase 2 and Phase 3).

| Post-Intervention Total (Phase 2 and Phase 3) | PC Consultation | Usual Care | Total |
|---|-----------------|------------|-------|
| Meet Criteria | 202 | 105 | 307 |
| Did Not Meet Criteria | 105 | 191 | 296 |
| Total | 307 | 296 | 603 |

Table 10. Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for Both Post-intervention Phases.

| | |
|---------------------------|-------|
| Post-Intervention Total | |
| Sensitivity | 65.8% |
| Specificity | 64.5% |
| Positive Predictive Value | 65.8% |
| Negative Predictive Value | 64.5% |

Table 11 shows the comparison between the average day of PC consultation after meeting criteria in the ICU and following ICU admission for patients from all three phases. The average day that PC consultations were received by patients in the ICU after meeting criteria was day 8.0 for patients in phase 1, day 3.08 for patients in phase 2, and

day 2.18 for patients in phase 3. In phase 1, patients received a PC consultation on an average of 9.55 days after ICU admission. In phase 2, patients received a PC consultation on an average of 5.12 days after ICU admission for patients who met criteria and 4.62 days for patients who did not meet criteria, with an average of 4.95 days for all patients in phase 2. In phase 3, patients received a PC consultation on an average of 4.63 days after ICU admission for patients who met criteria and 4.99 days for patients who did not meet criteria, with an average of 4.75 days for all patients in phase 3.

Table 11. Comparisons of Day of PC Consultation After Meeting Criteria in the ICU and Following ICU Admission Between All Three Phases.

| Patient Cohort (n) | Day of PC Consultation After Meeting Criteria in ICU | Day of PC Consultation After ICU Admission |
|--|--|--|
| Phase 1: Pre-Intervention Criteria Positive PC Consult (190) | 8.0 | 9.55 |
| Phase 2: Screening Tool Criteria Positive PC Consult (51) Criteria Negative PC Consult (26) Total (77) P-Value | 3.08 -- 3.08 -- | 5.12 4.62 4.95 0.0047* |
| Phase 3: Huddle Criteria Positive PC Consult (151) Criteria Negative PC Consult (79) Total (230) P value | 2.18 -- 2.18 -- | 4.63 4.99 4.75 0.0011* |

*P-values based on comparing phase 2 and phase 3 each with phase 1 (pre-intervention), the control group.

Table 12 shows the average hospital and ICU lengths of stay and the average day of meeting criteria after hospital admission from the three phases. In phase 1, the total hospital and ICU lengths of stay for patients who met criteria and received a PC consultation were 17.9 days and 14.0 days respectively, compared to 12.4 days and 8.2 days for patients who met criteria but received usual care. The hospital and ICU lengths of stay for patients in phase 2 who met criteria and received a PC consultation were 12.1 and 9.6 days, respectively, while the hospital and ICU lengths of stay for patients who met criteria but received usual care were 6.3 and 4.7 days, respectively. The hospital and ICU lengths of stay for patients who did not meet criteria in phase 2 but received a PC consultation were 10.7 and 8.5 days, respectively, while the hospital and ICU lengths of stay for patients who did not meet criteria and received usual care were 5.5 and 5.1 days, respectively. The hospital and ICU lengths of stay for patients in phase 3 who met criteria and received a PC consultation were 13.3 and 10.7 days, respectively, while the hospital and ICU lengths of stay for patients who met criteria but received usual care were 9.5 and 7.3 days, respectively. The hospital and ICU lengths of stay for patients in phase 3 who did not meet criteria but received a PC consultation were 11.2 and 9.0 days, respectively, while the hospital and ICU lengths of stay for patients who did not meet criteria and received usual care were 4.4 and 3.0 days, respectively. The total average hospital and ICU lengths of stay were 16.1 and 12.0 days for all patients in phase 1; 8.75 and 7.17 for all patients in phase 2; and 9.48 and 7.41 days for all patients in phase 3, respectively.

Table 12 also demonstrates the average day of meeting criteria after hospital admission. Of the patients who met criteria in phase 1, those who received a PC

consultation met criteria on an average of 1.78 days after hospital admission compared to an average of 1.46 days for patients who received usual care, with an average of 1.67 days for all phase 1 patients. Of the patients who met criteria in phase 2, those who received a PC consultation met criteria on an average of 4.14 days after hospital admission compared to an average of 3.14 days for patients who received usual care, with an average of 3.91 days for all phase 2 patients. Of the patients from phase 3 who met criteria, those who received a PC consultation met criteria on an average of 4.86 days after hospital admission compared to an average of 4.68 days for patients who received usual care, with an average of 4.8 days for all phase 3 patients.

