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Impact of Pulmonary Embolism Response Teams on Patient Quality Ratings

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This is to certify that the doctoral study by

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Walden University
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Abstract

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MSN, Walden University, 2012

BS, Lander College, 1996

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

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Abstract

Leaders of health care organizations have limited evidence of the impact of pulmonary embolism response teams (PERTs) on quality outcomes for patients with an intermediate and high-risk pulmonary embolism (PE). The purpose of this quantitative study was to determine whether there was any significant difference in patient HCAHPS linear mean scores for instructions given about medication and overall care between acute care hospitals with and without PERT teams. Donabedian's framework for assessing health care quality was used as the theoretical foundation for this research. Survey data collected by the Centers for Medicare and Medicaid, as part of its Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), were analyzed to determine the impact PERT-designated acute care hospitals have on patient experience; the HCAHPS domains that were evaluated were information given to patients regarding medications and the patient's overall experience of care. Results of independent sample *t*-tests indicated that PERTs significantly affected communication about medication scores and a hospital's overall rating of care. The findings confirm that PERTs have a positive effect on hospital quality measures. The study may contribute to positive social change by providing health care administrators an option for improving the treatment plan for PE and providing high-quality care to meet the needs of patients with this diagnosis.

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Dedication

I dedicate this doctoral study to the memory of my beloved mother, Louise Carter Simpkins. She received her angel wings while encouraging me on this journey and inspiring me to never give up. My late father, Thomas James Simpkins, was the best dad and role model a little girl growing up in the South could ever have. The cornerstone for this doctoral study is the love of my life, the late Tracy Fleming Morris, SFC-R, who died from a pulmonary embolism in 2014 after back surgery resulting from injuries sustained in the 82nd Airborne. Thank you for your ultimate sacrifice.

Acknowledgments

First, I honor my Lord and Savior, Jesus Christ. I want to thank my chair, Dr. Robin Carlson, and other committee members, Dr. Jimmy Melancon and Dr. Kristen Wiginton, for their support during this journey. A special thank you to the PERT Consortium for all the dedication and commitment you bring to the field of study of pulmonary embolism management. My brother, Derrick Lamont Simpkins, thank you for filling in where Mom left off; I love you dearly.

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Section 1: Foundation of the Study

Pulmonary embolism (PE), a blood clot that blocks blood flow to the artery of the lungs, can be a terminal diagnosis. The Centers for Disease Control and Prevention (CDC, 2022) estimated that 1 in 4 hospitalized patients will die from PE as an in-hospital death (see also Ortel et al., 2020). PE contributes to an estimated 100,000 deaths yearly in the United States (Ortel et al., 2020; Turetz et al., 2018).

Despite this substantial public health burden, no systematic PE-related morbidity and mortality data collection exists in the United States, based on my research. The available information about disease prevalence and incidence is from estimates on

population-based epidemiologic studies, analysis of hospital discharge medical records, or health insurance claims databases (Barco et al., 2021). Researchers have shown that the diagnosis of PE lacks reporting as the underlying cause of death in cases accompanied by other admission illnesses, such as cancer, pregnancy, or postoperative complications (Barco et al., 2021; Farmakis et al., 2022). The limited scope of surveillance makes it challenging to report on mortality rates related to PE.

As part of efforts to focus on prompt recognition and early intervention for PE management, hospital administrators are focusing on interventions that optimize high-quality outcomes. One strategy for attaining that goal is the use of specialized pulmonary embolism response teams (PERTs) to manage PE in the hospital setting. The PERT concept originated in 2012 following the advent of practices like rapid response teams (Porres-Aguilar et al., 2021). Unlike rapid response teams, PERTs feature a multidisciplinary approach. The multidisciplinary approach delivers patient-centered care

that incorporates all disciplines for a broader holistic approach to the treatment plan for each patient (Schultz et al., 2019). For example, the care plan for a cancer patient with PE differs from that for a pregnant patient with PE, as evidenced by a hematologist in one case and an obstetrician in the other. The multidisciplinary approach builds upon a patient-centered care plan, sometimes incorporating the patient's input in decision-making (Rosovsky, Zhao, et al., 2019).

The quality of PERT outcomes from the patient's perspective remains unknown, however this study evaluated the patient's experience in acute care hospitals with and without the multidisciplinary approach from the PERT model. The outcomes from the study can improve quality outcomes for future patients diagnosed with PE. The patient's perception and understanding of care, as measured by the Centers for Medicare and Medicaid's (CMS') Hospital Consumer Assessment Provider Survey (HCAHPS), could assist hospital administrators in improving quality outcomes in the management of PE.

Patient satisfaction comes from addressing a patient's primary concerns. Patient-centered care aligns with patient values, preferences, and satisfaction levels (Ziemba et al., 2019). The need for more research on patient values and priorities for PE treatment in the hospital setting remains evident due to the lack of standardized surveillance of mortality reporting (Swarup et al., 2021). The HCAHPS provides a standardized assessment of the patients' perceptions of care received in the hospital setting. The HCAHPS consists of composite and global measure questions. I selected composite questions for evaluation at the direct level of patient care, whereas the global items address the overall patient experience with the hospital.

In this study, I sought to bridge a gap currently identified in the literature regarding patients' perceptions of care related to PE treatment. In this study, I focused on PERT-designated hospitals and their impact on HCAHPS linear mean scores. The research questions (RQs) I sought to answer were about patients' understanding of medications (composite measure) and perception of overall care rating (global measure). Together, the two questions provide insight on the effectiveness of the multidisciplinary approach disseminated by the PERT in PE management in the acute care hospital setting. This section includes the background, problem, and purpose statements, RQs and hypotheses, theoretical framework, nature of the study, definitions of key terms, assumptions, limitations, scope and delimitations, and significance.

Background

In 2008, the U.S. Surgeon General launched a call to action as PE became the third leading cause of cardiac death following myocardial infarction and strokes in the United States. Health care administrators were encouraged in the call to action to implement quality improvement initiatives within their health care system that would promote optimal outcomes and capture reimbursement incentives for reducing the high mortality associated with this diagnosis. Unfortunately, since the 2008 call to action, new PE cases have steadily increased in the United States. An estimated 900,000 people in the United States are diagnosed yearly (CDC, 2022). Among those yearly diagnoses, 60,000–100,000 cases will result in death from the diagnosis (Porres-Aguilar et al., 2021). Fourteen years after the Surgeon's General call to action, there was a need for data on the

effectiveness of resources for managing and decreasing the diagnosis of PE and improving hospital performance ratings.

Patient experience is an essential dimension in the quality of health care. The focus of PERTs has begun to include the patient and family in the treatment plan, allowing the patient's voice to provide input to the multidisciplinary team. Even though the founders of the original PERT model at Massachusetts General Hospital (MGH) included the patient and their family in shared decision-making, there still needs to be a greater understanding of how their involvement improves the patient experience and satisfaction with delivered care (Rosovsky et al., 2018). The HCAHPS survey for inpatients focuses on the patient's perception and ways quality of care can improve in the hospital setting (Ziemba et al., 2019). This doctoral study provides insight on the impact of PERT on patients' understanding of medication information and their overall perception of care, as measured by HCAHPS. The results could bridge a knowledge gap currently missing in the literature.

In this study, I used Donabedian's conceptual framework for assessing health care quality to examine the structure of PERT. To measure the outcomes, I used the HCAHPS linear mean scores, which are used to determine star ratings. The two domains I assessed for this study were communication about medications (composite domain) and overall hospital rating (global domain). The two domains provide quantifiable insight into patients' perception of care, which indicates the value a multidisciplinary approach PERT brings to the bedside. The results could support positive social change by providing

evidence of how PERT contributes to the overall quality of performance in the management of PE care.

Problem Statement

The diagnosis of PE is steadily increasing in the United States. Before the COVID-19 pandemic, the National Quality Forum, using data from U.S. health care claims, predicted that PE cases could approximately double, from 950,000 cases seen in 2006 to 1.82 million in 2050 (Choudhury & Khuda-Buksh, 2020). The COVID-19 pandemic has since added to the health care burden by increasing the percentage of patients admitted to U.S. hospital intensive care units from 16.5% to 24.7% (Tsao et al., 2022). As options for treatment evolve, health care administrators have not identified an optimal approach to managing a PE diagnosis.

Specialized response teams are beginning to merge a multidisciplinary approach centered on the patient. PERT implementation in acute care hospitals provides rapid consultation and expert consensus with experienced specialists in care management for patients with PE (Porres-Aguilar et al., 2018). The multidisciplinary approach of PERT brings multiple specialists to the team, enhancing a patient-centered care plan in real-time. The real-time concept refers to all consultative specialists discussing the case at the activation time (Porres-Aguilar et al., 2018). The PERT can respond to a patient experiencing PE with other underlying conditions, such as pregnancy or cancer. A real-time concept allows team members to discuss and decide on interventions during activation. The primary intervention focuses on the team utilization of anticoagulation medications. The patient’s understanding and comprehension of their medication therapy

are crucial. The most common recommendation by PERT includes implementing anticoagulation therapy in hospitals and upon discharge (Kuhrau et al., 2022). However, there remains a lack of evidence of how knowledge of the patient experience and overall satisfaction with care may improve the quality of care in interventions for PE management. This study could bridge a gap by providing data on the measurement of quality outcomes related to patients' understanding of information received about medication and their overall perception of care.

Purpose of the Study

The purpose of this quantitative study was to determine whether there is any significant difference in patient HCAHPS linear mean scores for instructions given about medication and overall care between acute care hospitals with and without PERT teams. The independent variable was PERT and non-PERT-designated acute care hospitals. The descriptive characteristics of the hospitals included bed size, ownership, location, and teaching status. The dependent variables were the patient's perception of information about medication linear score rating (composite domain) and the overall perceptions of care linear score rating (global domain). The HCAHPS means linear scores are what CMS uses to predict the calculation of the hospital star values (HCAHPS, 2021).

Research Questions and Hypotheses

The RQs and hypotheses for this quantitative study were

RQ1: Is there a significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams?

$H_0$1: There is no significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

H_a1: There is a significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

RQ2: Is there a significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams?

$H_0$2: There is no significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

H_a2: There is a significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

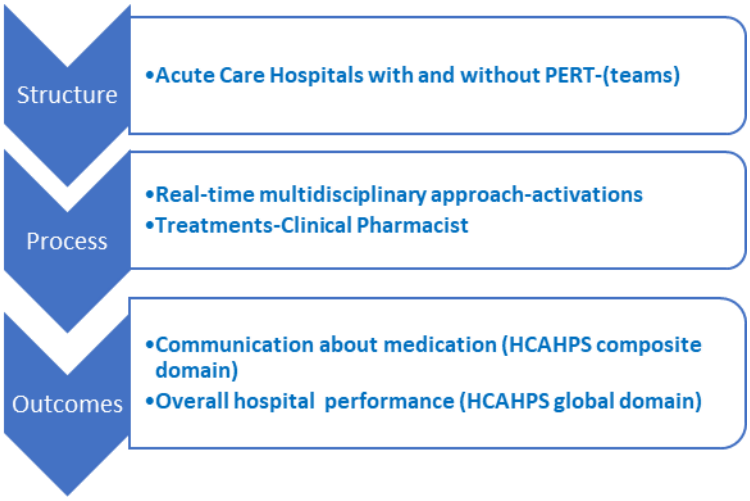
Theoretical Foundation

The Donabedian quality framework, which originated in 1966, was the theoretical framework for this study. Donabedian's (1966/2005) conceptual model provides a framework for examining health services and evaluating health care quality. The model emphasizes that structure drives processes that drive outcomes. Pelletier and Beaudin (2018) defined the three components of Donabedian's framework as the resource state (structure), resources available for care delivery (process), and the resources between

practitioners and patients(outcome). Figure 1 explains the framework's original structure and how it relates to the variables in this study. In this study, acute care hospitals with the PERT model in place constituted the structure. The delivery of the multidisciplinary approach utilizing specialists and clinical pharmacists in real-time activation was the process. The measured outcome was the HCAHPS survey mean linear score ratings.

Figure 1

Donabedian's Framework



Note. The figure defines variables for the structure and outcomes used in this study. I based the work on Donabedian (1966/2005).

Nature of the Study

As part of the study's quantitative design, I used the independent sample *t*-test to statistically analyze data. My research focus was on assessing the impact of (a) patients' understanding of the information given about medication and (b) patients' overall care rating. The PERT model incorporates a clinical pharmacist as oversight to ensure that the dosing of different drugs, such as thrombolytic and anticoagulants, is appropriate and

adequate (Groth et al., 2022). The composite domain of patients' understanding of the information given about medication was selected to provide an assessment of the impact the role of the pharmacy discipline brings to the PERT. The global domain of overall care rating was selected as an additional assessment to provide administrators insight into PERT's effects on value-based care. The independent variable in the study was hospitals with and without a PERT. The dependent variables were patients' understanding of the information given about medication and overall care rating. The dependent variables represented the patients' understanding and perception of care delivered by a specialized multidisciplinary response team (PERT). The secondary data came from the HCAHPS survey instrument. The period reviewed was from January 1, 2019, to December 31, 2019. I analyzed two domains, communication about medications and overall care ratings.

I selected the *t*-test application for this study because it allows a comparison of means between two unrelated groups using random selection (Muijs, 2011). The *t*-test was used to answer both RQs. Hospitals with PERT were identified from the consortium's website (as listed in Appendix A). I selected hospitals within the United States for both the PERT and non-PERT sites of care.

Literature Search Strategy

I searched multiple discipline-related databases, including CINAHL, Science Direct, Medline, ProQuest Health, PubMed, and Sage Knowledge. The Google Scholar search engine helped with article research and review. I used the following key terms in my initial searches: *response teams*, *pulmonary embolus*, *hospital quality measures*,

pulmonary embolus response teams, and *patient experience.* The keywords expanded to include *HCAHPS, Donabedian, hospital outcomes, performance measures, overall hospital ratings,* and *multidisciplinary team approach.* The time frame encompassed articles from peer-reviewed journals that were published between 2018 and 2022. My study includes 75 references, of which 60 are peer-reviewed journals and published within five years of my expected graduation. References included journal articles, government websites, and textbooks.

Literature Review Related to Key Variables and/or Concepts

Hospitals worldwide are adopting PERTs to treat PE. PE teams have developed outside the United States, extending to Asia and Europe. The PERT model offers an approach for expediting and streamlining care for the management of PE (Hobohm et al., 2010). There is no exact blueprint for a PERT, and team structure variations depend on the institutional demographics and stakeholders' interests (Hobohm et al., 2010; Root et al., 2017). The lack of standardization among each PERT makes it challenging to benchmark best practices.

