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Effect of cardiovascular surgeon and acute care nurse practitioner collaboration on postoperative outcomes.

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EFFECT OF CARDIOVASCULAR SURGEON AND ACUTE CARE NURSE PRACTITIONER COLLABORATION ON POSTOPERATIVE OUTCOMES

by

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
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ABSTRACT OF DISSERTATION
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The changes occurring in the health care environment require health care delivery systems to provide high quality care services with increased efficiency and cost effectiveness. Health care systems are encouraged to use less expensive care providers for medical management responsibilities while at the same time maintaining or increasing quality of patient care. Accompanying the changes in health care delivery modes is the parallel rise in patient acuity levels related to chronic illnesses of patients admitted for cardiac services such as cardiovascular surgeries. Based upon the conceptual framework of Donabedian (1980), patients with the primary diagnostic related group (DRG) 104, 105, 106, or 107 in 1998 and DRG 104, 105, 107, or 109 in 2001 were studied. The purposes of this retrospective, 2-group comparison study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with acute care nurse practitioners (ACNPs). Postoperative cardiovascular care included all patient care management from the time the patient was transferred from the operating room until the patient was discharged from the health care system. Postoperative patient outcomes included length of stay and patient satisfaction. Length of stay was analyzed by evaluating selected contributing variables or covariates. These included comorbidity, complications,

readmissions, reoperations, minutes of intubation, supplemental oxygen, and infections. The economic outcome evaluated was the health care system total cost for an episode of care utilizing a cost index for weighted comparison. The sample included 215 subjects from 2 nursing units in a north Alabama health care system. Using ANCOVA procedures for statistical analyses, results indicated that cardiovascular surgeons in collaboration with ACNPs did indeed decrease length of stay by 1.91 days per patient, and total cost of that care decreased by $5,038.91 per patient. Patient satisfaction information was inconclusive.

DEDICATION

Walter, I dedicate this dissertation to you. Your support and encouragement were the wind beneath my wings throughout the dissertation process. Eric and Scot, you are both such joys and you have always been my cheering squad. Mom, thank you for your encouragement and patience all these years. You always knew I could do it.

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CHAPTER 1

INTRODUCTION

Health care takes place in an environment of change. The changes occurring in the health care environment require health care delivery systems to provide high quality care services with increased efficiency and cost effectiveness. In a managed care environment, the challenges to a health care system are to maintain quality of care while decreasing the cost associated with that care. Health care systems are encouraged to use less expensive care providers for routine medical management responsibilities while at the same time maintaining or increasing the quality of care provided to patients. With the changes occurring in the health care arena, it is imperative that health care delivery settings redesign care delivery systems into ones that are highly efficient and cost effective (Callahan, 1996; Clochesy, Daly, Idemoto, Steel, & Fitzpatrick, 1994; Jones, 1993; Parrinello, 1995).

Accompanying the changes in health care delivery modes is the parallel rise in patient acuity levels in health care systems. This increase in acuity is due in part to the increasingly aged population and the incidence of chronic illnesses continuing to increase in society (Dunn, 1997; Rudy et al., 1998). One hundred-ten million Americans have at least one chronic illness such as arthritis, diabetes, or hypertension (Clochesy et al., 1994). Chronic illnesses compound the acuity of patients admitted to health care facilities for cardiac services such as cardiovascular surgeries.

Cardiovascular disease remains the primary cause of death in the United States (Riddle, Dunstan, & Castanis, 1996). One-third of the Health Care Financing Administration's (HCFA) Medicare budget each year is spent on cardiovascular care (Urban, 1997). Because acute care nurse practitioners (ACNPs) are educated in clinical expertise and integration of care across the acute care continuum and are familiar with the health care system, they could streamline the care delivery process that would result in minimal length of stay and minimized costs. ACNPs practicing in collaboration with physicians is a collegial relationship of decision making for patient management (Clochesy & Daly, 1997). Results of collaborative practice are synergistic because the contributions of both health care professionals are optimized to a level that would not be achievable through independent practice (Parrinello, 1997). To date, there has been little research on ACNP collaborative practice to document how ACNP collaborative care affects patient outcomes and whether that care is cost efficient.

Nurse practitioners' (NPs) education prepares them with cognitive and clinical skills to function independently and interdependently with physicians in identifying and delivering medical care. This highly skilled care provided by NPs may decrease costs to payors, both individual patients and insurance providers, and health care facilities while at the same time providing quality patient care (Hylka & Beschle, 1995). Research shows that NPs have a significant impact on decreasing patient length of stay, decreasing patient morbidity and mortality, and increasing patient satisfaction (Callahan, 1996). When quality of care provided by NPs was compared with that of resident house physicians, no difference was found (Bissinger, Allred, Arford, & Bellig, 1997; Rudy et al., 1998), but the cost of care was significantly less when the care was provided by NPs (Bissinger et al.).