Table 12. Comparisons of Hospital and ICU Lengths of Stay and Day of Meeting Criteria After Hospital Admission for Patients Who Died from the Three Phases.

| Patient Cohort (n) | Hospital LOS | ICU LOS | Day of Meeting Criteria After Hospital Admission |
|----------------------------------|--------------|---------|--|
| Phase 1: Pre-Intervention | | | |
| Criteria Positive | | | |
| PC Consultation (190) | 17.9 | 14.0 | 1.78 |
| Usual Care (95) | 12.4 | 8.2 | 1.46 |
| P-Value | 0.0072 | 0.0003 | 0.1161 |
| Total (285) | 16.1 | 12.0 | 1.67 |
| Phase 2: Screening Tool | | | |
| Criteria Positive | | | |
| PC Consultation (51) | 12.1 | 9.6 | 4.14 |
| Usual Care (21) | 6.3 | 4.7 | 3.14 |
| P-Value | 0.0054* | 0.0051* | 0.4223 |
| Criteria Negative | | | |
| PC Consult (26) | 10.7 | 8.5 | -- |
| Usual Care (51) | 5.5 | 5.1 | -- |
| P-Value | 0.2002* | 0.3796* | -- |
| Total (149) | 8.75 | 7.17 | 3.91 |
| Phase 3: Huddle | | | |
| Criteria Positive | | | |
| PC Consultation (151) | 13.3 | 10.7 | 4.86 |
| Usual Care (84) | 9.5 | 7.3 | 4.68 |
| P-Value | 0.0123* | 0.0037* | 0.8306 |
| Criteria Negative | | | |
| PC Consultation (79) | 11.2 | 9.0 | -- |
| Usual Care (140) | 4.4 | 3.0 | -- |
| P-Value | 0.0002* | 0.0006* | -- |
| Total (454) | 9.48 | 7.41 | 4.80 |

LOS = length of stay.

*P-values based on comparisons between PC consultation and usual care for each respective cohort.

Figure 4 shows the comparison of the average number of PC consultations per month for the three different time periods. In the pre-intervention phase, an average of 10.6 PC consultations occurred per month out of an average of 15.8 total hospital deaths per month, or 67% of all the patients who died in the hospital. In phase 2, after the screening tool was implemented in April 2013, the average number of PC consultations per month increased to 12.8, while the average number of hospital deaths per month was 24.8, or approximately 52% of all the patients who died in the hospital. In phase 3, the average number of PC consultations per month increased to 17.7 while the average number of hospital deaths per month was 34.9, or approximately 51% of all the patients who died in the hospital. The growth from 10.6 to 12.8 PC consultations per month from phase 1 to phase 2 indicated a 21.5% increase in the number of PC consultations per month received by patients after the screening tool intervention was implemented. The growth from 12.8 to 17.7 consultations per month from phase 2 to phase 3 indicated a 37.9% increase in the number of PC consultations per month received by patients after the daily huddle was implemented in October of 2013. In total, there was a 67.5% increase in the average number of PC consultations per month received by patients.

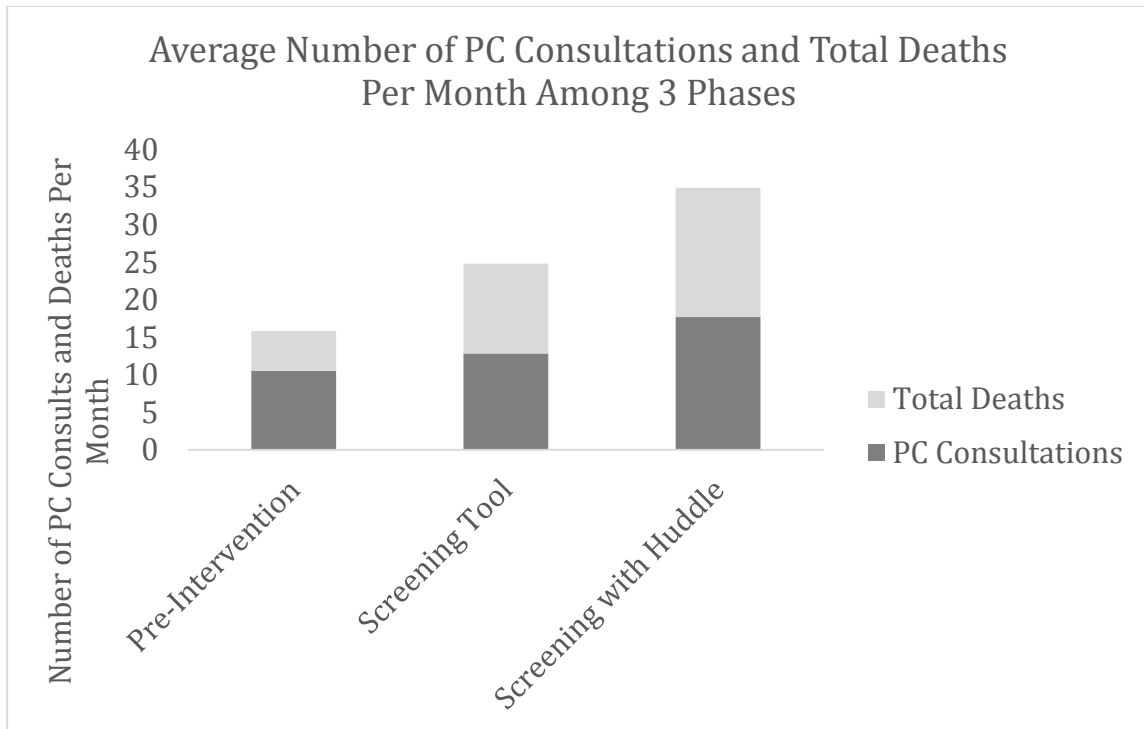


Figure 4. Average Number of PC Consultations and Total Deaths Per Month Among 3 Phases. Comparison of the average number of PC consultations per month and the average number of total hospital deaths per month between the pre-intervention phase and the two post-intervention phases.