The PERT model builds on practices like rapid response teams. The approach of rapid response teams—to respond rapidly and prevent further deterioration in cardiac emergencies—is the same concept seen in PERTs (Root, et al., 2017). By using PERTs, health care leaders aim to coordinate and expedite a treatment plan for PE using a multidisciplinary approach in real-time (Channick, 2021; Rosovsky, Zhao, et al., 2019). The approach makes the management of PE patient centered.

A patient-centered approach focuses on an individualized plan of care. Therefore, the voice of the customer becomes a vital aspect to consider in delivering health care management. Patient satisfaction has been evaluated as a component of health care quality for over 30 years through the widespread use of patient satisfaction surveys and promotion by CMS (Krueger et al., 2021). Measuring patient satisfaction has become a fundamental requirement for accreditation and reimbursement agencies. Implementing PERT could significantly improve financial incentives for health care system reimbursement.

Currently, most research centered around PERT has focused on outcomes addressing mortality rates, length of stay days, and advanced therapy as treatment options for PE management. Some hospitals reported no change in these outcomes, while others have seen a significant improvement, ranging from 20% to 40% mortality rate improvement and a decrease of 50% in length of stay days (Channick, 2021; Peacock & Singer, 2019). However, there seems to be consensus on the recommendations for advanced therapy. The options are anticoagulation therapy, either as a single approach or accompanied by surgical interventions, i.e., catheter-directed thrombolysis and surgical thrombectomy (Porres-Aguilar et al., 2018). The reporting of how PERT impacts the patient's perception remains underreported in the literature. This study will bring a body of knowledge currently lacking for health care administrators managing PE care.

Pulmonary Embolism

A PE is a blood clot that develops in the lungs. The prompt recognition for diagnosing PE is crucial in approximately 5% to 10% of in-hospital deaths directly

resulting from PE (Turetz et al., 2018). The symptoms range from no signs to shortness of breath or chest pain (Schultz et al., 2019). A patient's symptoms can classify their PE type.

The literature identified three types of PE: low-, intermediate-, and high-risk. PERT provides interventions for intermediate- and high-risk PE. High-risk PE, or massive PE, carries the highest mortality rate, exceeding 50% (Channick, 2021; Porres-Aguilar et al., 2018). A high-risk PE is hemodynamically unstable, often leading to cardiogenic shock or cardiac arrest (Myc et al., 2020; Porres-Aguilar et al., 2018). In clinical practice, this patient will have persistently low blood pressure. The intermediate PE, sometimes called submassive, describes patients with evidence of right-side heart damage but normal blood pressure (Piazza, 2020). The European Society of Cardiology guidelines suggest dividing intermediate-risk PE into intermediate high-risk and intermediate low-risk (Pores-Aguilar et al., 2018). The differentiation involves the detection of right ventricular strain identified on imaging (Pores-Aguilar et al., 2018).

Several risk factors predispose a patient to develop PE. Postoperative patients, cancer patients, obstetrical patients, coronavirus patients, or patients who have traveled either via car or plane for an extended time have high predisposition risk factors for developing PE (Rivera-Lebron et al., 2021; Rosovsky et al., 2020). Specialty providers treating these predispositions include surgeons, obstetricians, hematologists, or internal medicine. The diverse population for PE occurrence makes it crucial to implement a care plan from a multidisciplinary approach.

Pulmonary Embolism and COVID-19

The COVID-19 pandemic changed the care plan for PE management in health care. After January 2020, the mortality rate, length of stay, and readmission rates became distorted due to COVID-19. The care plan for non-PERT PE cases changed in practice (Finn et al.,2021; Kwok et al., 2021). A single-center study examined PERT consultation requests from March 1, 2020, through April 30, 2020, and found that 2020 PERT consults were 2.8 times more common in 2019 (Kwok et al., 2021). There were higher frequencies of in-hospital mortality and more cases of reported PE during the pandemic, with fewer PERT activations during the COVID-19 period (Finn et al., 2021; Kwok et al., 2021). PERT teams expressed concerns that the pandemic changed routine medical management related to PE. The rate of PERT activation decreased. The cases treated included younger patients with fewer comorbidities than those routinely seen in the PE population (Kwok et al.,2021; Rosovsky et al., 2020). In 2022, with the resurgence of COVID-19 cases, the PERT community hospitals have continued to press forward to provide high-quality care in treating PE in this population.

The PERT research community, known as the PERT Consortium, launched a COVID-19 PE registry in April 2020 to trend treatment interventions during the pandemic. The COVID-19 PE registry will provide expedient public reporting of aggregate data on the clinical characteristics and outcomes of patients with COVID-19 and PE to facilitate clinical decision-making and allocate resources (Kwok et al., 2021; Rosovsky et al., 2020). The registry addresses the urgent need to rapidly collect and disseminate information about patients with COVID-19 and PE, given that both

conditions carry high morbidity and mortality rates (Rosovsky et al., 2020). The outcomes and findings reported by the registry may provide insight to health care administrators on how PERT can further enhance the quality of care within their institution.

Pulmonary Embolism Response Teams

The treatment for PE remains non-standardized in the clinical setting. The lack of structured recommendations makes treatment options vary among health care organizations. The American Heart Association provides rapid standardization for heart attacks and strokes as algorithms for rapid response teams to utilize universally in health care institutions. However, the American Heart Association acknowledges a gap in the 2020 guidelines for treating adult resuscitation efforts in patients with cardiac arrest due to suspected PE who could benefit from emergency thrombolysis during resuscitation (Merchant et al., 2020). Like the American Heart Association, the European Society of Cardiology and the American College of Chest Physicians lack specificity in recommendations for advanced treatment strategies for managing PE (Porres-Aguilar et al., 2018).

The lack of direction in care coordination for PE led to the development of a response team to treat PE. Researchers credit the PERT for the stratification and algorithm approach for treating PE (Wright et al., 2021; Xenos et al., 2019). The stratification and algorithm process in hospitals with an identified PERT occur in practice with some similarity to the following steps (Bejjani et al., 2022; Wright et al., 2021):

- Patient requiring consultation is identified.

- Patient is evaluated, triaged, and stratified by a PE response team member (stratification includes low-, intermediate-, or high-risk). Many low-risk patients are either treated as outpatients or discharged home from the emergency department (Kabrhel et al., 2021).
- The team holds a teleconference or videoconference to decide the optimal therapeutic approach according to guidelines and expert consensus (a real-time approach).

Leaders at MGH developed the first response team with physicians in 2012 to guide treating PE. The response team was called PERT. MGH recognized that in addition to a prompt rapid response to manage PE, there was also a need to treat patients who developed the diagnosis as risk factors from surgery, pregnancy, cancer, and other pre-indicators. The recognition of a real-time treatment plan with multiple specialties became their focus. The hospital developed the first multidisciplinary response team to proactively diagnose and treat pulmonary emboli (Hobohm et al., 2010; Root et al., 2018). The PERT approach has grown globally in China, Singapore, and Poland. The European Society of Cardiology, European Association for Cardiothoracic Surgery, American College of Cardiology, and American Heart Association have promoted this multidisciplinary approach to significantly enhance care for patients with complex PE (Fanola et al., 2019).

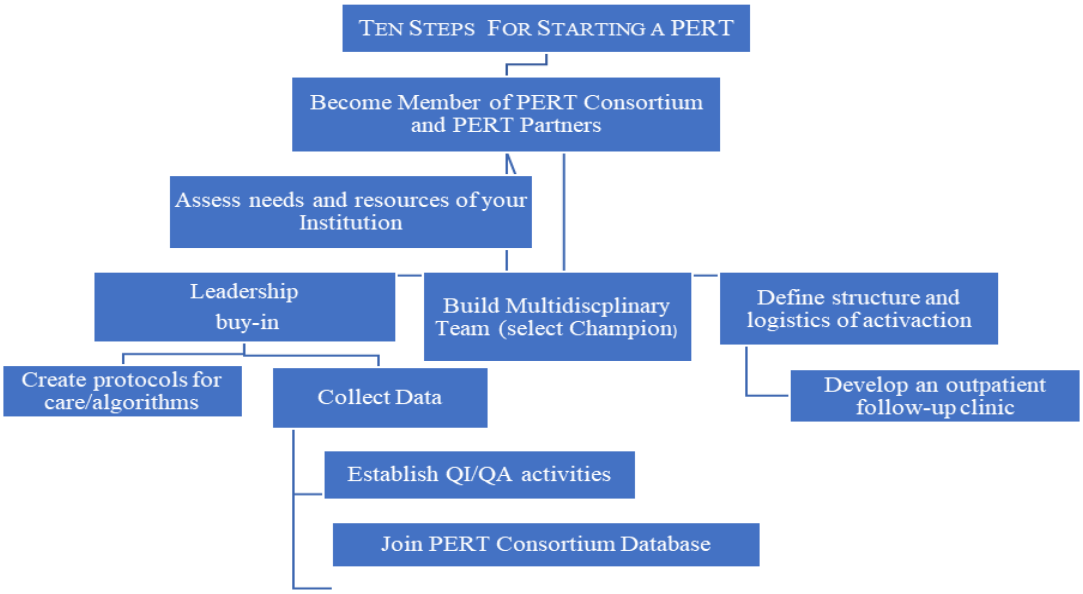
The optimal membership of a PERT remains unknown and varies by institution. The team's members can include critical care, pulmonary, internal medicine, emergency medicine, cardiology, interventional radiology, cardiac surgery, hematology, and

pharmacy (Rosovsky, Chang et al., 2019). Each area has a specific function in the management of PE and plays an integral role in the team. As seen in high-risk populations, i.e., pregnancy, cancer, and operative patients, an obstetrician, hematologist, or surgeon may be consulted for the underlying condition. However, the admitting physician may be the patient's primary care or internal medicine provider working with a consulted pulmonologist, surgeon, or interventionalist radiologist.

There are many ways to create a PERT, and the organization and structure of each one largely depends on the institution's resources, its members' interests, and the community's clinical demands (Rosovsky, Zhao et al., 2019; Xenos et al., 2019). Figure 2 shows a recommended outline of what researchers at MGH and the PERT Consortium recommend at the implementation's start.

Figure 2

Steps for Starting a Pulmonary Embolism Response Team (PERT)



Note. I created this figure from information provided by Dr. Rachel Rosovsky (personal communication, September 29, 2022, at the 8th Annual PERT Symposium)

The number of members on the team may start small and increase in size as the patient's history becomes solidified. Most PERTs begin with the inclusion of an emergency department physician since this is the most frequent location of the initial diagnosis. The emergency department provider will collaborate with a radiologist, perhaps an interventionalist, to confirm the diagnosis of PE through obtained images. As the treatment approach expands, so may the consulting members.

Facilities with established PERTs have participated in studies to show how variations of team members contribute to the multidisciplinary approach—a survey

across eight teaching facilities detailing which providers participated in their PERT activations. The emergency department provider was at the forefront for 59% of the activations, followed by ICU intensivists at 16.5% for PE diagnosed in critical care units, and 10.5% included hospitalists for cases diagnosed in the medical surgical units (Schultz et al., 2019). After the PE diagnosis is confirmed or highly suspected, the treatment plan is individualized to meet the patient's needs (Rosovsky et al., 2020). Ultimately, the provider who covers most of the patient care and is with the patient at the end of the day has the decision-making capacity to bring in as many disciplines as they feel will be the most beneficial to the patient's care plan (Secemsky, 2022). The consultation-as-needed approach optimizes consensus among the team.

Activations. Health care organizations' activations vary among PERT facilities. The ability to organize and activate a PERT can occur in large, urban, rural, teaching, and non-teaching facilities. For larger institutions, such as MGH, activations and consultations occur in real-time and are initiated by a PERT fellow (Rosovsky et al., 2020). The diagnosing physician calls a 24-hr hotline, which notifies the PERT fellow on call. The fellow will perform the initial patient evaluation with the direct involvement of an attending physician. The two decide whether to activate a broader team. If so, every specialist on the team receives a page for real-time review. The team reviews each patient's clinical course and images, sometimes allowing the patient or family members on the call.

To better fit the needs of their organizations, different hospitals have developed PERT activations that differ from MGH's version. The University of Virginia established

a call center to assist with implementing its PERT (Myc et al., 2020). In New York, NYU alerts the entire team upfront and minimizes team members following an initial consult. The NYU PERT is uniquely focused on the early activation of the whole team for all consults. Referring clinicians call the 24/7 call center at 4PERT (or 844-NYU PERT), which automatically texts and calls the interventional radiology attending, critical care attending, and cardiac surgery attending on call. The referring clinician presents the case directly to all the specialists and gets rapid initial feedback (Root et al., 2018).

PERT activations extended to the West Coast. In Los Angeles, Cedars-Sinai Medical Center's PERT members include pulmonary and critical care clinicians, interventional cardiology, interventional radiology, and cardiac surgery (Root et al., 2018). The PERT activation occurs by dialing 3-CLOT from any hospital phone. If needed, the provider immediately contacts the pulmonary critical care fellow to decide on advanced treatment options (Root et al., 2018). For rural facilities without a robust PERT, the opportunity to initiate an interfacility transfer is becoming the endorsed recommendation (Rosovsky et al., 2020).

Function. A PERT's function rapidly identifies and treats PE utilizing a multidisciplinary approach. Transferring to a larger facility with a robust PERT may be the best treatment option for those with limited resources. The interfacility transfer promotes optimal function among those institutions without a robust PERT (Rosovsky et al., 2018). Realizing that all PERT are not created equal in the acute care setting, the PERT Consortium endorsed the interhospital facility transfer initiative. As seen with patients diagnosed with acute heart attacks and strokes, transfer to other facilities expands

access to care. The interfacility transfer initiative allows centers without access to advanced treatment options for PE to be transported to facilities with broader multidisciplinary options and access to interventional modalities (Rali et al., 2021). Health care leaders' buy-in depends on how the functions of PERT improve hospital outcomes. The data for PERT outcomes are reported regarding mortality rate, length of stay, and medication management.