The advantages of using a unit-based advanced practice nurse (APN) in a cardiovascular surgery unit were presented by Rudisill (1995). The critical care unit-based APN was described as a nurse who had a master's degree, had an area of expertise related to critical illness, and whose practice was geographically limited to a specific patient unit within a hospital. The APN directed patient care and monitored variances from the expected course of events of the cardiac surgical care maps. Results of the 3-month study at the Presbyterian Hospital in Charlotte, North Carolina, involved approximately 150 patients and revealed positive outcomes of APN-directed care as evidenced by procedures being done in a time-efficient manner for individual patients. Quality management issues improved when APNs began directing clinical decisions, such as weaning patients from ventilators and cardiac support, and cost effectiveness of care delivery directed by APNs was documented by decreased length of stay. APN-directed care also led to increased patient satisfaction. Other duties of the APN in Rudisill's study included following patients in intermediate care on a daily basis until discharge, and the APNs followed all patients readmitted to the hospital for complications after surgery. These duties provide a continuity of care across the acute care continuum.

Although NPs' effects on patient outcomes have been studied in a variety of health care settings, ACNPs practicing in postoperative cardiovascular acute care settings have not been studied. The literature related to ACNPs reveals that clarification and differentiation of ACNP practice from other NP practices have not been clearly established. Although NPs have been practicing in acute care settings and have been identified as ACNPs, in reality often they were family nurse practitioners (FNPs) or adult nurse practitioners (ANPs) practicing in acute care settings and identified themselves as ACNPs. Educational prepara-

tion and experiential preparation for primary NPs and ACNPs are different. Because ACNPs are uniquely prepared to direct the care process for acutely ill patients, such as postoperative cardiovascular patients, it would seem that patient outcomes would improve when ACNPs, in collaborative practice, direct the care process during these acute episodes of a patient hospitalization. The effect of ACNP collaborative care in this study focused on relevant outcomes identified in the literature and by the study health care system's management team.

Purposes

The purposes of this retrospective, 2-group comparison study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. It was hypothesized that patient length of stay would decrease and patient satisfaction would increase when cardiovascular surgeons and ACNPs collaboratively directed care. The economic outcome examined was health care system total cost. Because length of stay was hypothesized to decrease when cardiovascular surgeons and ACNPs collaboratively direct care, it was anticipated that the decreased length of stay would be reflected in decreased total cost for an episode of care.

Research Questions

For the purposes of this study, the research questions were (a) What is the difference in patient outcomes between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for

whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care? (b) What is the difference in one economic outcome between 2 groups of patients, 1 group of patients for whom cardiovascular surgeons alone directed postoperative care and 1 group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care?

Specific Aims and Hypotheses

This study had the following specific aims and hypotheses.

Specific Aim 1 was to compare patient outcomes between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed care.

Hypothesis 1a stated that postoperative cardiovascular patients who are cared for by cardiovascular surgeons and ACNPs collaboratively will have a shorter postoperative length of stay in the hospital, measured in days, than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.

Hypothesis 1b stated that postoperative cardiovascular patients who are cared for by cardiovascular surgeons and ACNPs collaboratively will have increased patient satisfaction with care than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.

Specific aim 2 was to compare an economic outcome between the 2 groups of patients, 1 group of patients for whom cardiovascular surgeons alone directed postoperative care and 1 group of patients for whom cardiovascular surgeons and ACNPs collaboratively

directed care. The economic outcome was health care system total cost for an episode of care.

Hypothesis 2 stated that collaborative care by cardiovascular surgeons and ACNPs will result in a lower health care system total cost compared to total cost when care was directed by cardiovascular surgeons alone.

Definitions of Terms

ACNP

Theoretical

ACNPs are master's-prepared registered nurses who have graduated from an accredited ACNP program and are certified as an ACNP. An ACNP is a health care provider who practices in ambulatory, acute, and long-term care settings (The American Academy of Nurse Practitioners, 1998). The American Nurses Association described an ACNP's role as providing advanced nursing care across the continuum of acute care services to patients who are acutely and critically ill (Daly, 1997). All ACNPs practice autonomously and in collaboration with health care professionals and other individuals to diagnose, treat, and manage patient health problems.