Figure 5 shows the comparison of total direct cost per discharge, ICU cost, and the costs for respiratory therapy, pharmacy, and laboratory between patients who received a PC consultation and patients who received usual care. Patients who received a PC consultation had a direct cost per discharge of \$47,785 compared to \$40,158 for patients who received usual care. Patients who received a PC consultation spent \$7,647 more on direct cost per discharge compared to usual care. Out of the \$47,785 total direct cost per discharge for patients who received a PC consultation, \$16,747 (35%) came from ICU costs. Out of the \$40,158 total direct cost for patients who received usual care,

\$11,101 (27.6%) came from ICU costs. Patients who received a PC consultation also had an insignificantly higher direct cost per discharge from respiratory therapy, pharmacy, and laboratory.

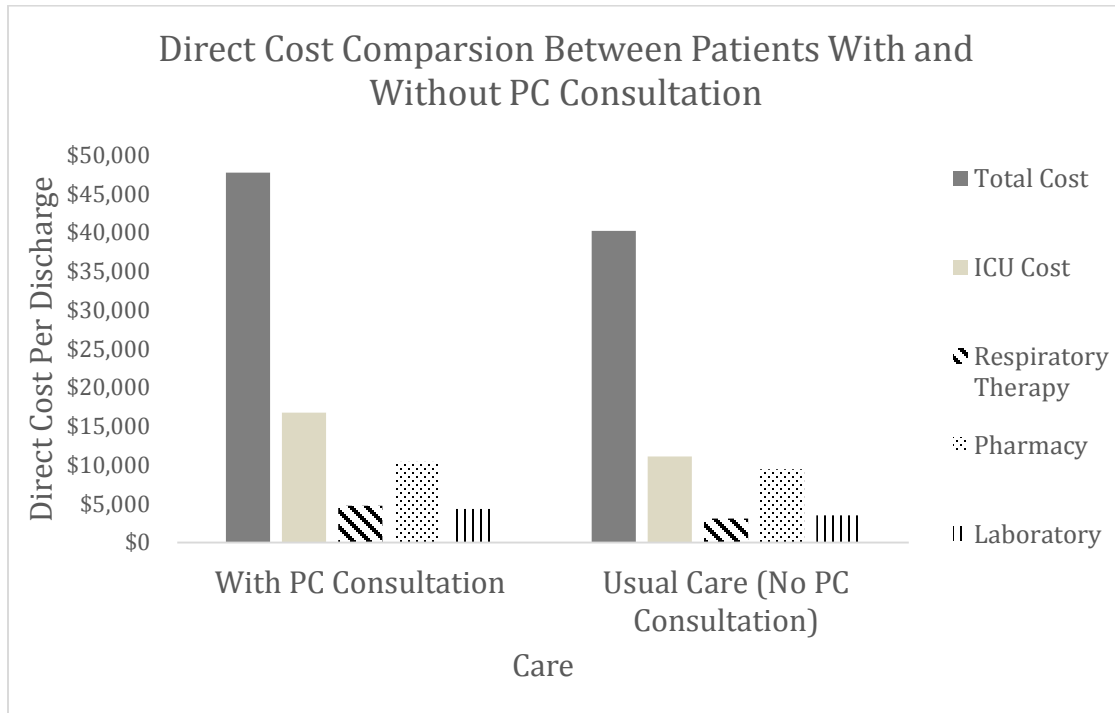


Figure 5. Direct Cost Comparison Between Patients With and Without PC Consultation. Comparison of direct costs of total hospital stay, ICU stay, respiratory therapy, pharmacy, and laboratory between patients who received a PC consultation and patients who received usual care. ICU cost, respiratory therapy, pharmacy, and laboratory are all part of the total cost.

DISCUSSION

This study aimed to examine the impact and measurable outcomes of implementing a screening tool and daily ICU huddle intervention as a proactive approach to increase access to PC for patients in the ICU of an academic hospital. The study demonstrated that the early implementation of a screening tool and a daily huddle was effective and successful. The intervention assisted the critical care physicians to better discriminate and identify which patients would benefit from a PC consultation and which patients would not. The intervention reduced the time to PC consultation following ICU admission and after meeting criteria in the ICU, which was the major focus of the quality improvement effort. Implementation of the daily ICU huddle in phase 3 further reduced the time for patients to receive a PC consultation. Although receiving a PC consultation did not reduce the length of stay when compared to patients who received usual care, the overall length of stay of all patients who received PC consultation and all patients who received usual care decreased when comparing between the respective cohorts in the pre-intervention and post-intervention phases.