Mortality Rates. In-hospital mortality rates from PE vary between institutions. The diagnosis of PE in a hospital setting has an estimated mortality rate of 48% (Rosovsky et al., 2018). In 2019, the Cleveland Clinic conducted a study that reported a significant improvement in the 30-day mortality rate after implementing a PERT (Choudhury & Khuda-Bukhsh, 2020). The authors included an investigation of 769 patients diagnosed by computed tomography over 3 years. Choudhury and Khuda-Bukhsh (2020) demonstrated a decrease in mortality in the entire cohort (8.5% vs. 4.7%, $P = .03$) and those with intermediate- or high-risk PE (10.0% vs. 5.3% ($P = .02$). In contrast, other hospitals reported no change in their inpatient 30-day mortality rate (Melamed et al., 2020; Wiske et al., 2020). Science indicates that reporting exact hospital mortality rates from PE without institutional reviews and retrospective chart studies is challenging (Barco et al., 2021; Carroll et al., 2020).

Length of Stay. The hospital days of care to manage PE can be lengthy; before PERT activations, inpatient stays ranged from 4 to 10 days (Melamed et al., 2020). Implementing PERT has decreased the length of stay days by half at some institutions (Melamed et al., 2020). The overall mean length of stay for patients treated at Beaumont

Health System with high/immediate-risk PE decreased from 8.2 days to 5 days (p = 0.008). After PERT implementation, the low/immediate-risk PE population significantly reduced from 5 to 3 days (p = 0.05). The length of stay average among other institutions with pre- and post-study time intervals for PERT implementation is like Beaumont Healthcare, ranging from 9.1 versus 6.5 days with significance (p = 0.007) and 4.78 days versus 2.96 days (p = <0.01; Melamed et al., 2020; Wright et al., 2021). Overall, hospitals report a greater significance in reducing the length of stay days compared to other outcomes post-PERT deployment.

Medication Management of Pulmonary Embolism

The medication management for PE is anticoagulant therapy. Anticoagulation has been the preferred treatment approach to PE for decades unless contraindicated (Lentjeens et al., 2017; Rivera-Lebron et al., 2021). Anticoagulation medications aim to prevent thrombus extension, embolization, and formation of new clots. Anticoagulation consists of the administration of the following: unfractionated heparin, low molecular weight heparin, vitamin K antagonists, or direct oral anticoagulants without any additional therapies and systemic thrombolysis referred to the intravenous administration of recombinant tissue plasminogen activator (Kuhrau et al., 2022; Rivera-Lebron et al., 2021). Anticoagulation is the mainstay of PE treatment, both in the in-hospital treatment phase and after discharge (Kuhrau et al., 2022). Therefore, the patient's understanding of the information about this medication is essential to the patient's care plan.

In 2019, The Joint Commission outlined specific recommendations for hospitals' compliance with anticoagulation. The guidance stated that organizations/hospitals must provide the following:

- Education to patients and families on the anticoagulant medication prescribed, including the following: Adherence to medication dose and schedule, the importance of follow-up appointments and laboratory testing (if applicable), potential drug-drug and drug-food interactions, and the potential for adverse drug reactions.
- Approved protocols and evidence-based practice guidelines for initiating and maintaining anticoagulant therapy that addresses medication selection; dosing, including adjustments for age and renal or liver function; drug-drug and drug-food interactions; and other risk factors, as applicable.
- Approved protocols and evidence-based practice guidelines for reversing anticoagulation and managing bleeding events related to each anticoagulant medication.

Hospitals began incorporating pharmacy teams into the care plan to help meet these recommendations. The pharmacy staff remains active in the discharge and outpatient follow-up process for safety and for establishing optimal outcomes to prevent readmission under the 30-day CMS (2021a) rule. The 30-day CMS rule penalizes hospitals by reducing reimbursements for any patient readmitted less than 30 days from the last admission due to any adverse reaction, side effects, improper dosing, or complications from medication management treatment (Kabrhel et al., 2021; van der

Wall et al., 2018). As part of the multidisciplinary approach provided by PERT, the pharmacy participates in real-time activation throughout the entire course of hospitalization.

Researchers credit health care organizations with improved outcomes in medication management by including pharmacy discipline in patient care plans. In 2020, a team of pharmacists at Loyola University conducted a retrospective review of their PERT activations from 2016 to 2018 to characterize anticoagulation prescribing patterns made by their PERT (Kuhrau et al., 2022). A total of 209 patients received anticoagulation therapy on discharge. Of those, 47% received a non-vitamin K oral anticoagulant (like Eliquis), 29% received warfarin (Coumadin), and 23% received low molecular weight heparin (Kuhrau et al., 2022). Including the pharmacy team improves the quality of care and provides optimal outcomes as part of the care plan to minimize side effects and adverse conditions (Konstantinides et al., 2019; Todoran et al., 2018).

A Northern California health care system expanded its pharmacist-led discharge process to assist with their high readmission rates due to medication management (Lee et al., 2022). The lack of patients' understanding of managing medications contributed to 47% of the readmissions within their health care system. Insufficiencies identified were the patient's lack of knowledge of adverse reactions caused by food, drug, and drug interactions and incorrect dosing (Lee et al., 2022). The health care system increased pharmacy staff by adding pharmacy fellows/residents and a remote pharmacy for the post-discharge process. The 30-day readmission rate decreased from 17.5% to 15.5% in the expansion phase ($p = .003$). Lee et al. (2022) concluded that including pharmacy

services helped reduce readmission rates. The multidisciplinary approach implemented by the PERT could offer health care administrators additional resources in The Joint Commission certification and avoid potential penalties imposed by CMS.

Multidisciplinary Approach to Pulmonary Embolism Treatment

A response team with multiple disciplines brings a broader range of expertise to treat PE. The multidisciplinary approach optimizes outcomes in PE management as delivered by the PERT model. The American College of Cardiology and the European Society of Cardiology promote a multidisciplinary, team-based approach to treating complex cardiovascular disease, as seen in PERT (Fanola et al., 2019). The PERT model has raised the standards by which institutions treat and manage PE.

The multidisciplinary approach allows decision-making to be an integral part of the care plan for PE treatment. Such teams engage multiple specialties to synthesize complex treatment options and optimize shared decision-making with patients and their families (Fanola et al., 2019; Rosovsky, Chang et al., 2019). The advantages of PERT include a patient-centered care plan approach, a real-time approach that allows every discipline involved in the patient care plan to discuss treatment options at the time of activation, and a multitude of specialists with highly qualified expertise in providing insight to the patient's plan of care (Rosovsky, Chang, et al., 2019).

In contrast, some researchers have identified challenges with the PERT model. Challenges from previous studies include a lack of interest, enthusiasm, and commitment to setting up the team; la lack of effective agreement and partnership with other disciplines and specialists within the hospital; lack of maintaining involvement once a

patient becomes admitted; an inadequate or lack of reimbursement for PERT multidisciplinary consults; a false perception that PERT will increase the use of expensive endovascular procedures; and a lack of accessibility for 24-hr house coverage prohibiting the real-time approach for all disciplines to be present at the time of activation (Mahar et al., 2018; Porres-Aguilar et al., 2018; Sista et al., 2018). To overcome these barriers, facilities need to focus on recruitment efforts of team members committed to working on a team with 24/7 coverage in which there is no reimbursement guarantee for consultative services (Sista et al., 2018). The model must consist of team members who tailor needs to implement a care coordination approach with other team members and reach a consensus on treatment strategies.

Beyond the United States. The multidisciplinary approach has extended beyond the borders of the United States. After MGH launched the PERT model, institutions in Asia and Europe began to explore the multidisciplinary approach. Hospitals in China and Poland have started to launch the multidisciplinary approach utilized in the PERT model. China initiated its PERT at a large teaching institution. In July 2017, Beijing Anzhen Hospital, affiliated with Capital Medical University, created its PERT in China (Liang et al., 2020). Their structure composition includes the disciplines of respiratory, nuclear medicine, emergency medicine, pulmonary critical care, and interventional cardiology. Beijing has yet to publish any studies from within its institution, but its focus remains on establishing a PERT network and improving the clinical outcomes of its patients with PE (Liang et al., 2020).

Poland was the first country after China to initiate a multidisciplinary approach PERT model. In April 2019, Poland began a multidisciplinary PERT under an agreement called the Polish PERT Initiative (Araszkiewic et al., 2019). Araszkiewic and several colleagues (2019) published a paper on creating and operating a PERT team. Their study aimed to assess the frequency of activations, patients' characteristics, PE severity, applied treatments, and outcomes of PE patients treated by a Polish PERT. Their team composition included cardiologists, emergency medicine, interventional radiologists, and surgeons of different specialties. Data are currently in progress for measuring if there is any statistically significant difference in quality measures, such as mortality, morbidity, and length of stay, in Poland's health care facilities with PERT (Araszkiewic et al., 2019).

PERT Consortium

The PERT community has a platform to discuss best practices, research strategies, and how to implement a center of excellence to improve PE care. The platform is known as the PERT Consortium and originated in May 2015. The consortium strongly encourages facilities with an operating PERT to join the platform. Currently, over 100 institutions are participating in the consortium. The consortium's website lists all members divided into two categories: founding and institutional members (see Appendix A). The list is not inclusive of all operating PERTs. Membership in the consortium requires approval from senior health care administration leaders, as a fee is required to join the consortium (C. Kabrhel, personal communication, October 15, 2021).

As the consortium promotes the adoption of the PERT model in health care institutions across the United States to ensure the prompt diagnosis and treatment of PE, future endeavors are focusing on more research, strategic alliances, and patient-driven satisfaction. In the summer of 2022, the consortium began implementing Centers of Excellence with interest from 75 sites across the globe, including the United States, Poland, Egypt, Italy, and Spain (B. Keeling, personal communication, September 30, 2022). The latest collaboration will be an upcoming book printed in January 2023, *The PERT Consortium: Handbook of Pulmonary Embolism: Research, Care, and Management*. B. Keeling (personal communication, September 30, 2022) said that the consortium would target future endeavors on more patient-driven outcomes. The results obtained from this doctoral study could provide knowledge to health care administrators about outcomes that could prove beneficial from patient-driven data.

Donabedian's Framework for the Assessment of Health Care Quality

Donabedian's original framework was the first to offer an approach to assess quality. Donabedian (1966/2005) argued that health care researchers and practitioners examine the quality of health provision by focusing on structure, process, and outcome. In current practice, Donabedian’s framework of implementing strategies in health care organizations and measuring their outcomes remains pivotal for quality improvement initiatives in health care organizations. Binder et al. (2021) investigated how their emergency department’s triage system (organizational component) implemented in the epicenter of a pandemic in upstate New York improved patient disposition wait times (outcomes) utilizing Donabedian's framework. The emergency department triage

command center was the organizational structure in which the triage process occurred to promptly enhance the operations of admitting, transferring, or discharging patients in the emergency department. The outcome measurements were based on the patient's wait time from triage to disposition (Binder et al., 2021).

Donabedian's structure-process-outcome model has been utilized to show how patient safety is affected by hospital nursing organizational factors and the nursing care process. Patient errors, nurse burnout, and lack of bedside interventions not being performed were higher in hospitals where nurses had higher patient workloads (Liu et al., 2018). The hospitals' organizational process of unsafe staffing methodology practices led to adverse or unwarranted outcomes. The findings supported Donabedian's model in that a better work environment was associated with better patient safety outcomes, as seen in lower nursing workload assignments (Liu et al., 2018).

Hospital Consumer Assessment of Health Care Providers and Systems

CMS and the Agency for Healthcare Research and Quality (AHRQ) began a partnership of public and private organizations to publicly report patients' perspectives of hospital care. The HCAHPS survey is the first national, standardized, publicly reported survey of patients' perspectives of hospital care (HCAHPS, 2021). While hospitals collected information on patient satisfaction for their internal use before HCAHPS, there were no common metrics and no national standards for collecting and publicly reporting patient experience of care (Wilson et al., 2020). Since 2008, HCAHPS has allowed valid comparisons to be made across hospitals locally, regionally, and nationally. The assessment of patient satisfaction can assist with improving system performance. The

HCAHPS survey provides feedback for the customer that can help build on the organization's commitment to excellence.

HCAHPS data show current relevancy. The Trauma Society of Trauma Nurses utilized responses from HCAHPS scores to help guide nursing care for the trauma patient. In 2019, a retrospective study was done on 89 trauma centers to evaluate the nurses' communication domain in trauma care (Watts et al., 2021). The highest individual domain contributor was the nurses' impact on the trauma patient at 63.9% ($p < 0.001$). The score was the highest ranking among surgical patients at 59% ($p < 0.001$) and medical surgery nurses at 58% ($p < 0.001$). According to Watts et al. (2021), the highest-ranking critical component of the HCAHPS domain was nurse communication. In this study, the patient's perception of the information given about medication and overall care will provide knowledge currently lacking in the patient's perception of care received by a multidisciplinary team approach delivered by a PERT.

HCAHPS Linear Means Scores

In April 2015, CMS added HCAHPS star ratings to its public reporting website. HCAHPS star ratings summarize all survey responses for each HCAHPS measure and present these in a simple format familiar to consumers, making it easier to use the information and spotlight excellence in health care quality. HCAHPS star ratings are updated quarterly and are calculated using the mean of the hospital linear scores (HCAHPS, 2021). To gain this calculation, hospitals must have at least 100 completed HCAHPS surveys over four quarters to be eligible for public reporting of HCAHPS measures. Hospitals with fewer than 100 completed surveys are not assigned HCAHPS

star ratings. Unlike with top-box, middle-box, and bottom-box scores, which only measure the rate of the most positive response options to the HCAHPS survey, linear mean scores incorporate the full range of survey response categories into a single metric for each HCAHPS measure (HCAHPS, 2020).

The HCAHPS linear mean scores published by CMS on Hospital Compare represent a rolling four-quarter average for each hospital with 100 completed surveys. These averages are weighted proportionately by the number of eligible patients seen by a hospital in each quarter of the reporting period. A hospital's quarterly weight is equal to the quarter's eligible discharge size divided by the total eligible discharge size in the four-quarter reporting period. After adjusting for hospital patient mix and survey mode, the linear mean score is transformed into a 0–100 linear-scaled score (HCAHPS, 2020). The HCAHPS linear mean four-quarter averages are rounded to integer values using standard rounding rules. For example, if Hospital A's weighted, four-quarter average *cleanliness* score was 82.02, the linear mean score would be reported as 82. Then the linear mean scores are used to create star ratings for each of the HCAHPS measures. (The actual questions can be found in Appendix B). A star rating of 1, 2, 3, 4, or 5 whole stars are assigned for each HCAHPS measure, based on cut points derived from CMS applying a clustering algorithm to the individual linear mean measure scores. This same method is used for many CMS Part C and Part D star ratings (HCAHPS, 2020). HCAHPA composite measures include the following (with question [Q] numbers in parentheses):

- communication with nurses (Q1, Q2, Q3)
- communication with doctors (Q5, Q6, Q7)

- responsiveness of hospital staff (Q4, Q11)
- pain management (Q13, Q14)
- communication about medicines (Q16, Q17)
- discharge information (Q19, Q20)
- care transition (Q23, Q24, Q25)

HCAHPS individual items include cleanliness of hospital environment (Q8) and quietness of the hospital environment (Q9). HCAHPS global items include overall hospital rating (Q21) and recommend the hospital (Q22).