Operational

For the purposes of this study, an ACNP was a master's-prepared registered nurse who had graduated from an accredited ACNP program and was certified as an ACNP. The ACNPs in this study were hired and paid by the health care system to collaborate with the cardiovascular surgeons in the cardiovascular intensive care unit (CVICU) and the pro-

gressive cardiovascular unit (PCV). These ACNPs were employed by a North Alabama health care system and had been working in the CVICU as staff nurses prior to becoming ACNPs. The ACNP-1 worked in the CVICU and PCV as a staff nurse for 15 years and as an ACNP for 2 years. The ACNP-2 worked in the CVICU and PCV units for 8 years and as an ACNP for 9 months. The ACNP-3 worked in the CVICU and PCV as a staff nurse for 11 years and as an ACNP for 9 months. The ACNP-4 worked in the CVICU and PCV for 1 year and as an ACNP for 9 months. All four of these ACNPs attended the same university for their ACNP program, passed the ACNP certification exam offered by the American Nursing Credentialing Center (ANCC), and worked in collaborative practice with the cardiovascular surgeons.

Cardiovascular/Thoracic Surgeons

The 4 cardiovascular surgeons in this study were trained and board certified as cardiovascular surgeons. Surgeon 1 had been operating at this facility for 20 years, Surgeon 2 and Surgeon 3 had been operating for 11 years each, and Surgeon 4 had been operating for 5 years. They were members of the same medical practice and shared office space and call schedule.

Collaboration

Theoretical

Collaboration was defined in the dictionary as the process or act of working together (Steinmetz, 1997). Using the dictionary definition as the beginning point for clarification, Baggs et al. (1999) and Wells, Johnson, and Salyer (1998) defined physician-nurse

collaboration as doctors and nurses working together, sharing responsibility for problem-solving, and sharing decision making about patient care. These authors explained that the more collaboration nurses reported, the lower the risk of negative patient outcomes that included mortality and readmission rates.

Professional collaboration brings together the skills and talents of both disciplines, creating an enhanced environment for better patient outcomes (Neale, 1999). Improved patient outcomes can ultimately translate into improved quality of care, quality of life, and cost-effective health care delivery. The Balanced Budget Act (1997) clarified collaboration as working as a team, frequent consultation, shared ideas and knowledge, and consistent interaction regarding patient needs that results in enhanced patient care and satisfaction. Neale elaborated that collaboration is more effective and comprehensive than independent practice, is more cost-effective than independent practice, and is a more effective delivery mode that results in comprehensive quality care.

Operational

For the purpose of this study, cardiovascular surgeon and ACNP collaborative practice was defined as cardiovascular surgeons and ACNPs working together, sharing responsibility for problem solving, and sharing decision making about postoperative cardiovascular patient care. Collaborative care was provided 24 hr a day, 5 days a week; on weekends collaborative care was 12 hr a day with physicians on-call the other 12 hr each weekend night. Census in the units remained constant except for Sunday when census in the CVICU would be less due to no surgery on Sunday and transfer to PCV of most patients who had surgery on Friday or Saturday. Usual surgery days were Monday through

Friday with overflow and emergency cases scheduled for Saturday. Every patient who was discharged with one of the diagnostic related groups (DRGs) being investigated in this study had collaboratively directed postoperative cardiovascular care. The years 1998 and 2001 were chosen as the years to study because November 1998 was the time the health care system hired ACNPs to work collaboratively with cardiovascular surgeons, and 2001 was the year when collaborative practice was well established. The years 1999 and 2000 were used for stabilization of collaborative practice, which was a time for the ACNPs and cardiovascular surgeons to orient themselves to the collaborative practice model in patient management. Also, the availability of ACNPs to work in the CVICU and PCV was scarce during the years of stabilization, and availability of coverage for 24-hr days was not possible until the year of study, 2001.

Postoperative Cardiovascular Care

Postoperative cardiovascular care included all patient care management from the time the patient transferred from the operating room after surgery until the patient was discharged from the health care system for patients with the primary DRG of 104, 105, 106, or 107 in 1998 and DRG 104, 105, 107, or 109 in 2001. In 1998 DRG 104 was a cardiac valve procedure and other major cardiothoracic procedures with a cardiac catherization; DRG 105 was a cardiac valve procedure and other major cardiothoracic procedures without cardiac catherization; DRG 106 was coronary bypass with cardiac catherization; and DRG 107 was coronary bypass without cardiac catherization. In October 1998 some of the DRG codes in cardiovascular surgery changed. The new codes, which were used in 2001, were as follows: DRG 104 was cardiac valve procedure and other major cardiothoracic

procedures with a cardiac catherization, DRG 105 was a cardiac valve procedure and other major cardiothoracic procedures without cardiac catherization, DRG 107 (which replaced 1998 106) was coronary bypass with cardiac catherization, and DRG 109 (which replaced 1998 107) was coronary bypass without cardiac catherization (*DRG Guidebook 2001*, 2000). Comparisons were made between the same DRGs by definition, not by code number.