This study is the first, to our knowledge, that found an effect and impact between a daily ICU huddle and the potential to allow physicians to better determine and decide the group of patients most appropriate to receive a PC consultation. Determining which patients need a subspecialty consultation can be a challenging and complex process that must not only take into consideration each patient and their family's complexities, but also factors of the referring physician. This determination is particularly important, especially with the increasing number of deaths in the ICU while the PC resources remain

limited. A huddle between the referring critical care physician and the palliative consultant allows an active and dynamic dialogue that respects the autonomy of the critical care physician better than a passive screening instrument. The screening tool and daily ICU huddle showed that this intervention process was able to help physicians distinguish and better discriminate the patients who may benefit most from a PC consultation from the patients whom a PC consultation may not be beneficial, depending on their illness severity. The daily huddle was an effective and efficient process to determine which patients needed subspecialty PC and which end-of-life patients the critical care physician was able to manage without the help of the PC medical team.

The cost and length of stay analysis suggests that critical care physicians were able to accurately decide which end-of-life patients they could handle on their own. Unlike previous studies that reported an association between PC and reduction in hospital cost (Campbell and Guzman, 2003; Hanson *et al.*, 2008), this study did not find such association. In addition, this study also found no association between PC and reduced hospital or ICU length of stay, which does not support other studies that reported such association (Norton *et al.*, 2007; Campbell and Guzman, 2003; Campbell and Guzman, 2004; Schneiderman *et al.*, 2000; Humphreys *et al.*, 2014). Patients who received a PC consultation in this study, when compared to patients who received usual care, had no significant difference in hospital cost per discharge or reduction in length of stay. However, it is important to consider that this study only included patients who died in the hospital within the study period and not patients who were alive or discharged. Patients in this hospital who received a PC consultation had more complex and life-threatening

illnesses, which supports previous studies that also found patients who receive PC to have more complex physical and emotional issues (Wheatley and Baker, 2007; Nelson *et al.*, 2011; Mierendorf and Gidvani, 2014). This explains the longer hospital and ICU lengths of stay for patients who received a PC consultation. In contrast, patients who received usual care are those whose illnesses are not severe enough for them to receive PC and patients whose life expectancy is short due to the severity of their illness, causing PC to no longer be beneficial. This finding is consistent with other studies that showed patients who receive PC have a longer survival compared to patients who did not receive PC (Temel *et al.*, 2010; Kelley and Meier, 2010; Smith *et al.*, 2003) and explains the significantly shorter length of stay for patients who received usual care compared to patients who received a PC consultation.

Although patients who received a PC consultation had a longer length of stay, the average cost per discharge for patients who received a PC consultation and patients who received usual care were still similar. While patients who received PC had more complex issues, patients who received usual care were either 1) patients who are not ill enough to receive PC who may not be in need of advanced treatment, or 2) severely ill patients with short life-expectancy who may no longer benefit from a PC consultation. Because patients who receive usual care include patients from both ends of the health spectrum, their cost per discharge was similar to that of PC patients, who tend to fall in between the two ends of the health spectrum. Because patients with complex illnesses are usually in the middle of the spectrum, it is also another reason why it is crucial that this screening tool and daily ICU huddle help the physicians determine if the patients need or do not

need a PC consultation. As a result, the average cost per discharge for usual care patients was similar to the patients who received PC consultation and used more hospital resources.

Although this study found an increase in average PC consultations per month, the proportion of the patients who received a PC consultation among all patients who died each month did not increase, suggesting that the intervention did not necessarily increase the average amount of PC consultations per month. The increase of deaths in the hospital was primarily due to the changes the hospital was undergoing, such as adopting an open door policy for accepting transfers from other hospitals for higher level of care and increasing the number of ICU beds in the hospital. This result does not support previous studies that found an association between the implementation of a screening tool or a huddle and an increase in the number of PC consultations (Villarreal *et al.*, 2011; Sihra *et al.*, 2011; Trout *et al.*, 2012). Unlike this study, the previous studies, however, did not examine the efficacy and how discriminatory the screening tool and huddle is deciding which patients may benefit from a PC consultation. Additionally, this study also had a screening tool with different criteria compared to other studies. Thus, it may not be a similar comparison.

This study presents several strengths. It is the first study, to our knowledge, that examined the effectiveness and ability of a screening tool and daily ICU huddle intervention to allow the physicians to better discriminate and distinguish the patients who may benefit from and need PC consultation the most. Additionally, while most previous studies used either a screening tool or a huddle intervention as a proactive

approach to PC referral, this study used both the screening tool and a daily ICU huddle as an intervention to examine the impact it may have on measurable clinical outcomes. The combination of a screening tool and daily huddle intervention used in this study in order to better identify and discriminate the appropriate patients for PC may assist with future studies.

This study of pre-intervention and post-intervention also has several limitations. This was a single-site study conducted at an academic hospital, so the results of this study may not be generalized to other hospitals. Because it is a retrospective cohort study, selection bias may have occurred. In addition, because this study only included data from MICU and NICU, its applicability to other types of ICUs, such as surgical and burn ICUs, are limited. Another important limitation is that the pre-intervention and post-intervention screening criteria were different, so variables based on and related to the screening tool such as day of meeting criteria after hospital admission and day of PC consultation after meeting criteria in the ICU cannot be compared directly between the pre-intervention and post-intervention phases. The broad screening criteria used in the pre-intervention phase explains why patients in the pre-intervention phase met criteria much sooner whereas the intervention screening tool was more specific, comprehensive, and accurate, which explains the longer average day patients met criteria following hospital admission. Furthermore, this study only examined the patients who died in the hospital and does not include patients who did not die and were discharged from the hospital. Although the direct cost per discharge between patients who received a PC

consultation and those who received usual care were similar, the quality of care and symptom management towards the end of life were not evaluated.