The absence of linear mean scores would not make it permissible for the Five-Star Quality Rating System for health care consumers to rate their quality of care. The star ratings go up from one to five stars, with five stars being the highest and one star being the lowest possible score (HCAHPS, 2021). Higher star ratings attract more patients and offer the hospital more cost savings. For example, private insurance plans and Medicare reimburse hospitals up to $3 billion annually based on overall hospital performance star ratings (Wilson et al., 2020). In previous studies, hospital size has been linked to star ratings (Rodriguez-Homs et al., 2020; Todoran et al., 2018), Magnet status designation of hospitals (Zhu et al., 2018), and nurse-staff-patient ratios (Liu et al., 2018) all have been linked to the patient's perception of care. Although these studies focused on the HCAHPS star rating, none have included examining the actual linear mean score to differentiate between hospitals with and without a PERT regarding the patient experience as outcomes.

Medication Communication

The patient's understanding of instructions regarding new medications is critical in preventing readmission and medication errors. More than 40% of medication errors occur because the patients do not understand how to manage their medications after leaving the hospital (Lee et al., 2022). The use of anticoagulation therapy has proven effective in preventing and managing PE; however, initiating treatment may bear the clinical burden of these agents causing bleeding and adverse events. Medication errors associated with direct oral anticoagulants can be minimized with the participation of a multidisciplinary approach, including the pharmacy discipline (Barr & Epps, 2019). The inclusion of pharmacy as part of the multidisciplinary approach reduces errors by implementing standardized policies, risk reduction strategies, and guiding principles to achieve optimal therapeutic outcomes (Barr & Epps, 2019; Kwok et al., 2021). The pharmacy staff also clearly understand and implement The Joint Commission guidelines regarding anticoagulation therapy (The Joint Commission, 2021). Current primary literature is not robust in assessing the clinical impact of medication errors associated with direct oral anticoagulants but reports of adverse drug events have been noted. Future studies should be guided to evaluate clinical outcomes associated with medication errors and identify potential clinical interventions to optimize therapy (Barr & Epps, 2019). The PERT model incorporates the pharmacy team as part of the multidisciplinary approach; however, no studies have been conducted to show their impact on patients' understanding of information measured by HCAHPS.

Overall Care Rating

CMS believes that the overall hospital rating will be helpful to consumers by allowing them to compare the quality provided by hospitals. CMS has contracted with Yale University to develop a methodology that allows a national technical expert panel of consumers, hospital representatives, public reporting experts, and methodology experts to provide feedback and guidance in developing a methodology for incorporating this domain for easier public awareness and understanding. The overall rating of care is heavily utilized in programs promoting hospital incentives, especially hospital value-based purchasing programs (HCAHPS, 2021).

The Hospital Value-Based Purchasing Program was designed to promote better clinical outcomes for patients and improve their care experience during hospital stays, while reducing costs to make care affordable (CMS, 2021b). Specifically, hospital value-based purchasing seeks to incentivize hospitals to improve the quality and safety of care that Medicare beneficiaries and all patients receive during acute care inpatient stays. Specifically, there are nine measures from HCAHPS that are used in the Hospital Value-Based Purchasing Program: six composite measures (Communication with Nurses, Communication with Doctors, Staff Responsiveness, Communication about Medicines, Care Transition, and Discharge Information); two individual measures (Cleanliness of Hospital Environment and Quietness of Hospital Environment); and one global measure (Overall Hospital Star Rating; CMS 2021b). This study could provide insight to hospital administrators on the quality impact PERTs have on incentive care.

Summary

PE care has traditionally been fragmented. In 2014, a team of physicians created an approach to treat PE utilizing a multidisciplinary approach. The physicians at MGH introduced the PERT to transform health care in managing all types of PE. The European Society of Cardiology publicly promoted the multidisciplinary approach to optimize the treatment for PE.

PERT models have been activated globally. There are pulmonary response teams in Asia and Europe. China, Singapore, and Poland teams recognized their commitments patterned after the 2014 MGH model. PERT was launched on the West Coast in the United States prior to 2019. The teams are in prominent academic, teaching, and nonteaching institutions. Rural hospital leaders are familiar with and have adopted the PERT model in their communities.

The PERT Consortium has collaborated with facilities as PERT partners to provide direction on how to start a PERT. In addition, the consortium has established recommendations for coaching communities on activating interfacility transfers. The transfers will allow smaller communities to network with larger PERT institutions to access care for patients who may need more advanced therapies, for example, interventional treatment for care.

The PERT model is making approaches to receive recognition as Centers for Excellence. In September 2022, researchers shared efforts at the 8th Annual PERT Symposium on how criteria have begun to recognize institutions for their commitment to improving the standards of care for PE management. As PERT started to expand focus on

bringing patients and families to the treatment plan, measuring the impact a PERT has on overall rating of care will fill a gap currently lacking in the literature.

Definitions

Acute care hospitals: Hospitals with an average stay of 25 days or fewer (Sayles & Gordon, 2020). These hospitals constituted the population for this study.

Centers for Medicare and Medicaid Services (CMS): The government agency responsible for Medicare and parts of Medicaid. CMS also maintains and publishes patient survey results that affect U.S. hospital performance ratings (Sayles & Gordon, 2020).

Communication about medications: Patients' feedback on how often hospital staff explained the purpose of any new medicine and what side effects that medicine might have (AHRQ, 2021). Effective communication about medicine prevents misunderstandings that could lead to severe problems for a patient (AHRQ, 2021).

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) *star ratings*: A multiquestion tool for evaluating critical aspects of a patient's hospital experience that allows direct comparison between facilities with public reporting of the information (HCAHPS, 2021).

Linear mean score: The score utilized by CMS officials to determine star ratings on a rolling four-quarter average for each hospital. The averages are weighted proportionately by the number of eligible patients seen by a hospital in each quarter of the reporting period (HCAHPS, 2020).

Medication information: Information given to patients that includes instructions on adherence, side effects to medication dose, and scheduling time; the importance of follow-up appointments; laboratory test requirements; and potential drug-to-drug and drug-to-food interactions (The Joint Commission, 2021).

Patient experience: The range of interactions patients have within the hospital and with doctors and other health care professionals during an inpatient stay at an acute care hospital (HCAHPS, 2021).

Patient overall rating of care: A measurement that interprets the hospital's reputation by the patient's interaction with the facility (Ziemba, 2019).

Pulmonary embolism response team (PERT): An institutionally based, multidisciplinary team that rapidly assesses and provides treatment for patients with acute PE (Rosovsky et al., 2018).

Value-based purchasing: Incentive payments that are offered to acute care hospitals as a reward for the quality of care provided in the inpatient hospital setting (Ziemba, 2019).

Assumptions

There are two assumptions associated with this study. First, the assumption was that the patients answered the HCAHPS survey questions honestly and that their patient experience memory recall was accurate when they completed the survey. The assumption is justified as HCAHPS is a reliable instrument for measuring patient perception. The second assumption is that all hospitals listed on the PERT Consortium website still have an active PERT.

Scope and Delimitations

The scope of this study will concentrate on how patients perceived the information they were given about medication (composite domain) and their overall perception of rating of care (global domain), and if any differences in those domains exist between hospitals with and those without PERT designation. The PERT-designated hospitals will be conveniently selected with PERT as members of the PERT Consortium. As of December 2022, the consortium has 103 PERT-designated hospitals as members. I will utilize all 103 PERT-designated hospitals in the study. The non-PERT-designated hospitals will be randomly selected from the October 2020 HCAHPS participant survey, which covers the time frame from January 1 to December 31, 2019.

Limitations

There are three limitations associated with this study. First, I will only select PERT hospitals that are consortium members of the PERT-designated group. Second, in the study, I will include only the states with hospital representation on the PERT website. Therefore, all 50 states will not be represented in this study. Third, secondary data were collected pre-COVID-19; future results and parameters may change as the pandemic presents new challenges.

Significance

Health care leaders focus on quality-driven data, such as those measured by HCAHPS (Schrimmer et al., 2019). The patient experience from public reporting enhances an engaged culture in a hospital environment that results in optimal clinical outcomes (Pelletier & Beaudin, 2018). The findings of this research could lead to positive

social change for health care administrators by developing a better understanding of the impact of PERT on HCAHPS ratings.

Summary and Conclusions

The PERT model was designed with a multidisciplinary approach to address the management of PE. The model has been implemented in hospitals worldwide. The PERT Consortium originated as a forum to bring together evidence-based practice and share how to form a PERT with others. The literature currently addresses the structure, challenges, and treatment modalities prescribed by the PERT. The data analysis on the impact of PERT targets length of stay, mortality, and readmission rates; however, there needs to be a study regarding the gap in addressing the patient's perception of the care the multidisciplinary approach delivers. In this doctoral study, I will examine PERT's impact on the patient's perception of information on medication and overall rating of care, as measured by HCAHPS. In Section 2, I will address the independent *t*-test, research design, methodology, data analysis, and threats to validity.

Section 2: Research Design and Data Collection

In this quantitative study, I sought to determine whether hospital PERT designation is linked to patient satisfaction. My specific focus was on the impact the PERT designation status of acute care hospitals has on the patient's understanding of the information given on medication and the patient's overall perception of care, both as measured by HCAHPS. The instrument I used to capture hospital performance was HCAHPS star ratings. Donabedian's (1966/2005) theoretical framework served as the basis for the study. Donabedian's triad encompassed the independent variables' structure (acute care hospitals) and process (PERT multidisciplinary approach) concerning the dependent variable (outcomes-ratings). The results from this study may assist health care leaders in improving outcomes for patients diagnosed with PE. This section contains discussion of the research design and rationale, methodology, and threats to validity.

Research Design and Rationale

I used a quantitative method to analyze secondary data from the HCAHPS survey data set, which was available to the public on the Hospital Compare website. The use of secondary data made available for public usage reduced any time constraints for requesting permission for copyright. The independent variable in this study was acute care hospitals with and without PERT designation status. The dependent variables were composite and global domains from the HCAHPS survey data set that measured the patient's understanding of the information about medications and the patient's perception of overall care.

I used an independent sample *t*-test for each RQ. Prior studies concerning the single and multicenter implementation of PERT pre- and post interventions utilizing statistical analysis with the *t*-test (Carroll et al., 2020; Finn et al., 2021; Kwok et al., 2021) informed my selection for this study. Researchers use an independent sample *t*-test to compare the means between two independent groups on the same dependent variable (Gerald, 2018). The groups that were compared were hospitals with PERT and hospitals without PERT. PERT status was the independent variable. The linear mean scores for communication about medication and overall care were the dependent variables. Using Donabedian's health care quality framework, I analyzed the relationship between acute care designated PERT hospitals (structure) to determine if the multidisciplinary approach (process) had an impact on hospital quality scores (outcomes).

Methodology

Population

The population for this study was acute care hospitals. The PERT-designated hospitals are listed on the PERT Consortium website (see Appendix A). There were 103 PERT-designated hospitals listed on the website at the time of data collection. As of January 2019, 4,482 hospitals publicly reported HCAHPS scores (HCAHPS, 2021).

Sampling and Sampling Procedures

The CMS implements the adult version of the HCAHPS nationally. The random sampling method is the sampling strategy for the HCAHPS data set (HCAHPS, 2021). I analyzed HCAHPS survey data collected from January 1, 2019, to December 31, 2019. HCAHPS was administered to a random sample of adult inpatients between 48 hr and 6

weeks after discharge. Patients admitted in the medical, surgical, and maternity care service lines were eligible for the survey; HCAHPS is not restricted to Medicare patients. The inclusion criteria for the survey were patients 18 years or older who had at least one night stay in the hospital for a nonpsychiatric principal diagnosis; had a U.S. mailing address; and were admitted for medical, surgical, or maternity care. The exclusion criteria were patients with a foreign home address; patients who were discharged to hospice care, a nursing home, or a skilled nursing facility; and/or patients who were discharged to law enforcement or any pediatric, psychiatric, and specialty hospitals.

PERT and Non-PERT Sampling

There were 103 PERT-designated hospitals listed on the PERT Consortium website at the time of data collection; I examined them all to determine inclusion in this study. This type of selection is called convenience sampling (Muijs, 2011). A convenience sample is used when selecting a population (in this case, hospitals) that is easily accessible (Muijs, 2011). The list was cleaned for duplication; for example, a founding member hospital may also be an institutional hospital, where the hospital was counted only once. After I cleaned the list for duplication, I counted and assorted the hospitals by the state location. The number of PERT-designated hospitals in a particular state determined how many non-PERT-designated hospitals were selected for the corresponding state. For example, if New York had 12 designated PERT hospitals, then 12 non-designated PERT hospitals were selected for New York. If a state did not have a PERT designation on the consortium's website, then the state was not included in the

study. Only PERT-designated hospitals with state representation on the website were included.

The selections for the non-PERT-designated hospitals came from the 2019 HCAHPS hospital list. The HCAHPS instrument lists hospitals in alphabetical order by their state's location. I selected the non-PERT-designated hospitals using the systematic sampling random technique. For example, if Alaska had three PERT-designated hospitals, I chose the first three states listed on the HCAHPS list for Alaska. If New York had five PERT-designated hospitals from the consortium website, I selected the first five listed hospitals on the HCAHPS list under the State of New York. Suppose a PERT site was chosen by chance while selecting the non-PERT-designated hospitals. In that case, I selected the next hospital on the list for that corresponding state if it is a hospital of academic affiliation. By using this method, I attempted even distribution among PERT versus non-PERT hospital participants and to minimize the impact of state-specific differences.

Sample Size

To determine the sample size, I used the freely available G*Power (Version 3.1.9.2) to conduct an a priori power analysis. For RQ1 and RQ2, I used a significance, or alpha, level of 0.05 to reduce the risk of a Type 1 error. The effect size was 0.80 because Cohen (1988) suggested a large effect size to enhance the chances of finding statistically significant differences among variables. I calculated a total sample size of 84 hospitals. The sample size for each group equaled 42 hospitals with PERT and 42 hospitals without a PERT. HCAHPS data from 3,462 hospitals were available for analysis. However, I

restricted my focus to the 103 hospitals listed on the PERT Consortium website (in the case some PERT-designated hospitals were eliminated due to duplication on the founders' and institutional lists), which was still greater than the 42 needed for the study.