Patient Outcomes

Theoretical

Outcomes are changes in current and future status that can be attributed to an antecedent event (Donabedian, 1980). They also must be quantitative in nature to allow for measurement. Outcomes research involves the measurement of the effect of an activity and is focused on the assessment of the influence of an activity (Ingersoll, 1998).

Operational

In this study, the antecedent event was the process of postoperative care and who directed that care. The outcome was a measurement that could assess a change in a patient or patient process. Patients were defined as adults over the age of 18 years. The patient outcomes for this investigation were length of stay and patient satisfaction, utilizing group, number of complications, number of readmissions, number of reoperations, minutes intubated, hours of supplemental oxygen, number of infections, and comorbidity as contributing factors (covariates) to length of stay. It was thought that mortality would contribute to length of stay but was found to be unrelated so was not utilized as a covariate.

Length of stay. Length of stay was measured in days from day of surgery to day of discharge from the health care system.

Complications. Number of complications was the summed total of complications, including prolonged ventilation, pulmonary embolism, postoperative renal failure, vascular-aortic dissection, iliac/femoral dissection, acute limb ischemia, heart block, cardiac arrest, anticoagulant complications, tamponade, gastrointestinal complications, multisystem failure, and atrial fibrillation.

Readmissions. Readmissions included readmissions to the CVICU and to this health care facility within 30 days postoperatively.

Reoperations. Reoperations included the total number of reoperations for bleeding problems, valve problems, graft problems, other cardiac problems, or for a noncardiac problem.

Minutes of intubation. Minutes intubated included the total number of minutes the individual was intubated for this surgery and postoperatively.

Supplemental oxygen. Hours of supplemental oxygen was calculated in full hours, not fractions of hours, and included all units (hours) of oxygen usage as recorded by the respiratory care department.

Infections. Infections was a total number for all infections, which included infected sternum, infected thoracotomy, infected leg incision, septicemia, a urinary tract infection, and pneumonia.

Comorbidity. Comorbidity was a sum of several preexisting conditions that an individual had prior to entering the cardiovascular operating room. These factors included a history of hypercholesterolemia; diabetes; renal failure; dialysis; hypertension; cerebrovascular accident or stroke; infectious endocarditis; immunosuppressive therapy; peripheral vascular disease; cerebrovascular disease; previous cardiovascular intervention including previous bypass, valve, or nonsurgical intervention; myocardial infarction; congestive heart failure; angina, cardiogenic shock; and an arrhythmia that was atrial fibrillation/flutter.

Mortality. Mortality information included discharge status and status 30 days after discharge.

Patient satisfaction. Patient satisfaction was measured as a monthly mean for both the CVICU and PCV reported on The Press, Ganey Questionnaire (Appendix A) that patients were given at the time of discharge and that are mailed back to the health care system. Patient satisfaction monthly means were obtained from the marketing department of the health care facility and were the only data available for measuring patient satisfaction in these units.

The outcomes management personnel obtained patient outcome data for use in this study through the health care system's computerized records department. These outcomes were selected because they are measurable and some have been used in other studies and were identified by the health care facility's administration as good predictors of quality.

In personal interviews with the cardiovascular surgeons and the ACNPs conducted in preliminary stages of this study, discussions of issues such as roles, expectations, and thoughts about collaborative practice in this setting were clarified. The cardiovascular surgeons were in total support of the research and believed that results would support the hypotheses. They were already experiencing results of collaborative practice by receiving fewer calls while in the operating room, in their office on clinic days, and after hours when they were home. They believed that patient management was in good hands with the ACNPs. The ACNPs also were in support of this research because they said they believed a good indicator of their effectiveness in their collaborative role was patient length of stay.

Economic Outcome

Theoretical

The economic outcome being investigated in this study was the total cost for an episode of care. Total cost is defined as fixed costs plus variable costs (Finkler, 1993). Cost comparisons were made between the 2 groups. A cost comparison study was defined by Zarnke, Levin, and O'Brien (1997) as comparison of only the costs of 2 or more programs.

Operational

For the purpose of this study, the economic outcome was defined as the health care system's total cost for the DRG encounter being investigated per patient as reported by the health care system. The total cost included both fixed and variable costs. Fixed costs included CVICU bed cost per day and PCV bed cost per day. Variable costs included surgery costs, pharmacy costs, cardiac support costs, anesthesia costs, and other variable costs undefined by the health care system.

Conceptual Framework

When designing an outcomes research study, an appropriate framework to guide that research is the structure, process, and outcome trilogy described by Donabedian (1980). Outcomes cannot be measured without a prior intervention or process, and the process cannot take place outside of a structure. The trilogy described by Donabedian has both antecedents and descendents and is useful for evaluation. After a review of the trilogy of structure, process, and outcome, application to the current study will be discussed.