This is the first study, to our knowledge, that examined the sensitivity and specificity of a nationally proposed screening tool. Although the screening tool and huddle allowed physicians to better identify and distinguish the patient cohorts that may benefit from PC consultation and those who may not, the screening tool yielded a low sensitivity and specificity, which suggests that there is still significant room for improvement. Because validity is measured by sensitivity and specificity, it is important to have a high true positive and true negative proportion. By refining the screening tool and increasing the proportion of true positives and true negatives, it will assist physicians in better discriminating patients who may benefit most from a PC consultation from the patients who may not, depending on whether or not they met criteria. A screening tool with high sensitivity and high specificity will ensure that the patients who meet screening tool criteria will receive a PC consultation and those who do not meet criteria will not receive a PC consultation and receive usual care instead.

Future research is needed to confirm the findings of this study. A prospective randomized trial is needed to evaluate the impact of the screening tool and the daily ICU huddle. More research is also needed in order to evaluate the effectiveness of a screening tool and daily huddle to the surgical and burn ICUs. A multi-site study that includes hospitals from different regions and of different types would improve the generalizability of the results. Furthermore, the daily ICU huddle should also be implemented during the weekend in addition to weekdays, in order to accurately determine and better understand

when patients met criteria following ICU admission and which day after ICU admission and meeting criteria patients actually received a PC consultation. Future research can also look to improve the sensitivity and specificity of the PC screening process.

In conclusion, the implementation of a PC screening tool and daily huddle in the ICU was effective and efficient. The proactive approach to PC is a feasible method to offer terminally ill patients' the most appropriate care most beneficial to themselves and their family members or other loved ones. The intervention assisted critical care physicians in distinguishing and discriminating the patient population who may benefit most from a PC consultation and reduced the time from ICU admission and after meeting criteria to receiving the PC consultation. Despite the limitations of this study, the results nevertheless offer great potential in showing how effective a proactive approach to PC with a screening tool and daily huddle is and the positive effects it may have for severely ill patients' end-of-life care. Future research, however, is still needed to confirm these findings.

REFERENCES

- Angus DC, Barnato AE, Linde-Zwirble WT, Weissfeld LA, Watson RS, Rickert T, Rubenfeld GD, on behalf of the Robert Wood Johnson Foundation ICU End-of-Life Peer Group. Use of intensive care at the end of life in the United States: An epidemiologic study. *Critical Care Medicine* 2004;32(3):638—643.
- Bedell SE, Delbanco TL. . Choices about cardiopulmonary resuscitation in the hospital: when do physicians talk with patients? *New England Journal of Medicine* 1984; 310:1089–93.
- Brimblecombe C, Crosbie D, Lim WK, Hayes B. The Goals of Patient Care project: implementing a proactive approach to patient-centered decision-making. *Internal Medicine Journal* 2014;44(10): 961-966.
- Brooksbank M. Palliative care: where have we come from and where are we going? *Pain* 2009;144(3):233-236.
- Campbell ML, Guzman JA. A proactive approach to improve end-of-life care in a medical intensive care unit for patients with terminal dementia. *Critical Care Medicine* 2004;32:1839-1843.
- Campbell, ML, Guzman JA. Impact of a proactive approach to improve end-of-life care in a medical ICU. *CHEST* 2003;123:266-271.
- Center to Advance Palliative Care. Building Hospital Palliative Care. <https://www.capc.org/topics/hospital/>. Accessed February 11, 2015.
- Clark D, Graham F. Evolution and change in palliative care around the world. *Medicine* 2011;39(11):636-638.
- Clark D, Graham F. Evolution and change in palliative care around the world. *Medicine* 2011;39(11):636-638.
- Covinsky KE, Goldman L, Cook EF, Oye R, Desbiens N, Reding D, Fulkerson W, Connors AF Jr, Lynn J, Phillips RS. The impact of serious illness on patients' families. *The Journal of the American Medical Association* 1994;272:1839-1844.
- Curtis JR, Rubenfeld GD. Improving palliative care for patients in the intensive care unit. *Journal of Palliative Medicine* 2005;8:840-854.
- Desbiens NA, Mueller-Rizner N, Connors AF Jr, Wenger NS, Lynn J. The symptom burden of seriously ill hospitalized patients. *Journal of Pain and Symptom Management* 1999;17:248-255.