Instrumentation and Operationalization of Constructs

The first question, taken from the composite domain of the HCAHPS survey, addressed patients' understanding of the information about any new medication (outcome). I analyzed these data to determine whether any statistically significant difference exists among hospitals with and without PERT (structure) as the independent variable. The second question, taken from the global domain, concerned overall care (outcome). This question addressed hospital quality measures for the dependent variables connected to incentivizing care.

HCAHPS Instrumentation

The instrument I used in this study was the HCAHPS survey, developed by CMS and AHRQ in October 2020, covering patients discharged between January 1, 2019, and December 31, 2019 (HCAHPS, 2020). HCAHPS has been utilized in several studies analyzing patients' perception of care and its relationship to quality outcomes and incentives for health care (e.g., Watts et al., 2021; Will et al., 2019; Ziemba et al., 2019). Ten categories comprise the HCAHPS survey, and the linear mean score, which ranges from 0 to 100, represents each category. The linear mean scores are continuous.

Operationalization of Variables. The independent variable in this study was hospitals with and without implemented PERT teams. I coded hospitals with PERT teams as yes (coded 1) and hospitals without PERT teams as no (coded 0) for this study. There

were two dependent variables in this study. They were the linear mean score about medicine communication (composite domain) and overall care linear mean score (global domain). The linear mean score was continuous and could range from 0 to 100. Table 1 includes the operational definitions of variables.

Table 1

Operational Definitions of Variables

Variable	Type of measurement	Coding
PERT (IV)	Categorical	0 = No PERT 1 = PERT
Communication about medication (DV)	Continuous	0 to 100
Overall care	Continuous	0 to 100

Note. PERT = pulmonary embolism response team; IV = independent variable; DV = dependent variable.

Descriptive Characteristics. Academic affiliation is a categorical descriptive of the independent variable, characteristic of the independent variable. PERT designations can occur in teaching hospitals and non-teaching hospitals. The coding for this descriptive will be 0 for non-teaching facilities and 1 for teaching facilities. The hospital location was a categorical descriptive of the independent variable. Only acute care hospitals in the United States were analyzed for this study. The United States was grouped into the five regions specified by the National Geographic Society. The regions were coded 1 to 5 as follows: Northeast (1), Southeast (2), Southwest (3), Midwest (4), and West (5). The number of beds in each acute care hospital was listed as a continuous variable for this study. I used Schultz et al. (2019) as a blueprint for the bed size grouping. The actual bed sizes were grouped into four categories: bed sizes less than 300

(1), 301–499 beds (2), 500–999 beds (3), and greater than 1,000 beds (4). Table 2 provides an overview of the descriptive characteristics.

Table 2

Descriptive Characteristics

Variable	Type of measurement	Coding
Academic affiliation	Categorical	0 = nonacademic/no teaching
		1 = institutional/teaching
Location	Categorical	1 = Northeast states
		2 = Southeast states
		3 = Southwest states
		4 = Midwest states
		5 = Western states
Bed size	Categorical	1= < 300 beds
		2= 301–499 beds
		3= 500–999 beds
		4= > than 1,000 beds

Data Analysis

I will enter and analyze the collected data using the Statistical Package for the Social Sciences (SPSS) Version 28 to conduct an independent samples *t*-test. The independent *t*-test assists researchers in determining whether there is a statistically significant difference in the mean score between the two groups (Gerald, 2018). I will analyze the results by checking the following statistical assumptions for an independent sample *t*-test (Gerald, 2018):

1. The dependent variable should be measured on a continuous scale (i.e., interval or ratio level).

2. The independent variable should consist of two categorical, independent groups.
3. There is an independence of observations.
4. There are no significant outliers.
5. The dependent variable should be approximately normally distributed for each independent variable group.
6. Variances are homogeneous.

For Assumption 1, the dependent variables are the linear mean score, which are measured on a continuous scale. In Assumption 2, the two independent groups will be hospitals with and without PERT status. In Assumption 3, an independence of observation exists between the two groups as the occurrence of PERT hospitals provides no information in relationship to the observations of the non-PERT hospitals. The last three assumptions will be tested once the data are retrieved. Specifically, for Assumption 5 and Assumption 6, Levene's test will be applied in SPSS. Levene's test is an inferential statistical test used to assess the equality of variances for a variable calculated for two or more groups (Gerald, 2018).

Research Questions and Hypotheses

RQ1: Is there a significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams?

$H_0$1: There is no significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

H_a1: There is a significant difference in patients' HCAHPS linear mean scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

RQ2: Is there a significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams?

$H_0$2: There is no significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

H_a2: There is a significant difference in patients' HCAHPS linear mean scores for overall care between acute care hospitals with PERT teams and acute care hospitals without PERT teams.

Interpretation of Results

I will analyze the independent samples *t*-test in SPSS Version 28, available through Walden University. The interpretation of results will come from analyzing, comparing means, and independent samples *t*-test utilizing the defined groups dialogue box. The specified values for Group 1 and Group 2 will be entered with the confidence interval percentage set at 95% to exclude cases analysis by analysis. The group statistics will display *n* = number of hospitals for both groups. Both groups will show the mean,

standard deviation, and standard error mean. Levene's test for equality will reveal the results and significance of the *t*-test. Significance will be achieved for *p*-values <0.05. If significance is achieved, then the groups (PERT and no PERT) can be said to come from populations whose means are different. I will assess the assumption of homoscedasticity from the results output on a scatterplot for residuals versus predicted values. The assumption of outliers will be determined using the standard deviation values from the same scatterplot (Gerald,2018).

Threats to Validity

Validity indicates that a study's results measure what is supposed to be measured (Field, 2013). The two primary types of validity are external validity and internal validity. External validity represents the extent to which study findings can be generalized to other broader populations (Frankfort-Nachmias et al., 2015). The results of this study may be generalizable to newly formulated PERT-designated hospitals. For example, other acute care hospitals considering forming a PERT-designated facility can utilize their HCAHPS scores in the domains test in this study to see how patient perception of care is measured in their health care facility. The sample population supports another example of external validity: representatives of only acute care hospitals across the United States. However, the study excludes pediatric, psychiatric, and specialty hospitals; therefore, the means of comparison for these hospital settings are limited. Internal validity assesses the capacity of the data set to support the RQ. The impact on internal validity from the collection of this research data could be affected by the systematic random technique I will utilize to select the non-PERT-designated hospitals. An additional example of internal validity

could occur due to the time the patient responds to the survey after being discharged from the hospital. For example, HCAHPS surveys are given to patients 48 hr through 6 weeks following discharge from an inpatient stay which could influence patients' responses to their scores on the overall hospital rating.

Ethical Procedures

The data for this study will come from secondary sources from public databases. The CMS and PERT Consortium data are available at no cost. Informed consent for the study will not be necessary since the population is hospitals, not patients. Before accessing secondary data, I obtained approval from Walden University's Institutional Review Board "(approval no. 01-26-23-0070934)." I will list the hospitals used in the study in the appendices. I will store the data used to conduct this research study for 7 years on a password-protected computer network monitored by virus-scanning software and secured by a hardware and software firewall. After the 7-year data retention period, I will erase the electronic information using commercially available software, such as Eraser.

Summary

In this research study, I will use a quantitative design using the statistical independence sample *t*-test to determine if a difference exists between hospitals with and without a PERT. I will use the HCAHPS survey as the instrument to measure the difference between the two groups examining communication about medications and overall care. The descriptive characteristics of the population in this study will be

location, academic affiliation, and bed size. The results of the independent sample *t*-test analysis used to test the RQs will be discussed in Section 3.

Section 3: Presentation of the Results and Findings

The purpose of this quantitative study was to determine whether there is any significant difference in patient HCAHPS linear mean scores for instructions given about medication and overall care between acute care hospitals with and without PERT teams. In this section, I describe the secondary data set and provide data collection and analysis details to address the RQs and hypotheses. The statistical analyses and the assumptions are discussed by presenting results regarding the RQs.

Data Collection

The secondary data sets for this study came from the HCAHPS and PERT Consortium databases. The HCAHPS secondary data set included 4,482 acute care hospitals with collected surveys from January 1, 2019, through December 31, 2019. The PERT Consortium database included 103 acute hospitals with PERT from founding members from 2015 through December 31, 2019 (see Appendix A). I selected the complete sets of data available from before the COVID-19 pandemic to establish a baseline of data from CMS HCAHPS and PERT Consortium that the effects of the pandemic would not influence. The final data set included 76 acute care hospitals with PERT taken from the Consortium's website and 76 without PERT from HCAHPS.

I retrieved identifiable data for the hospitals from the HCAHPS survey. CMS assigns a facility identification number for each participating hospital with a completed survey. The survey also lists the address and phone number of each participating hospital. For each PERT hospital identified, I called the emergency or admitting department for confirmation of an existing PERT. After validation, the original 103 hospitals decreased

to 76 due to multiple affiliations with the same university, mergers with other facilities, or inability to identify the primary site of PERT activations for the health care system. The non-PERT hospitals were selected from the states where the PERT hospitals were located and selected from the HCAHPS survey. For example, if New York had five PERT hospitals on the PERT consortium website, the first five hospitals listed on the HCAHPS survey under New York were selected for non-PERT representatives. The selection order was chronologically identified by hospital CMS number unless one of the hospitals was a PERT-designated hospital or one of the non-PERT hospitals was not academically affiliated with residency, fellowship, or internship program, which was a criteria change from the original plan to allow equal representation for PERT and non-PERT hospitals. In those cases, the next hospital on the list was selected. This study comprised 152 acute care hospitals (76 PERT hospitals and 76 non-PERT hospitals), which exceeded the estimated sample size of 84 hospitals.

Descriptive Characteristics

The acute care hospitals (76 with a PERT and 76 without a PERT) are in the United States. Twenty-six states are represented in the study. The states are inclusive of all five geographical national regions. Region 1 (Northeast) had the most representation, with New York having 12 acute care PERTs, followed by Massachusetts with five. Region 2 (Southeast) had the most representation in Georgia, with three PERT hospitals. Region 3 (Southwest) had the second highest PERT representation in Michigan, with six PERT hospitals, followed by Wisconsin, with five PERT hospitals. Region 4 (Midwest) had the least representation, with two PERT hospitals, one in Oklahoma and one in

Texas. The state of California represented Region 5 (West Coast) along with five PERT hospitals. Appendix A shows a list of the states with acute care hospitals with active PERT in 2019. Appendices C and D break down the hospitals by PERT and non-PERT status and include CMS facility identification numbers, bed size, and location by region and state,

I categorized the hospitals by academia affiliation, bed size, and location by state and region. The hospitals selected in this study all had an association with academic affiliation with the inclusion of a residency program, internship, or fellowship, and/or university affiliation for both the PERT and non-PERT groups. Compared to bed size, PERT activations occurred in 17 acute care hospitals with over 1,000 beds. The non-PERT hospitals did not have a bed capacity of over 1,000. Most PERT activations occurred in acute care hospitals with bed capacities ranging from 500 to 999, while most non-PERT hospitals had bed capacities averaging fewer than 300.

Regarding location, New York, Massachusetts, and Maryland (Region 1) had bed capacity averaging over 1,000. The results show that PERT activations predominantly occurred in larger acute hospitals. MGH, John Hopkins, Pennsylvania State, and New York University were some of the larger acute hospitals identified in this study. The larger acute care hospitals in this study were active participants of the PERT Consortium-endorsed interfacility initiative, which means the hospitals served as accepting centers to receive transfer patients from outlying rural non-PERT hospitals. Table 3 lists the hospital characteristics by academic status, bed size, and region. The states for each region are listed in Appendices C and D.

Table 3

Hospital Characteristics

Characteristic	%	
	PERT hospital (*n* = 76)	Non-PERT hospital (*n* = 76)
Academic affiliation		
Nonteaching (no residents or university affiliations)	0	0
Teaching (residency, interns, or university affiliations)	100	100
Bed size		
< 300	14	51
301–499	16	22
500–999	21	26
> 999	22	0
Region		
Northeast	38	38
Southeast	18	18
Southwest	33	33
Midwest	4	4
West	7	7

Note. PERT = pulmonary embolism response team.

Results

Dependent Variables

The dependent variables for this study were patients' ratings for their understanding referencing communication about medications and their ratings on the overall rating of care (perception) as measured by the linear mean scores in the 2019 HCAHPS survey. The linear mean scores were used in SPSS to determine the statistical significance of the difference among PERT and non-PERT acute care hospitals. As

defined by the HCAHPS star ratings technical notes (2020), the linear means score ranges from 0 to 100 and calculates the five-star ratings assigned by CMS. Like grade 10-point score averages, linear means score values have similar ratings. The HCAHPS technical notes (2020) range the linear means scores into a conversion of the star ratings. Five stars are the highest ranking, and one is the least ranking score. Table 3 outlines how the linear mean scores convert to star ratings.

The star ratings are calculated based on linear mean scores. The star ratings are listed as a 1- 5-star ranking scale reported in whole numbers. The one star is the lowest rating, and the five star is the highest rating. As outlined in the HCAHPS star ratings technical notes (2020), linear mean scores with ranges of 90-100 equal a five-star rating. Linear mean scores with ranges 89-80 equal a four-star rating. Linear mean scores with ranges 79-70 equal a three-star rating. Linear mean scores 69-60 equal a two-star rating. Linear mean scores ranging from less than 60 equals a one-star rating. In the domain of communication about medications, PERT hospitals average a 3-star ranking. The two-star ranking was the lowest in communication about medications for the non-PERT hospitals in the Northeast region.

The overall perception of care domain had averages between 3- and 4-star rankings. PERT hospitals in all regions averaged four stars. The non-PERT hospitals in all regions averaged three stars. Individual PERT and non-PERT hospitals had 5-star rankings, but when combined for the region's average, the highest was 4-star. Table 4 compares the star ratings of PERT and non-PERT hospitals by region. The two domains

that were rated were communication about medicines and overall perceptions of care. Appendices C and D list each hospital by facility number with each linear mean score.

Table 4

Star Ratings by Hospital Region and PERT Status

Domain		No. of stars	
		PERT hospital	Non-PERT hospital
Communication about medications			
Region	Northeast	3	2
	Southeast	3	3
	Southwest	3	3
	Midwest	3	3
	West	3	3
Overall perceptions of care			
Region	Northeast	4	3
	Southeast	4	3
	Southwest	4	3
	Midwest	4	3
	West	4	3

Note. Star ratings are reported in whole numbers. PERT = pulmonary embolism response team.