Donabedian (1980) defined structure as the relatively stable environment within which patient care is provided. The environment influences the kind of care that is provided in that it establishes what resources are available with which to provide care. Structure is relevant to quality of care in that the resources available to provide care may increase or decrease the probability of providing good care. Because structure is relatively stable, it is not a good measure of changing care quality, but it is probably the most important means of protecting and promoting quality of care (Donabedian).

As part of the trilogy described by Donabedian (1980), process is defined as the set of activities of care that take place between the health care provider and the patient. Evaluation of the process involves examining the characteristics of care and the consequences of that care in accordance with the value placed upon health by the individual and/or society (Donabedian). In this study the cardiovascular surgeon and ACNP collaborative care is an integral part of the process. ACNPs providing postoperative care collaboratively with cardiovascular surgeons have a keen awareness of the financial aspects of care. It is by evaluating patient outcomes and associated cost changes that the effectiveness of the process of collaborative care of the cardiovascular surgeon and ACNP can be measured.

Outcomes are changes in current and future status that can be attributed to an antecedent event (Donabedian, 1980). Outcomes research involves the measurement of the effect of an activity and is focused on the assessment of an intervention's influence (Ingersoll, 1998).

Donabedian (1980) offered the structure, process, and outcome framework as an approach to the acquisition of information about the presence or absence of quality. In this way, Donabedian's trilogy of structure, process, and outcome was a useful framework to guide nursing research that examined the process of care and evaluated that process based upon outcomes while keeping in mind that the process took place within a structured environment. In this retrospective, 2-group comparison study, the investigator examined the effect that cardiovascular surgeon and ACNP collaborative care had on postoperative cardiovascular patient and economic outcomes.

The structure, according to Donabedian (1980), is the environment within which health care is provided. For this study, the structure was a 901-bed comprehensive health care system located in north Alabama (Figure 1 and Methodology for greater detail). The CVICU and PCV were the settings within which the ACNPs were hired to manage, in collaboration with the cardiovascular surgeons, all postoperative cardiovascular care. Clinical pathways or care maps (Appendix B) were used to guide the process of care for all cardiovascular DRGs for the years of study, 1998 and 2001, and served as an integral part of the structure. The same care map was used for all DRGs in this study. The care map was reviewed in August 1999 and remained unchanged.

In this study the process examined was the direction of postoperative cardiovascular care, whether care was directed by cardiovascular surgeons alone or by cardiovascular surgeons and ACNPs in collaboration. The outcomes achieved by way of the process were compared between 2 time periods with 2 independent groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and another group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care (Figure 1). The only thing that changed in the care process was the addition of ACNPs.

Donabedian (1980) discussed the fact that quality and monetary cost are interrelated in many ways. "Quality costs money, but it is possible by cutting out useless services and by producing services more efficiently to obtain higher quality for the money that is now spent on care, or to have the same quality at lower cost" (Donabedian, p. 7). For this study, outcomes were selected to measure changes related to the process of care delivery. Because outcomes are reflective of quality of care, the effectiveness of cardiovascular sur-

geon and ACNP collaborative care was quantified and used for evaluation in the postoperative cardiovascular units. Relevant outcome variables were identified from previous research findings and by clinical and administrative experiences (Figure 1). Patient length of stay and patient satisfaction with care were the patient outcome variables examined, and complications, readmissions, reoperations, minutes of intubation, hours of supplemental oxygen, and infections were contributing factors (covariates) to length of stay. The economic outcome variable for this study included the actual health care system cost for the DRGs being studied.

Significance of the Study

The significance of this study lies in its relationships to the research, practice, and education of nursing as a profession. Researchers have reported that NPs provided quality care with comparable patient outcomes at less cost than physicians and that collaborative care resulted in positive patient outcomes. Results of this study revealed that postoperative cardiovascular care directed collaboratively by cardiovascular surgeons and ACNPs results in better patient outcomes than when cardiovascular surgeons alone directed care. This research also showed that collaborative care costs less than traditional physician-directed care, which is important in this health care climate of cost containment. This research also could influence physician practice patterns by allowing physicians to see more patients either in the office or in the operating room as postoperative patients are being managed in the health care facility by ACNPs in collaborative practice.