- Emanuel LL, Barry MJ, Stoeckle JD, Ettelson LM, Emanuel EJ. Advance directives for medical care – a case for greater use. *New England Journal of Medicine* 1991;324(13):889-895.
- Hanson LC, Usher B, Spragens L, Bernard S. Clinical and economic impact of palliative care consultation. *Journal of Pain and Symptom Management* 2008;35(4):340-346.
- Harvard Medical School Special Health Report. Living Wills.
<http://www.health.harvard.edu/aging/living-wills-a-guide-to-advance-directives-health-care-power-of-attorney-and-other-key-documents>. Accessed March 16, 2015.
- Hecht MB. Advance medical directives (living will, power of attorney, and health care proxy). <http://www.medicinenet.com/script/main/art.asp?articlekey=7814>. Accessed March 6, 2015.
- Hickman SE, Tolle SW, Brummel-Smith K, Carley MM. Use of the Physician Orders for Life-Sustaining Treatment program in Oregon nursing facilities: beyond resuscitation status. *Journal of the American Geriatrics Society* 2004 Sep; 52(9):1424-299.
- Humphreys J, Harman S. Late referral to palliative care consultation service: length of stay and in-hospital mortality outcomes. *Journal of Community and Supportive Oncology* 2014;12(4):129-136.
- Ikaria – Advancing Critical Care. Milestones in critical care.
<http://www.ikaria.com/critical-care/milestones.html>. Accessed February 21, 2015.
- Kamel G, Paniagua M, Uppalapati A. Palliative care in the intensive care unit: are residents well trained to provide optimal care to critically ill patients? *American Journal of Hospice and Palliative Medicine* 2014.
- Kayser-Jones J. Decision making in the treatment of acute illness in nursing homes: framing the decision problem, treatment plan, and outcome. *Medical Anthropology Quarterly* 1995;9(2):236-256.
- Kelley AS, Meier DE. Palliative care – a shifting paradigm. *New England Journal of Medicine* 2010;363(8):781-782.
- Klaristenfeld DD, Harrington DT, Miner TJ. Teaching palliative care and end-of-life issues: A core curriculum for surgical residents. *Annals of Surgical Oncology*. 2007;14:1801–1806.

- Lanken PN, Terry PB, Delisser HM, Fahy BF, Hansen-Flaschen J, Heffner JE, Levy M, Mularski RA, Osborne ML, Prendergast TJ, Rocker G, Sibbald WJ, Wilfond B, Yankaskas JR, ATS End-of-Life Care Task Force. An official American Thoracic Society clinical policy statement: Palliative care for patients with respiratory diseases and critical illnesses. *American Journal of Respiratory and Critical Care Medicine* 2008;177:912–927.
- LaPuma J, Stocking CB, Silverstein MD, DiMartini A, Siegler M. An ethics consultation service in a teaching hospital: utilization and evaluation. *The Journal of the American Medical Association* 1988;260:808-811.
- Liao S, Ito S. Brain death: ethical challenges to palliative care concepts of family care. *The Journal of Pain and Symptom Management* 2010;40(2):309-313.
- Luce JM, White DB. A history of ethics and law in the intensive care unit. *Critical Care Clinics* 2009;25(1):221-237.
- Lutz S. The history of hospice and palliative care. *Current Problems in Cancer* 2011;35:304-309.
- Meo N, Hwang U, Morrison RS. Resident perceptions of palliative care training in the emergency department. *Journal of Palliative Medicine* 2011;14(5):548-555.
- Mierendorf SM, Gidvani V. Palliative care in the emergency department. *The Permanente Journal* 2014;18(2):77-85.
- Morrison RS, Maroney-Galin C, Kralovec PD, Meier DE. The growth of palliative care programs in the United States hospitals. *Journal of Palliative Medicine* 2005;8(6):1127-1134.
- Mosenthal AC, Weissman DE, Curtis JR, Hays RM, Lustbader DR, Mulkerin C, Puntillo KA, Ray DE, Bassett R, Boss RD, Brasel KJ, Campbell M, Nelson JE. Integrating palliative care in the surgical and trauma intensive care unit: a report from the Improving Palliative Care in the Intensive Care Unit (IPAL-ICU) Project Advisory board and the Center to Advance Palliative Care. *Critical Care Medicine* 2012;40(4):1199-1206.
- Multz AS, Chalfin DB, Samson IM, Dantzker DR, Fein AM, Steinberg HN, Niederman MS, Scharf SM. A “closed” medical intensive care unit (MICU) improves resource utilization when compared with an “open” MICU. *American Journal of Respiratory and Critical Care Medicine* 1998;157(5 Pt 1):1468-1473.
- National Hospice and Palliative Care Organization. History of Hospice Care. <http://www.nhpco.org/history-hospice-care>. Accessed February 21, 2015.