Results for Communication About Medications (RQ1)

I performed a two-sample t-test to compare communication about medications in acute care hospitals with and without PERT. The Independent t-test has six assumptions (Muijs,2011). Assumption 1, the dependent variables measurement was on a continuous scale (measured 0 to 100). Assumption 2, the independent variables consisted of two categorical groups (PERT hospitals and non-PERT hospitals). For Assumption 3, there was no relationship between the two groups (independence of observances). Assumption 4 requires a check for no significant outliers that could negatively influence your results.

For this assumption, three hospitals in the non-PERT hospitals had the lowest ranges of linear mean scores 67-68. The lower range of linear mean scores for the PERT hospitals were 80-83. The high values for non-PERT hospitals averaged 70-83, and for the PERT hospitals, 90-93.

In this category, the outliers were necessary to determine the difference between PERT and non-PERT hospitals in rankings for communication about medicine performance. The outliers' lowest and highest averages and rankings are shown in Appendices E and F. Assumption 5 requires normal distribution of each group; the 76 hospitals for both PERT and non-PERT are listed in Appendices E and F. For assumption six, Levene's test indicates the homogeneity of variances. A Sig. value greater than .05 means equal variances can be assumed. In communication about medication, equal variances are assumed with a Sig. value of .812 (shown in Appendix G).

There was a significant difference in communication about medications between hospitals with PERT (M= 77.99), SD= (3.5) and hospitals without PERT (M=75.88), SD= (3.2); t(df)=3.82, p= (<.001). The null hypothesis was rejected. The alternate hypothesis was accepted, indicating a significant difference in patients' linear means scores for instructions given about medication between acute care hospitals with PERT teams and acute care hospitals without PERT.

Results for Overall Care (RQ2)

A two-sample t-test was performed to compare the overall perception of care in acute care hospitals with and without PERT. The Independent t-test has six assumptions (Muijs,2011). Assumption 1, the dependent variables measurement was on a continuous

scale (measured 0 to 100). Assumption 2, the independent variables consisted of two categorical groups (PERT hospitals and non-PERT hospitals). For Assumption 3, there was no relationship between the two groups (independence of observances). Assumption 4 requires a check for no significant outliers that could negatively influence your results. For this assumption, there were no outliers in the overall rating of care domain. Hospitals with and without PERT had linear mean scores ranging from 79-93. The PERT group had two more hospitals than the non-PERT group, with averages of 93, which were enough to give a slight advantage in higher linear mean scores (Appendix E and F).

Assumption 5 requires normal distribution of each group; the 76 hospitals for both PERT and non-PERT are listed in Appendix C and D. For assumption six, Levene's test indicates the homogeneity of variances. A Sig. value greater than .05 means equal variances can be assumed. In an overall rating of care, equal variances are assumed with a Sig. value of .367 (shown in Appendix G).

There was a significant difference in the overall perception of care between hospitals with PERT (M=88.42), SD= (3.1) and hospitals without PERT (M=86.09), SD= (3.6); t(df)=3.82, p= (<.001). The null hypothesis was rejected. The alternate hypothesis was accepted as there was a significant difference in patient's perception regarding overall care between acute care hospitals with PERT teams and acute care hospitals without PERT.

Summary

This study provides perspective and insight into the relationships between PERT and the patient's perception of care as measured by HCAHPS. The two domains

measured from HCAHPS in this study utilizing independent samples t-test were communication about medication scores and overall rating of care. The study listed linear mean scores, which provided insight for both groups in this study.

The communication about the medication domain had a wider spread marginal average among hospitals with PERT than those without a PERT. The group statistics outline averages for the PERT hospitals at 77.99 and non-PERT averages at 75.88. Hospitals in the PERT groups did not have mean linear scores below the 78 thresholds. The non-PERT groups had three hospitals with linear means scores below 67 and a consistent average among the other 73 hospitals in the 70^{th} percentile for linear mean scores (Appendix E and F).

The overall rating of care domain was a much narrower margin for both groups of hospitals with and without a PERT. The consensus appeared based on the linear mean scores for both groups of hospitals; the overall goal was to deliver the best quality of care. The group statistics in Appendix G support that statement, as the mean linear scores for PERT hospitals were 88.42 and non-PERT hospitals at 86.09. Neither group's PERT nor non-PERT had linear mean scores below the 90th percentile in this domain. The advantage for the PERT hospitals was that they had consistently more linear mean scores in the 93rd percentile, and non-PERT stayed more consistent in the 92nd percentile (Appendix E and F).

In conclusion, the patient’s experience scores in communication about medication and overall care rating had statistically significantly higher linear mean scores in hospitals with PERT when compared to hospitals without a PERT. The discussion on the

interpretation of these findings, limitations of the study, recommendations for future research, implications for professional practice, and social change are presented in Section 4.

Section 4: Application to Professional Practice and Implications for Social Change

The purpose of this quantitative study was to determine if there is any statistically significant difference in patient HCAHPS linear mean scores for instructions given about medication and overall care between acute care hospitals with and without PERT. This study is one of the first, based on my review of the literature, to examine the impact of PERT on patients' perceptions of care. The patient experience is essential to focus on as it improves quality outcomes and brings incentives to the health care organization (Krueger et al., 2021). There are two key findings in this study. The first key finding is a statistically significant difference in communication about medication ratings in acute care hospitals with and without a PERT for the fiscal year 2019. The second key finding is a statistically significant difference in the overall rating of care in acute care hospitals with and without a PERT in fiscal year 2019.

Interpretation of the Findings

Research has shown that patient-centered care is critical to quality and that HCAHPS surveys are reliable for measuring patient-centered care (Amey et al., 2017). Patient-centered care incorporates the voice of the customer and improves patient outcomes (Krueger et al.,2021). The optimal goal for patient-centered care depends heavily on providing high-quality care with effective communication practices, practices measured by the HCAHPS patient survey (Krueger et al., 2021).

This study linked patient outcomes and quality performance utilizing HCAHPS as the measuring instrument. Like the findings of this research, other studies have linked quality and high-performance outcomes utilizing HCAHPS as the measuring tool. For

example, a retrospective analysis of Level I–IV trauma centers in a multistate hospital system, Watts et al. (2021) evaluated patients 18 years and older admitted from 2018 to 2019 with at least an overnight stay to determine the impact nursing had on the trauma response team. The study cited higher percentage scores in the domains of communication and overall rating of care in patients who received care from the trauma response team with nurses compared to patients who were admitted directly to the inpatient units. In another study, McCaughey et al. (2020) used HCAHPS secondary survey data set to explore the extent to which inpatient perceptions differed between Magnet and non-Magnet hospitals. The researchers used the domains of nurse communication, overall hospital rating, and willingness of patients to recommend the hospital. Results indicated that patients treated at a Magnet hospital and patients who rated nurses' communication highly were significantly more satisfied and more likely to say they would recommend the hospital. Tiperneni et al. (2022) examined patient rounding and its impact on HCAHPS scores. The researchers noted that the communication with doctor's domain improved from an 8% percentile rank in December to 78%, and the doctors treat you with courtesy/respect domain improved from a 24% percentile rank in December to as high as 90%. "Doctors listen carefully to you" improved from a 13% percentile rank in December to 88%. The study suggests that HCAHPS scores in the communication with doctors domain can be improved when employing the rounding approach with each patient encounter, the authors noted.

In the present study, I used independent sample t-test, group statistics, and linear mean scores to evaluate the two RQs. Concerning RQ1, communication about medication

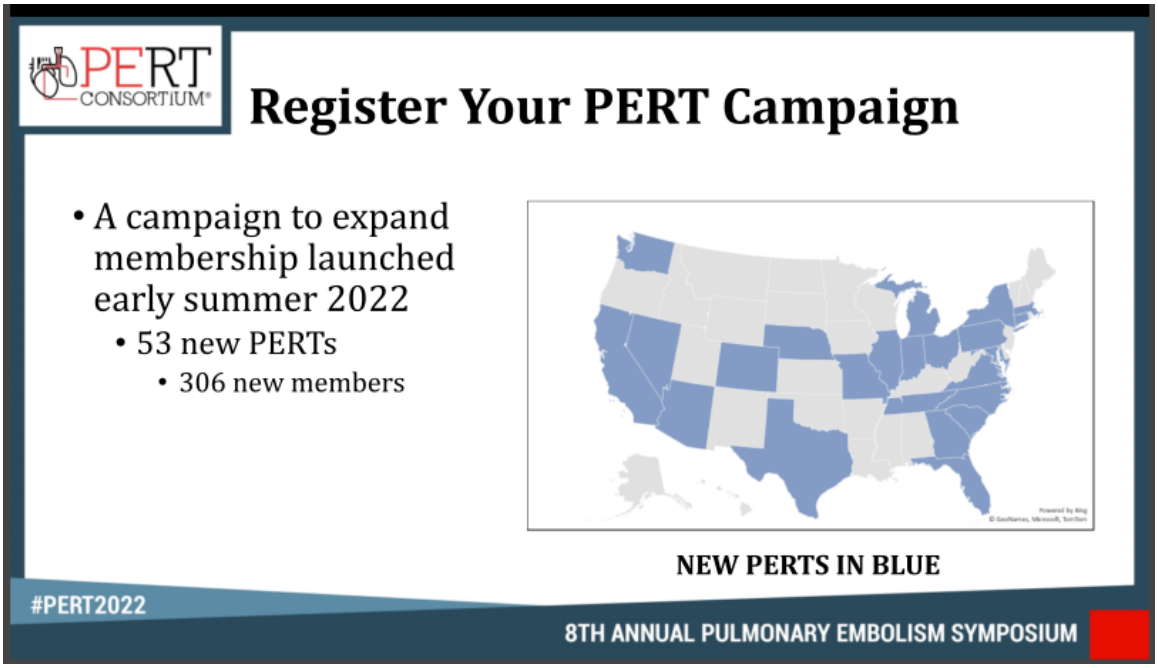
in hospitals with and without a PERT, linear mean scores were significantly higher in hospitals with PERT. The highest linear mean scores in the PERT hospitals were 93, 90, 84, and 83. The highest linear mean scores in the non-PERT hospitals were consistently 83, 80, 79, and 78. The states among the PERT hospitals with the highest linear mean scores were Pennsylvania, Wisconsin, Minnesota, and Massachusetts. The highest non-PERT hospitals with the highest linear mean scores were in Wisconsin, Virginia, Tennessee, and Kentucky. The pertinent indicator that ranked PERT hospitals statistically significant higher than the non-PERTS were two factors. PERT hospitals overall average in this domain had higher scores in the 90s, and their lowest scores did not fall below the average of 70. Whereas with the non-PERT hospitals, their highest averages were in the 80s, and their lowest averages were in the 60s. See Appendix C and D for a list of each linear mean score by region, state, and hospital name.

The results for RQ2 indicated that PERT hospitals had a significant difference over non-PERT hospitals in the overall perception of care ratings. In contrast to the averages seen in the medication domain, the PERT and non-PERT hospitals had similar linear mean scores in the 90s, and neither group had averages below the 70th percentile. The states with the highest scores for the PERT hospitals were Minnesota, California, Alabama, Wisconsin, Ohio, Massachusetts, and Illinois, all above 90 linear mean scores. The non-PERT hospitals also had linear mean scores above 90 in California, Connecticut, Georgia, Illinois, Kentucky, Massachusetts, and Missouri. See Appendix C and D for a list of each linear mean score by region, state, and hospital name.

For this study, the representation of West Coast states was minimal. At the time of the study interval, 2019, California was the only west coast state to represent PERT-designated hospitals. In 2022, west coast expansion of PERT-designated hospitals includes the states of Washington, Nevada, Arizonia, and New Mexico. Figure 3 shows the expansion of all five regions since 2019.

Figure 3

Growth in Pulmonary Embolism Response Team (PERT)-Designated Hospitals, 2019–2022



Note. I obtained this figure from Dr. Brent Keeling, at the 8th Annual Pulmonary Embolism Symposium. "Reprinted with permission (see Appendix H)."

I used the Donabedian model to determine if the process of PERT activations drives patient outcomes at acute care hospitals as measured by HCAHPS. The findings of this study suggest that acute care hospitals with a PERT have a statistically significant difference from non-PERT acute care hospitals in patient outcomes concerning communication about medications and overall perception of care ratings.

Limitations of the Study

There were three identified limitations associated with this study. First, the study only reflects PERT-designated hospitals that are members of the PERT Consortium. The study does not consider any active PERT-designated hospitals without membership in the Consortium. Hospitals with PERT designation operating under the auspices of the Consortium have a broader range of networking and resources, such as participating in the evidence-based practice committees formed within the PERT community. Second, this study did not incorporate states not represented in the Consortium in 2019. Future studies should consider examining hospitals that have newly joined the Consortium as they are more representative of the 50 states. Third, the study interval was a year preceding the pandemic, and practices could have since changed for both the PERT and non-PERT hospitals in treating patients diagnosed with PE.

Recommendations

Future research should include examining detailed data that would allow a more comprehensive evaluation of the importance of the multidisciplinary approach that HCAHPS scores can capture—for instance, adding the patient-doctor communication domain. I examined linear mean scores to use the statistical t-test for analysis; future

recommendations should focus on a statistical method inclusive of the star ratings since consumers are more familiar with the one through the five-star rating system. Based on the evidence of the findings, it is essential to continue to investigate the relationship between PERT-designation hospitals and patient outcomes such as patient satisfaction. The challenges for future research efforts weigh on the inability to find a specific list that identifies all PERT-designated hospitals within the United States. As the literature references heart attack, stroke, and trauma-designated centers across the US, it would be helpful for the PERT Consortium or other governing bodies to find a way to capture PERT-designated centers in the US and make the listing available for public awareness to conduct further research studies.

Implications for Professional Practice and Social Change

Patient experience is one of the most used indicators for measuring prompt, effective, and optimal outcomes in health care delivery. It has become essential to health care leaders because, in part, it is linked to hospital reimbursements through the HCAHPS survey (Watts et al.,2021). While implementing PERT in the acute care setting could be a promising avenue for improving HCAHPS scores, as suggested in this study, it would benefit health care administrators with an approach that incentivizes care. This study is the first to incorporate the patient experience measured by HCAHPS to examine if a difference exists between hospitals with and without a PERT. This study could serve as the stepping block to improve practice in examining PERT status compared to more HCAHPS domains. This study fills a gap in practice on the impact PERT has on communication about medications and overall perception of care ratings.