In the realm of nursing research, this study supports the relatively new and growing body of knowledge regarding patient and economic outcomes resulting from cardio-

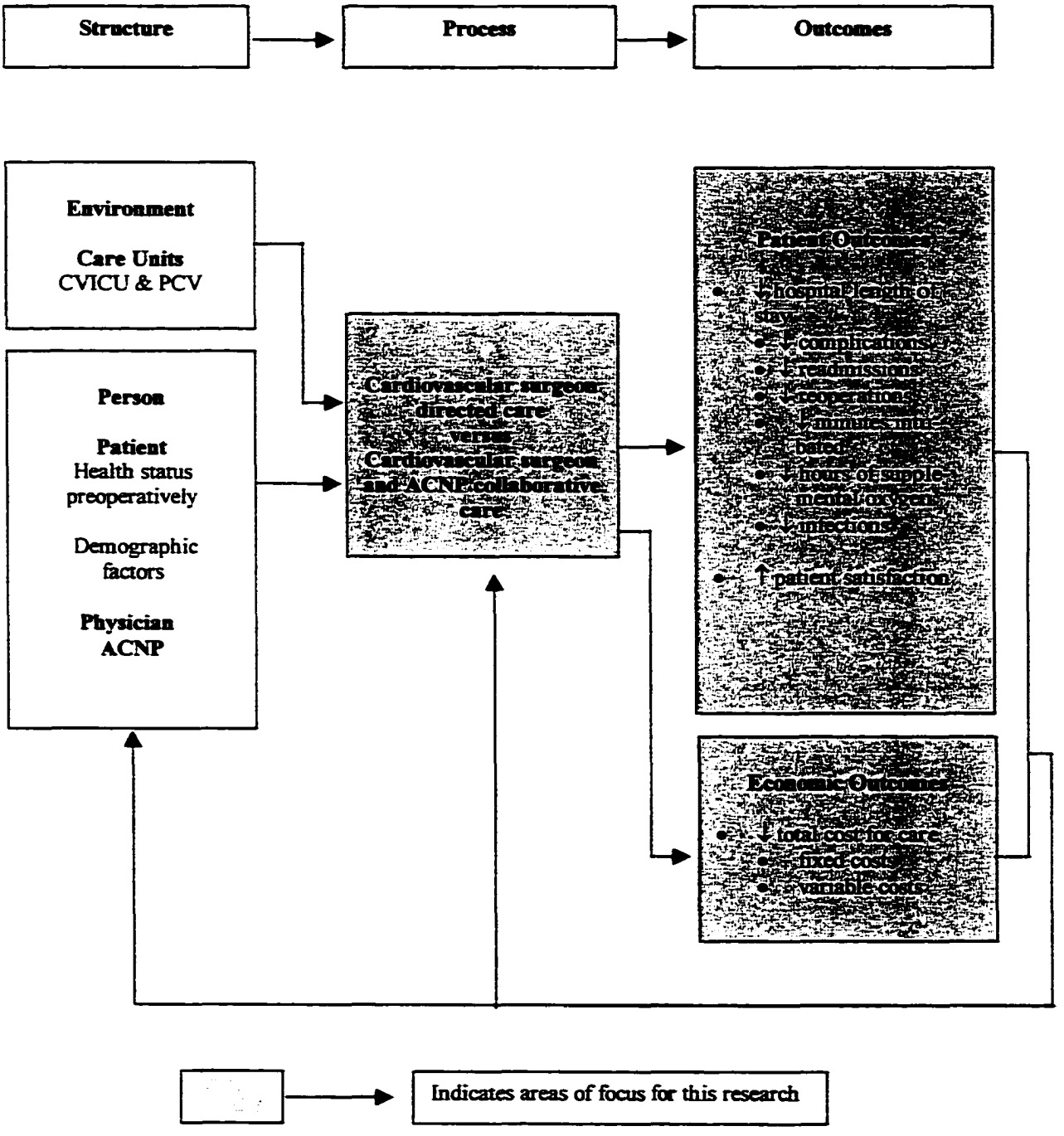

Figure 1. Conceptual framework. CVICU = cardiovascular intensive care unit; PCV = progressive cardiovascular unit; ACNP = acute care nurse practitioner.

vascular surgeon and ACNP collaborative care. The ACNPs collaboratively direct activities with physicians to expedite meeting the needs of the postoperative cardiovascular patient. These collaborative activities in this instance did decrease length of stay and decreased readmissions that will have quality implications as well as case management issues and cost ramifications to patients, the health care system, and other payors of health care. The value of decreasing length of stay was directly reflected in cost for the postoperative cardiovascular surgical events being examined.

Within nursing practice, cardiovascular surgeon and ACNP collaborative care is a comprehensive approach to cardiovascular patient care that, in this case, resulted in positive patient outcomes with decreased cost for postoperative care. In an environment that demands cost containment, utilization of cardiovascular surgeon and ACNP collaborative care for postoperative cardiovascular patients could result in appropriate utilization of resources with resulting cost containment.