- Nelson JE, Cortez TB, Curtis JR, Lustbader DR, Mosenthal AC, Mulkerin C, Ray DE, Bassett R, Boss RD, Brasel KJ, Campbell ML, Weissman DE, Puntillo KA, The IPAL-ICU Project. Integrating palliative care in the ICU: The nurse in a leading role. *Journal of Hospice and Palliative Nursing* 2011;13(2):89-94.
- Norton SA, Hogan LA, Holloway RG, Temkin-Greener H, Buckley MJ, Quill TE. Proactive palliative care in the medical intensive care unit: Effects on length of stay for selected high-risk patients. *Critical Care Medicine* 2007;35(6):1530—1535.
- Physician Orders for Life-Sustaining Treatment. History of POLST. <http://www.polst.org/about-the-national-polst-paradigm/history/>. Accessed on March 6, 2015.
- Radwany S, Mason H, Clarke JS, Clough L, Sims L, Albanese T. Optimizing the success of a palliative care consult service: how to average over 110 consults per month. *Journal of Pain and Symptom Management* 2009;37(5):873-883.
- Richmond C. Dame Cicely Saunders. *British Medical Journal* 2005;331(7510):238.
- Rome RB, Luminais HH, Bourgeois DA, Blais CM. The role of palliative care at the end of life. *Ochsner Journal* 2011;11(4):348-352.
- Sabatino CP. Advance directives and advance care planning: legal and policy issues. U.S. Department of Health and Human Services. <http://aspe.hhs.gov/daltcp/reports/2007/adacplpi.htm>. Accessed March 5, 2015.
- Schmidt TA, Hickman SE, Tolle SW, Brooks HS. The Physician Orders for Life-Sustaining Treatment program: Oregon emergency medical technicians' practical experiences and attitudes. *Journal of the American Geriatrics Society* 2004 Sep; 52(9):1430-4.
- Schneiderman LJ, Gilmer T, Teetzel HD. Impact of ethics consultations in the intensive care setting: a randomized, controlled trial. *Critical Care Medicine* 2000;28(12):3920-3924.
- Schneiderman LJ, Gilmer T, Teetzel HD. Impact of ethics consultations in the intensive care setting: a randomized, controlled trial. *Critical Care Medicine* 2000;28(12):3920-3924.
- Selecty PA, Eliasson AH, Hall RI, Schneider RF, Varkey B, McCaffree DR, American College of Chest Physicians. Palliative and end-of-life care for patients with cardiopulmonary diseases: American College of Chest Physicians position statement. *CHEST* 2005;128:3599–3610.

- Sepulveda C, Marlin A, Yoshida T, Ullrich A. Palliative care: the World Health Organization's global perspective. *Journal of Pain and Symptom management* 2002;24(2): 91-96.
- Sihra L, Harris M, O'Reardon C. Using the improving palliative care in the intensive care unit (IPAL-ICU) project to promote palliative care consultation. *Journal of Pain and Symptom Management* 2011;42(5):672-675.
- Smith TJ, Coyne P, Cassel B, Penberthy L, Hopson A, Hager MA. A high-volume specialist palliative care unit and team may reduce in-hospital end of life care costs. *Journal of Palliative Medicine* 2003;6(5):699-705.
- Steiber SR. Right to die: public balks at deciding for others. *Hospitals* 1987; 61(5):72.
- SUPPORT Principal Investigators: A controlled trial to improve care for seriously ill hospitalized patients. The study to understand prognoses and preferences for outcomes and risks of treatments (SUPPORT). *The Journal of the American Medical Association* 1995;274:1591-1598.
- Temel JS, Greer JA, Muzikansky A, Gallagher ER, Admane S, Jackson VA, Dahlin CM, Blinderman CD, Jacobsen J, Pirl WF, Billings JA, Lynch TJ. Early palliative care for patients with metastatic non-small-cell lung cancer. *New England Journal of Medicine* 2010;363(8).
- Teno JM, Clarridge BR, Casey V, Welch LC, Wetle T, Shield R, Mor V. Family perspectives on end-of-life care at the last place of care. *The Journal of the American Medical Association* 2004;291(1):88-93.
- Tolle SW, Tilden VP, Nelson CA, Dunn PM. A prospective study of the efficacy of the physician order form for life-sustaining treatment. *Journal of the American Geriatrics Society* 1998 Sep; 46(9):1097-102.
- Trout A, Kirsh KL, Peppin JF. Development and implementation of a palliative care consultation tool. *Palliative and Support Care* 2012;10(3):171-175.
- Truog RD, Campbell ML, Randall CJ, Haas CE, Luce JM, Rubenfeld GD, Rushton CH, Kaufman DC. Recommendations for end-of-life care in the intensive care unit: a consensus statement by the American College of Critical Care Medicine. *Critical Care Medicine* 2008;36(3):953-963.
- University of California Center to Advance Palliative Care Consensus Report private communication (2014).
- University of California Hospital Consensus Report private communication (2014).

- Villarreal D, Restrepo MI, Healy J, Howard B, Tidwell J, Ross J, Hartronft S, Jawad M, Sanchez-Reilly S, Reed K, Espinoza Se. A model for increasing palliative care in the intensive care unit: enhancing interprofessional consultation rates and communication. *Journal of Pain and Symptom Management* 2011;42(5):676-679.
- Walling AM, Asch SM, Lorenz KA, Roth CP, Barry T, Kahn KL, Wenger NS. The quality of care provided to hospitalized patients at the end of life. *Archives of Internal Medicine* 2010;170(12):1057-1063.
- Wheatley VJ, Baker JI. "Please, I want to go home": ethical issues raised when considering choice of place of care in palliative care. *Postgraduate Medical Journal* 2007;83(984):643-648.
- Wilkinson AW, Wenger N, Shugarman LR. U.S. Department of Health and Human Services. Literature Review on Advance Directives. <http://aspe.hhs.gov/daltcp/reports/2007/advdirlr.htm>. Accessed March 5, 2015.
- Wilkinson EK, Salisbury C, Bosanquet N, Franks PJ, Kite S, Lorentzon M, Naysmith A. Patient and carer preference for, and satisfaction with, specialist models of palliative care: A systematic literature review. *Palliative Medicine* 1999;13:197-218.
- World Health Organization. WHO Definition of Palliative Care. <http://www.who.int/cancer/palliative/definition/en/>. Accessed on February 21, 2015.