Conclusion

This quantitative research study identified differences in hospitals with and without a PERT. The difference was measured utilizing patient outcomes as measured by HCAHPS. The CMS HCAHPS data set allows health care administrators to improve patient outcomes by strategizing care with incentives. This study provided results that indicated a statistical difference for hospitals with a PERT in communication about medicine and overall care rating. This study's results filled a gap formerly missing in practice. Health care administrators have a working body of knowledge on the significance of implementing or maintaining a PERT in the acute care hospital setting that before this study was not known.

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Appendix A: PERT Consortium Members, 2016–2019

I obtained a list of PERT Consortium members from the organization's website. The website listed 103 acute hospitals with PERT from 2015 through December 31, 2019 (PERT Consortium, n.d.).

Founding Members

Abbott Northwestern Hospital – Alina Health

Aurora St. Luke's Medical Center

Baptist Health Louisville

Beaumont Health

Cedars-Sinai Medical Center

Christiana Care Health System

Cleveland Clinic

Detroit Medical Center

Duke University Medical Center

Edward-Elmhurst Heart Hospital

Emory Hospital Midtown

Gates Vascular Institute Kaleida Health

Grady Memorial Hospital

Icahn School of Medicine at Mount Sinai

Inova Health

Jacobi Medical Center (NYC Health+Hospital)

Jefferson Health

Lahey Hospital and Medical Center

Lancaster General Hospital

Massachusetts General Hospital

Mayo Clinic

Medical University of South Carolina

MedStar Heart & Vascular Institute

Memorial Hermann – Texas Medical Center

New York – Presbyterian/Columbia University Medical Center

Newton-Wellesley Hospital

Northwestern Medicine – Bluhm Cardiovascular Institute

NYU Langone Medical Center

OhioHealth Heart and Vascular

Ohio State University Medical Center

Oklahoma State University Medical Center

Piedmont Heart and Vascular Institute

SSM Health Saint Louis University Hospital

Temple Lung Center

UC Davis Health

University of Kentucky Medical Center

University of Pittsburgh Medical Center

University of Toledo Medical Center

Yale New Haven Hospital

Institutional Members

Albany Medical Center

Allina Health

Ascension Borgess Hospital

Ascension St. Vincent's

AtlantiCare

Augusta University

Beirut Cardiac Institute

Beth Israel Deaconess Medical Center

Cancer Treatment Centers of America at Southeastern Regional Medical Center

Carolinas Healthcare

Doylestown Hospital

Elkhart General Hospital Beacon Healthcare System

Ellis Medicine

Englewood Hospital

Essentia Health St. Mary's Medical Center

Geisinger Medical Center

Gundersen Health

Grady Health System

Harbor-UCLA Medical Center

Henry Ford Hospital

Infirmary Health

Jamaica Hospital Medical Center

Jefferson Health / South Jersey Washington Township Division

Jefferson Vascular Center

Johns Hopkins University

Lancaster General Hospital

Lenox Hill Hospital

Loma Linda University Medical Center

Loyola University

MacNeal Hospital

Marshfield Clinic Health System

MD Anderson Cancer Center

Medical University of South Carolina

Memorial Hospital Jacksonville

Mercy Hospital of Buffalo

Mercy Hospital/Saint Louis University

Miami Cardiac & Vascular @ Baptist Health South Florida

Mission Hospital

Mount Sinai School of Medicine

Northern Westchester Hospital

The University of Texas Southwestern Medical Center

NY Presbyterian/Columbia

Ohio State University Medical Center

Oklahoma University Medicine

Palos Community Hospital

Penn Medicine

Providence Holy Cross Medical Center

Providence Hospital

Rhode Island Hospital

St. Francis Hospital and Medical Center

St. Joseph Mercy Hospital Ann Arbor

UCLA David Geffen School of Medicine

University of Alabama Birmingham Medical Center

University of Chicago

University of Michigan

University of Minnesota

University of Rochester Medical Center

University of Virginia

University of Wisconsin Health

Vanderbilt University

Wellstar Health System

Wroclaw University Hospital

Weill Cornell Medicine

Yale University

Appendix B: 2019 Hospital Consumer Assessment of Healthcare Providers and Systems Survey

HCAHPS Survey

SURVEY INSTRUCTIONS

- You should only fill out this survey if you were the patient during the hospital stay named in the cover letter. Do not fill out this survey if you were not the patient.
- Answer <u>all</u> the questions by checking the box to the left of your answer.
- You are sometimes told to skip over some questions in this survey. When this happens you will see an arrow with a note that tells you what question to answer next, like this:

☐ Yes
☑ No ➔ ***If No, Go to Question 1***

You may notice a number on the survey. This number is used to let us know if you returned your survey so we don't have to send you reminders.
Please note: Questions 1-22 in this survey are part of a national initiative to measure the quality of care in hospitals. OMB #0938-0981 (Expires November 30, 2021)

Please answer the questions in this survey about your stay at the hospital named on the cover letter. Do not include any other hospital stays in your answers.

YOUR CARE FROM NURSES

1. During this hospital stay, how often did nurses treat you with <u>courtesy and respect</u>?

[1]☐ Never
[2]☐ Sometimes
[3]☐ Usually
[4]☐ Always

2. During this hospital stay, how often did nurses <u>listen carefully to you</u>?

[1]☐ Never
[2]☐ Sometimes
[3]☐ Usually
[4]☐ Always

3. During this hospital stay, how often did nurses <u>explain things</u> in a way you could understand?

[1]☐ Never
[2]☐ Sometimes
[3]☐ Usually
[4]☐ Always

4. During this hospital stay, after you pressed the call button, how often did you get help as soon as you wanted it?

[1]☐ Never
[2]☐ Sometimes
[3]☐ Usually
[4]☐ Always
[9]☐ I never pressed the call button

YOUR CARE FROM DOCTORS

5. During this hospital stay, how often did doctors treat you with courtesy and respect?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

6. During this hospital stay, how often did doctors listen carefully to you?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

7. During this hospital stay, how often did doctors explain things in a way you could understand?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

THE HOSPITAL ENVIRONMENT

8. During this hospital stay, how often were your room and bathroom kept clean?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

9. During this hospital stay, how often was the area around your room quiet at night?

[1] ☐ Never
[2] ☐ Sometimes

YOUR EXPERIENCES IN THIS HOSPITAL

10. During this hospital stay, did you need help from nurses or other hospital staff in getting to the bathroom or in using a bedpan?

[1] ☐ Yes
[2] ☐ No ➔ **If No, Go to Question 12**

11. How often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

12. During this hospital stay, were you given any medicine that you had not taken before?

[1] ☐ Yes
[2] ☐ No ➔ **If No, Go to Question 15**

13. Before giving you any new medicine, how often did hospital staff tell you what the medicine was for?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

14. Before giving you any new medicine, how often did hospital staff describe possible side effects in a way you could understand?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

WHEN YOU LEFT THE HOSPITAL

15. After you left the hospital, did you go directly to your own home, to someone else's home, or to another health facility?

- [1] ☐ Own home
- [2] ☐ Someone else's home
- [3] ☐ Another health facility ➔ **If Another, Go to Question 18**

16. During this hospital stay, did doctors, nurses or other hospital staff talk with you about whether you would have the help you needed when you left the hospital?

- [1] ☐ Yes
- [2] ☐ No

17. During this hospital stay, did you get information in writing about what symptoms or health problems to look out for after you left the hospital?

- [1] ☐ Yes
- [2] ☐ No

OVERALL RATING OF HOSPITAL

Please answer the following questions about your stay at the hospital named on the cover letter. Do not include any other hospital stays in your answers.

18. Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?

- [0] ☐ 0 Worst hospital possible
- [1] ☐ 1
- [2] ☐ 2
- [3] ☐ 3
- [4] ☐ 4
- [5] ☐ 5
- [6] ☐ 6
- [7] ☐ 7
- [8] ☐ 8
- [9] ☐ 9
- [10] ☐ 10 Best hospital possible

19. Would you recommend this hospital to your friends and family?

- [1] ☐ Definitely no
- [2] ☐ Probably no
- [3] ☐ Probably yes
- [4] ☐ Definitely yes

UNDERSTANDING YOUR CARE WHEN YOU LEFT THE HOSPITAL

20. During this hospital stay, staff took my preferences and those of my family or caregiver into account in deciding what my health care needs would be when I left.

- [1] ☐ Strongly disagree
- [2] ☐ Disagree
- [3] ☐ Agree

21. When I left the hospital, I had a good understanding of the things I was responsible for in managing my health.

[1] ☐ Strongly disagree
[2] ☐ Disagree
[3] ☐ Agree
[4] ☐ Strongly agree

22. When I left the hospital, I clearly understood the purpose for taking each of my medications.

[1] ☐ Strongly disagree
[2] ☐ Disagree
[3] ☐ Agree
[4] ☐ Strongly agree
[5] ☐ I was not given any medication when I left the hospital

ABOUT YOU

There are only a few remaining items left.

23. During this hospital stay, were you admitted to this hospital through the Emergency Room?

[1] ☐ Yes
[2] ☐ No

24. In general, how would you rate your overall health?

[1] ☐ Excellent
[2] ☐ Very good
[3] ☐ Good
[4] ☐ Fair
[5] ☐ Poor

25. In general, how would you rate your overall mental or emotional health?

[1] ☐ Excellent
[2] ☐ Very good
[3] ☐ Good
[4] ☐ Fair
[5] ☐ Poor

26. What is the highest grade or level of school that you have completed?

[1] ☐ 8th grade or less
[2] ☐ Some high school, but did not graduate
[3] ☐ High school graduate or GED
[4] ☐ Some college or 2-year degree
[5] ☐ 4-year college graduate
[6] ☐ More than 4-year college degree

27. Are you of Spanish, Hispanic or Latino origin or descent?

[1] ☐ No, not Spanish/Hispanic/Latino
[2] ☐ Yes, Puerto Rican
[3] ☐ Yes, Mexican, Mexican American, Chicano
[4] ☐ Yes, Cuban
[5] ☐ Yes, other Spanish/Hispanic/Latino

28. What is your race? Please choose one or more.

[1] ☐ White
[2] ☐ Black or African American
[3] ☐ Asian
[4] ☐ Native Hawaiian or other Pacific Islander
[5] ☐ American Indian or Alaska Native

29. What language do you mainly speak at home?

1 ☐ English
2 ☐ Spanish
3 ☐ Chinese
4 ☐ Russian
5 ☐ Vietnamese
6 ☐ Portuguese
7 ☐ German
9 ☐ Some other language (please print):
_____

[This next question is]/[These next questions are] from [NAME OF HOSPITAL] and [is/are] not part of the official survey.

NOTE: IF HOSPITAL-SPECIFIC SUPPLEMENTAL QUESTION(S) ARE ADDED, THE STATEMENT ABOVE MUST BE PLACED IMMEDIATELY BEFORE THE SUPPLEMENTAL QUESTION(S).

THANK YOU

Please return the completed survey in the postage-paid envelope.

[NAME OF SURVEY VENDOR OR SELF-ADMINISTERING HOSPITAL]

[RETURN ADDRESS OF SURVEY VENDOR OR SELF-ADMINISTERING HOSPITAL]

Note. Questions are part of the HCAHPS Survey and are works of the U.S. Government. The HCAHPS questions are in the public domain and therefore are NOT subject to U.S. copyright laws.

Appendix C: Pulmonary Embolism Response Team Hospitals 2019

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Abbott Northwestern Hospital – Alina Health	240057	80	91	672	Minnesota	3
Aurora St. Luke's Medical Center	520138	80	90	951	Wisconsin	3
Baptist Health Louisville	180130	78	90	499	Kentucky	2
Beaumont Health	230269	77	84	3343	Michigan	3
Cedars-Sinai Medical Center	050625	76	91	882	California	5
Christiana Care Health System	080001	77	89	1249	Delaware	2
Cleveland Clinic	360180	79	92	786	Ohio	3
Detroit Medical Center	230273	74	82	2000	Michigan	3
Duke University Medical Center	340030	81	92	978	North Carolina	2
Emory Hospital Midtown	110078	76	88	534	Georgia	2
Edward – Elmhurst Memorial	140200	80	91	258	Illinois	3
Gates Vascular/Buffalo General Kaleida Health	330005	80	85	1068	New York	1
Grady Memorial Hospital	110079	73	85	953	Georgia	2
Icahn School of Medicine at Mount Sinai	330024	74	87	1139	New York	1
Inova Health	490063	78	91	164	Virginia	2
Jacobi Medical Center	330127	72	79	623	New York	1
Lahey Hospital and Medical Center	220171	79	90	345	Massachusetts	1
Lancaster General Hospital	390100	79	92	620	Massachusetts	1
Massachusetts General Hospital	220071	81	92	1019	Massachusetts	1
Mayo Clinic	520004	84	81	107	Wisconsin	3
Medical University of South Carolina	420004	78	91	820	South Carolina	2
Medstar Heart @ Georgetown University Hospital	090004	80	88	402	Washington, DC	2
Memorial Hermann – Texas Medical Center	450068	77	90	1087	Texas	4
New York – Presbyterian/Columbia University Medical Center	330101	76	89	2600	New York	1
Newton-Wellesley Hospital	220101	81	91	273	Massachusetts	1

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Northwestern Medical - Bluhm Cardiovascular Institute	140281	80	92	903	Illinois	3
NYU Langone Medical Center	330214	77	89	511	New York	1
Ohio State University Medical Center	360085	78	90	1170	Ohio	3
Oklahoma State University Medical Center	370078	75	88	171	Oklahoma	4
SSM Health Saint Louis University Hospital	260105	73	85	350	Missouri	3
UC Davis Health	050599	78	89	632	California	5
University of Kentucky Medical Center	180067	76	89	991	Kentucky	2
University of Pittsburgh	390226	75	90	990	Pennsylvania	1
University of Toledo Medical Center	360048	77	87	246	Ohio	3
Yale New Haven Hospital	070022	77	89	1567	Connecticut	1
Albany Medical Center	330013	75	86	789	New York	1
Ascension Borgess Hospital	230117	75	86	353	Michigan	3
Ascension St. Vincent's	150100	79	89	376	Indiana	3
AtlantiCare	310064	74	88	540	New Jersey	1
Augusta University	110034	77	87	490	Georgia	2
Beth Israel Deaconess Medical Center	220086	80	90	743	Massachusetts	1
Carolinas Health Center	340075	79	88	874	North Carolina	2
Doylestown Hospital	390203	78	92	271	Pennsylvania	1
Elkhart General Hospital Beacon Healthcare System	150018	75	88	244	Indiana	3
Ellis Medicine	330153	71	83	356	New York	1
Englewood Hospital	310045	73	90	288	New Jersey	1
Essentia Health St. Mary's Medical Center	240002	83	88	329	Minnesota	3
Geisinger Medical Center	390006	90	78	554	Pennsylvania	1
Gundersen Health	520087	93	85	297	Wisconsin	3
Harbor-UCLA Medical Center	50376	77	85	407	California	5
Henry Ford Hospital	230053	78	88	672	Michigan	3
Infirmary Health	010113	83	89	654	Alabama	2
Jamaica Hospital Medical Center Queens NY	330014	72	82	424	New York	1
Johns Hopkins University	210009	80	93	999	Maryland	1
Lancaster General Hospital	390100	79	92	620	Pennsylvania	1
Lenox Hill Hospital	330119	72	87	442	New York	1