Within nursing education, research evaluating how ACNPs affect patient and economic outcomes may be useful in planning the educational process of ACNPs. Documenting the positive effect ACNPs have on patient and economic outcomes supports current educational programs in preparing effective, efficient managers of care in acute care settings such as postoperative cardiovascular units.

Assumptions

For the purposes of this study the researcher of this investigation assumed the following:

1. All data entered into the computerized health care system records, which were examined retrospectively, were accurate.

2. The ACNPs functioned at a level commensurate with their academic and clinical expertise.

3. The structure within which the study took place was fundamentally unchanged except for the addition of ACNPs between the 2 data collection times.

4. The process was unchanged except for who directed care.

Summary

In a health care environment that demands quality patient care that is cost effective, collaborative practice may be one way to accomplish these goals. Cardiovascular disease and the associated complications continue to consume much of the Medicare budget, as well as the budgets of other payors of health care, each year. In our cost-conscious health care environment that also looks for positive patient outcomes, investigating and documenting cost-effective practices are important.

The purposes of this retrospective, 2-group comparison study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. It was proposed that patient and economic outcomes, identified in the literature as reliable indicators, would reflect increased quality care and decreased cost of care when provided collaboratively. The economic outcome included health care system total cost for specific discharge DRGs of interest in this study. It was

anticipated that any change in outcomes would be attributed to collaborative care and the presence of the ACNP.

The conceptual framework for this study was based on Donabedian's (1980) structure, process, outcome trilogy. Figure 1 depicted that trilogy and clarified the focus of this investigation. Significance of this study from the perspectives of nursing research, education, and service roles of the nursing profession were described, and assumptions of the study were listed.

CHAPTER 2

REVIEW OF RESEARCH LITERATURE

Introduction

The purposes of this retrospective, 2-group comparison study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. A review of research literature related to NP practice was conducted to identify appropriate patient and economic outcomes that would reflect the effect of postoperative cardiovascular care processes directed by cardiovascular surgeons alone or cardiovascular surgeons and ACNPs collaboratively. Also, a literature review of physician-nurse collaborative practice, patient outcomes, and economic outcomes was conducted to identify the body of knowledge already developed and to assist in the selection of variables for study in this investigation. Data bases utilized for identification of sources used in this study included Medline, Cinahl, and PubMed, which also included dissertation abstracts.

Research literature related to NP outcome studies was examined and is presented as groups of studies by area of nursing expertise. The areas of expertise that were examined include ACNPs, NPs in acute care settings, APNs, and NNPs. These particular studies were selected as support for this study because some are the classic sources cited by experts in the NP field, others reflect current NP research, and all identify outcomes that reflect care processes related to advanced nursing skills and practice.

Studies of ACNPs

Since the introduction of NPs as acute care health care providers who are qualified to efficiently and effectively manage patient care in acute care settings, there have been few studies wherein researchers have evaluated ACNP practice (Kleinpell, 1997; Sidani & Irvine, 1999). This investigator agrees with other investigators regarding the paucity of nursing research literature documenting ACNPs in general (Ingersoll, 1995; Kleinpell; Sidani & Irvine). When ACNPs in the current study were asked what they saw as good indicators of their roles, they said length of stay and patient satisfaction. It would seem that these ACNPs in collaboration with cardiovascular surgeons had effective decision-making patterns that positively contributed to patient outcomes. The majority of the literature reviewed revealed studies utilizing NPs other than ACNPs in acute care settings. It was a premise of this study and documented in the literature that ACNPs are educated uniquely for acute care settings and, as such, should prove to improve patient outcomes in these settings (Giacalone et al., 1995; Ingersoll, 1995; Knaus, Felten, Burton, Fobes, & Davis, 1997).

Authors of several articles referred to ACNPs but defined that to mean an NP working in the acute care setting (Knaus et al., 1997; Parrinello, 1995). The ACNP is a uniquely prepared individual, and clarification of the term ACNP is necessary in order to build a body of knowledge unique to ACNPs and that describes effective ACNP practice.

In the only study found related to ACNPs, care activities and patient outcomes were examined by Rudy et al. (1998). Rudy et al.'s study utilized ACNPs and physician assistants (PAs) together and examined outcomes; therefore, their study was not about ACNPs alone. Patient care was given by 16 ACNPs and PAs together versus a matched

group of 54 resident physicians. The Acute Physiology and Chronic Health Evaluation II (APACHE II), a patient severity of illness tool, was used to match similar patients for comparison between groups of health care providers, and a therapeutic intervention scoring system was used to calculate a final score for each group. Findings indicated that patient outcomes, such as length of stay, in-hospital mortality, and readmission rates within 2 weeks of discharge, were not significantly different between the 2 groups of health care providers; ACNPs/PAs and resident physicians provided comparable patient care with similar outcomes.