CURRICULUM VITAE

JONATHAN WU

3811 Magnolia St. | Irvine, CA 92606
Year of Birth: 1989 | 949-419-4986 | jonw@bu.edu

EDUCATION

Boston University School of Medicine – Division of Graduate Medical Sciences
Master of Science, Medical Sciences, May 2015

Boston University School of Public Health
Master of Public Health, Epidemiology, May 2015

University of California, Irvine
Bachelor of Science, Biological Sciences, June 2012

University of Sussex, United Kingdom, England
Study Abroad, Physics, Summer 2011

ACTIVITIES AND AWARDS

- Publicity Chair Assistant and Social Chair, Habitat for Humanity of Orange County at UC Irvine.
- Phi Alpha Mu National Honor Society in Social and Behavioral Sciences.
- Psi Beta National Honor Society in Psychology.
- Integrative Medicine Education Certificate from UC Irvine School of Medicine.

EXPERIENCE

UC Irvine Medical Center, Orange, CA August 2014 – Present
Junior Research Specialist

- Collect data and run analysis on SAS for a clinical improvement research project on palliative care in the ICU.
 - Discovered that a proactive intervention to palliative care leads patients receiving consultations 33% sooner. Consequently, patients often receive better care during the stay – will be published.

- Recruit heart failure patients to a clinical research project.
 - Collect data and run analysis to examine the impact on the integration of cardiology and palliative care and how it may potentially lead to an improvement in the quality of life, symptom burden, and psychosocial outcomes – will be published.
- Consent, screen, and qualitatively interview patients to ensure the appropriate patients are enrolled in the research study while being IRB compliant.
- Completed a systematic review on the association between antiretroviral therapy (ART) use and congenital anomalies in infants born to HIV-infected pregnant women – will be published.

Boston Medical Center, Boston, MA

February – May 2014

Volunteer in the Department of Geriatrics Visiting Services

- Visited elderly patients from low-income communities and disadvantaged backgrounds weekly during their stay at the hospital.
- Improved quality of life and reduced the burden of hospitalized patients by providing comfort and emotional support.

UC Irvine Medical Center, Orange, CA

June – Aug 2013

Junior Research Specialist

- Completed and submitted the protocol narrative to the IRB.
- Collected data on the practice of stethoscope hygiene at an academic hospital and suggested an intervention to improve awareness – publication pending.
- Submitted a research abstract to the Society of Hospital Medicine and presented at the annual meeting to increase awareness of the importance of stethoscope hygiene to clinicians and the community.

Boston University School of Public Health, Boston, MA

January – May 2013

Public Health Core Course Tutor

- Tutored incoming MPH students the required core courses and provided a better understanding of the material by thoroughly explaining the concepts of each class.

Orange Coast College, Costa Mesa, CA

Sept – Dec 2011

Teaching Assistant, General Chemistry Lab

- Provided assistance to a professor in a Chemistry laboratory class of 28 undergraduates and proctored for examinations.
- Assisted students with assignments and various questions about chemistry lectures and experiments, effectively adding creative input to lesson plans.

Cosmetic Plastic Surgery Institute, Laguna Beach, CA

Jan 2011 – 2012

Intern

- Shadowed plastic surgeon in the operating room.
- Assisted plastic surgeon in publishing journal articles on new findings in an effective and efficient manner.

UC Irvine Medical Center, Geriatrics, Orange, CA

June 2010 – March 2011

Research Assistant and Intern

- Visited and conducted interviews with elderly patients with dementia and multiple sclerosis to obtain a better understanding of the physical, psychological, and emotional relationship between patients and their caregivers and the potential for neglect.
- Attended monthly LEAD panel (Longitudinal, Experts, All Data) meetings with geriatricians and public health workers at the forensic center and provided input from the collected data from patient visits.
- Assisted in completing various projects assigned by principal investigator.

UC Irvine Medical Center, Orange, CA

June 2008 – Sept 2009

Volunteer, Emergency Department

- Restocked materials for doctors and nurses while filing patient applications confidentially.
- Helped transfer patients to different departments, while providing assistance to technicians working in surgical rooms.

PUBLICATIONS AND PRESENTATION

- Pending – Jenkins I, Monash B, Wu J, Amin A. The Third Hand: Low Rates of Stethoscope Hygiene on General Medical Services. *Journal of Hospital Medicine*.
- Abstract – Amin A, Wu J.; Practice of Stethoscope Hygiene in a University Based Academic Medical Center [Abstract]. *Journal of Hospital Medicine* 9 Supplement 2:76.
- Will be published – Systematic Review on Antiretroviral Therapy (ART) Use in HIV-Infected Pregnant Women and Their Infant's Risk of Congenital Anomalies.
- Will be published – Proactive Palliative Care in the Intensive Care Units of an Academic Hospital.
- Presented at the Society of Hospital Medicine Annual Meeting in 2014 in Las Vegas, Nevada.