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Loma Linda University Medical Center	050327	81	90	1077	California	5
Loyola University	140276	78	87	547	Illinois	3
MacNeal Hospital	140054	76	85	328	Illinois	3
Marshfield Clinic Health System	520037	81	88	204	Wisconsin	3
Mercy Hospital of Buffalo	330279	76	87	473	New York	1
Mercy Hospital/Saint Louis University	260020	78	90	859	Missouri	3
Mission Hospital	340002	78	86	815	North Carolina	2
Mount Sinai School of Medicine	330024	74	87	1176	New York	1
University of Texas Southwestern Medical Center	450018	81	88	882	Texas	4
Northern Westchester Hospital	330162	78	92	202	New York	1
Providence Holy Cross Medical Center	50278	77	90	377	California	5
Rhode Island Hospital	410007	77	87	704	Rhode Island	1
St. Joseph Mercy Hospital Ann Arbor	230156	79	91	548	Michigan	3
University of Chicago	140088	78	90	811	Illinois	3
University of Michigan	230046	79	92	550	Michigan	3
University of Minnesota	240080	79	89	861	Minnesota	3
University of Virginia	490009	78	93	681	Virginia	2
University of Wisconsin Health	520098	82	92	624	Wisconsin	3
University of Alabama Birmingham Medical Center	10033	79	92	1157	Alabama	2
Vanderbilt University	440039	79	91	1000	Tennessee	2

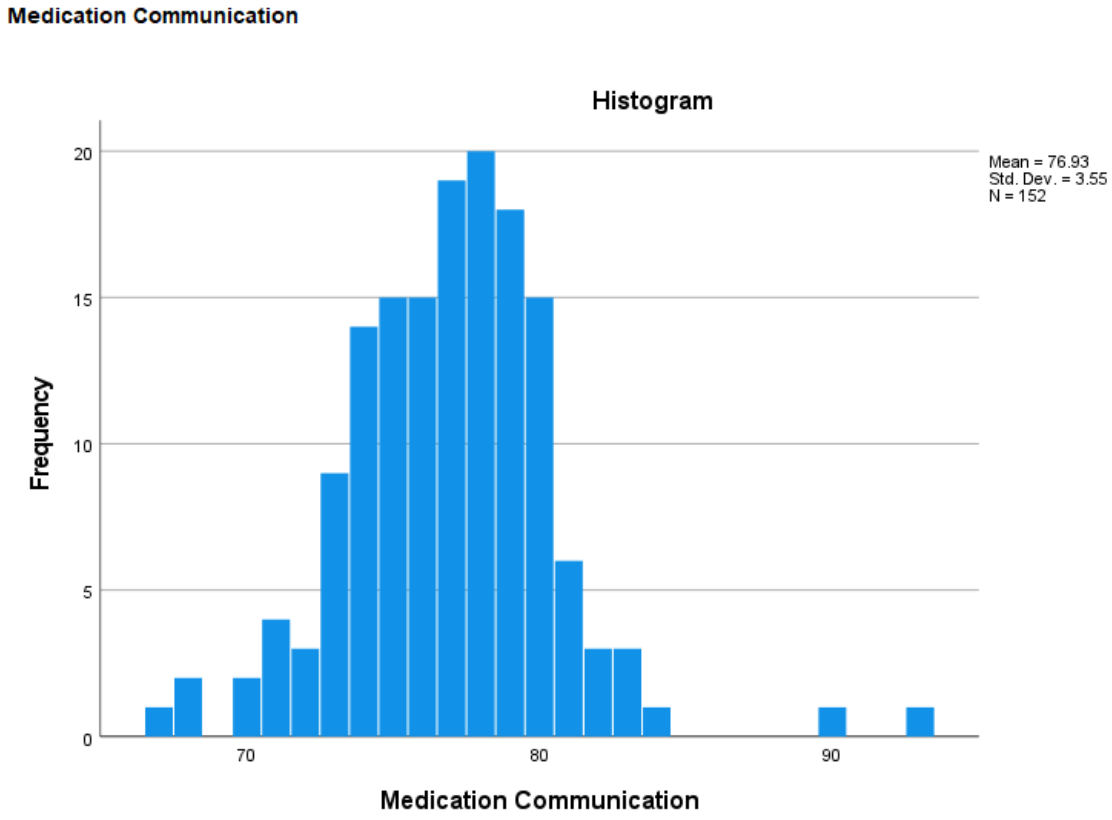
Appendix D: Non-Pulmonary Embolism Response Team Hospitals 2019

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Southeast Alabama Medical Center	10001	80	88	520	Alabama	2
North Alabama Medical Center	10006	76	86	263	Alabama	2
ST. Rose Hospital Alameda California	50002	76	87	153	California	5
ST. Joseph Hospital Eureka California	50006	76	84	150	California	5
Peninsula Medical Center Burlingame California	50007	79	92	501	California	5
California Pacific Medical Center (Davies Campus) San Francisco	50008	73	85	191	California	5
Queen of The Valley Medical Center (Napa)	50009	76	87	208	California	5
Waterbury Hospital	70005	78	90	506	Connecticut	1
ST. Francis Hospital Wilmington Delaware	80003	74	85	146	Delaware	2
Hamilton Medical Center	110001	78	88	222	Georgia	2
Upson Regional Medical Center	110002	79	89	105	Georgia	2
ST. Mary's Hospital	110006	77	90	105	Georgia	2
Alton Memorial	140002	79	90	121	Illinois	3
Presence Saint Joseph Medical Center	140007	75	81	303	Illinois	3
Gottlieb Memorial Hospital	140008	74	86	201	Illinois	3
Northshore University Health System	140010	77	90	738	Illinois	3
Southern Illinois Hospital Services	140011	79	88	162	Illinois	3
Methodist Hospital	150002	76	84	802	Indiana	3
ST, Margaret Health Hammond	150004	75	85	500	Indiana	3
ST. Elizabeth FT. Thomas Kentucky	180001	82	89	157	Kentucky	2
Whitesburg ARH Hospital	180002	82	90	110	Kentucky	2
Meritus Medical Center Hagerstown	210001	77	87	254	Maryland	1
HealthAlliance Hospital Leominster	220001	74	85	145	Massachusetts	1
Mount Auburn Hospital Cambridge	220002	78	90	201	Massachusetts	1
Sturdy Memorial Hospital Attleboro	220008	79	91	131	Massachusetts	1
Lawrence General Hospital	220010	75	85	186	Massachusetts	1
Cambridge Health Alliance	220011	76	87	253	Massachusetts	1
ST Joe Mercy Hospital Trinity Health	230002	77	90	537	Michigan	3
Providence Hospital	230019	75	87	599	Michigan	3
Lakeland Hospital	230021	78	88	296	Michigan	3
Promedica Coldwater Regional Hospital	230022	73	85	101	Michigan	3
Sinai-Grace Hospital	230024	73	79	334	Michigan	3
ST Joseph Mercy Oakland	230029	75	89	504	Michigan	3
North Memorial Health	240001	75	89	372	Minnesota	3
Hennepin County Medical Center	240004	74	85	569	Minnesota	3
Mercy Hospital Joplin	260001	76	90	221	Missouri	3

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Bothwell Regional Healthcare	260009	78	87	108	Missouri	3
Hackensack University Medical Center	310001	74	86	702	New Jersey	1
Newark Beth Israel Medical Center	310002	75	86	665	New Jersey	1
HealthAlliance Hospital Broadway Campus Kingston	330004	74	81	147	New York	1
Buffalo General Hospital -Kaleida Health	330005	75	85	504	New York	1
ST. Joseph's Medical Center Yonkers	330006	70	79	194	New York	1
Bronx Health System Fulton St. Campus*	330009	71	81	859	New York	1
Lourdes Hospital Binghamton	330011	77	86	197	New York	1
New York Community Hospital of Brooklyn	330019	68	82	524	New York	1
Nassau University Medical Center	330027	67	80	530	New York	1
Richmond University Medical Center	330028	74	78	507	New York	1
Newark-Wayne Community Hospital	330030	77	86	300	New York	1
Chenango Memorial Hospital	330033	73	86	138	New York	1
South Shore / Southside Hospital	330043	73	85	341	New York	1
Faxton-ST Luke's Healthcare	330044	74	85	370	New York	1
Northern Regional Hospital-Mount Airy	340003	78	89	635	North Carolina	2
High Point Regional Health System	340004	74	86	351	North Carolina	2
Scotland Memorial Hospital	340008	74	76	152	North Carolina	2
Mercy Health- Anderson Hospital	360001	79	89	226	Ohio	3
Marion General Hospital	360011	77	86	250	Ohio	3
Mount Carmel St. Ann's	360012	73	88	233	Ohio	3
Hillcrest Medical Center	370001	75	85	656	Oklahoma	4
Holy Spirit Hospital	390004	76	88	503	Pennsylvania	1
Chestnut Hill Hospital	390026	77	87	148	Pennsylvania	1
Schuylkill Medical Center	390030	71	81	186	Pennsylvania	1
ST Luke's Quakertown Hospital	390035	75	88	112	Pennsylvania	1
Roger Williams Medical Center	410004	76	87	160	Rhode Island	1
Piedmont Medical Center Rock Hill	420002	78	84	300	South Carolina	2
Jackson-Madison County General	440002	80	90	642	Tennessee	2
The Hospitals of Providence-Memorial Campus	450002	77	85	500	Texas	4
Valley Baptist Medical	450028	75	88	550	Texas	4
Norton Community Hospital	490001	80	89	129	Virginia	2
Sentara RMH Medical Center	490004	80	88	250	Virginia	2
United Medical Center	090008	67	75	330	Washington, DC	2
Waukesha Memorial Hospital	520008	79	90	262	Wisconsin	3
ST. Joseph Hospital	520017	83	91	193	Wisconsin	3

Hospital Name	Facility ID	Linear Score Medication	Linear score overall rating	Bed Size	State	Region
Ascension St Mary's Hospital	520019	80	86	500	Wisconsin	3
United Hospital System	520021	80	89	556	Wisconsin	3
Aurora Medical Center	520034	80	91	938	Wisconsin	3

Appendix E: Mean Scores of Medication Communication

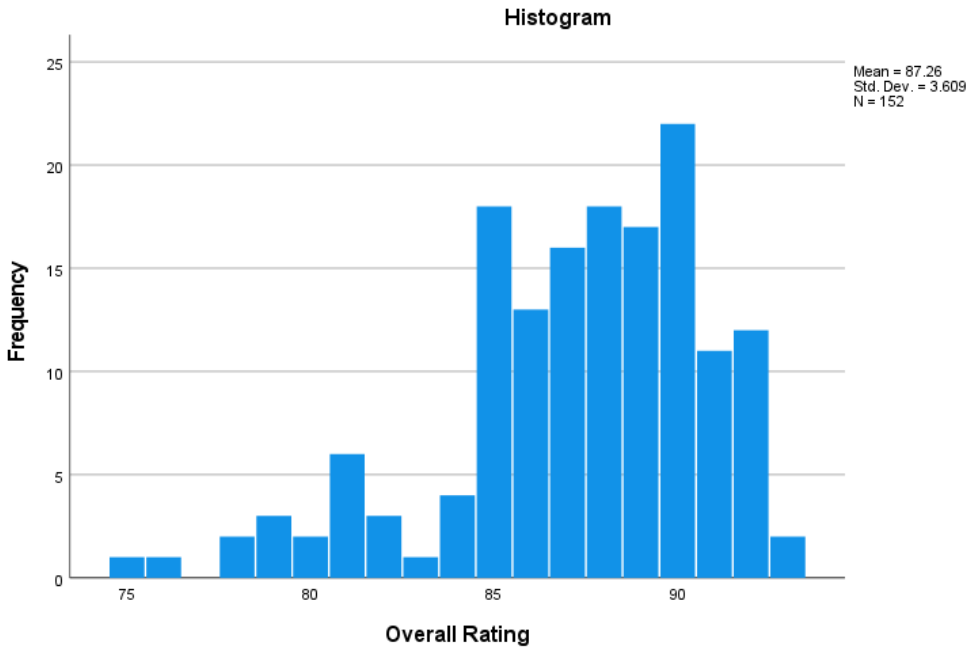


Note. Dependent Variable: HCAHPS Medication Communication

Averages above 90 = Pulmonary Embolism Response Team Hospitals

Averages below 70= Non-Pulmonary Embolism Response Team Hospitals

Appendix F: Mean Scores of Overall Rating



Note. Dependent Variable: HCAHPS Overall Rating

Averages above 90 = Pulmonary Embolism Response Team Hospitals

Averages below 80 = Non-Pulmonary Embolism Response Team Hospitals

Appendix G: Levene's Equality of Variances

Group Statistics

	PERT(1) Non-PERT(0)	N	Mean	Std. Deviation	Std. Error Mean
Medication	0	76	75.88	3.249	.373
Communication	1	76	77.99	3.546	.407
Overall Rating	0	76	86.09	3.656	.419
	1	76	88.42	3.180	.365

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Medication Communication	Equal variances assumed	.057	.812	-3.82	150	<.001	<.001	-2.11	.552	-3.20	-1.02
	Equal variances not assumed			-3.82	149	<.001	<.001	-2.11	.552	-3.20	-1.02
Overall Rating	Equal variances assumed	.818	.367	-4.19	150	<.001	<.001	-2.33	.556	-3.43	-1.23
	Equal variances not assumed			-4.19	147	<.001	<.001	-2.33	.556	-3.43	-1.23

Note. Scores Analysis: Dependent Variables

Appendix H: Permission Letter

Subject: Permission to use maps

We discussed this at the executive committee level on Monday evening, and all were unanimously in favor of you moving forward with the slides. Thank you again for asking.

Again, thank you so very much for reaching out.

Sincerely,