Studies of Primary Care NPs in Acute Care Settings

NPs have practiced in inpatient settings for years, but most have typically practiced in pediatrics or specialty areas like trauma (Spisso, O'Callaghan, McKennan, & Holcroft, 1990). In an attempt to accommodate large volumes of trauma patients and decrease the number of hours surgical housestaff worked, one California hospital utilized NPs with surgical critical care/acute care experience to provide assistance to the trauma team. In order to determine the effectiveness of the NP, several studies were conducted including analysis of cost-benefit ratio of NPs, an assessment of the documentation of quality of care for both inpatients and outpatients, and an evaluation of the impact of NPs on the health care team. Findings indicated that NPs working in conjunction with housestaff produced a 1.05-day decrease in length of stay with resulting decreased care costs, improved quality of care, and improved health care team efficiency and communication.

Practice of NPs in a new cardiac surgery program was studied by Callahan (1996). Although referred to as ACNPs by Callahan, the NPs in her study predated formal ACNP preparation and were defined as FNPs and ANPs in primary care who made the role transi-

tion to acute care. Callahan stated that actual ACNP training would be a more "desirable course of study" (p. 492) for nurses in this role. The NPs in this study provided continuity and skilled management of the care of cardiac surgery patients. Results of this care were high patient satisfaction related to the NP's personal approach and close follow up by the NP, a steady decline in patient length of stay, and consistently low patient morbidity and mortality rates.

Investigators in another study examined satisfaction with primary care NPs in an acute care setting (Knaus et al., 1997). This study took place in The University of Missouri Hospital and Clinics, Columbia, and was undertaken to evaluate how NPs worked to assist resident physicians to coordinate patient care on specialty care services. Although results reported by the researchers supported the appropriateness of NPs in the acute care setting, the NPs in Knaus' study were educated as primary care providers, and the authors suggested that NPs, because of educational background and critical-thinking skills, were prepared to be "transferable" (Knaus et al., p. 20) to acute care settings, although role ambiguity resulted from lack of clarity related to acute care role responsibilities.

Ingersoll (1995) reviewed literature on NP evaluation and made recommendations based upon evaluation theory. She stated that NPs have been practicing in the health care market since the 1970s, although these NPs were practicing in an acute care setting and thus called ACNPs. Expansion of the NP role prompted the need for formal evaluation as to contributions to the health care delivery process. Without exception, NPs have provided care equal to or greater than that of physicians and directly and indirectly influence patient outcomes. A comprehensive review of nursing journals since 1990 "likely" (p. 25) to contain studies related to NP role evaluation were reviewed, and, of the 2,391 nursing articles

published, none pertained to ACNP role evaluation. Ingersoll (1995) stated that one medical journal reported formal ACNP evaluation in a retrospective, descriptive design. The medical journal study authors evaluated cost-benefit analysis, assessment of quality of care, and impact analysis of the influence of the ACNP role on the health care team. The findings reported included decreased length of stay, increased quality of care, and increased patient satisfaction. Ingersoll's (1995) review also looked at role evaluation. Ideal outcome measures must be able to be measured quantitatively. When ACNPs, who were graduates of one of the nation's first ACNP programs, were asked by Ingersoll (1995) what they viewed as appropriate measures of their care processes, they gave 2 answers most often: (a) patient satisfaction and also family, physician, nurse, and other health care professional's satisfaction; and (b) to measure the planning processes and decision making patterns that contribute to patient outcomes.

Studies of APNs

Dahl and Penque (2000) examined an inpatient heart-failure program managed by APNs to document APN effects on patient outcomes. The purposes for the research were to improve patient care, decrease resource consumption, improve clinical management, and increase patient education. The APN was described as a master's-prepared, certified, nurse specialist, which included either an NP or a clinical nurse specialist. Results revealed statistically significant decreases in length of stay and mortality rates when APNs were utilized as care managers in this setting.

Giacalone et al. (1995) reported on a Cardiac Access Program at Massachusetts General Hospital that utilized APNs. The program was utilized to reduce delays in access

to care for cardiac patients and to maximize efficiencies in length of stay. The APNs were described as a blending of the NP and the clinical nurse specialist resulting in an advanced practitioner position. The APNs in this setting had a master's degree in nursing, national NP certification, and a strong background in critical care nursing. The APNs were key members of the health care provider team because of (a) length and level of educational preparation, (b) preparation in physical examinations and diagnostic reasoning, (c) socialization to autonomous practice, and (d) comprehensive approach to patient care management. Patient satisfaction was good with the APNs providing care, but more evaluation was needed on length of stay and complication rates.

Studies of NNPs

Neonatal nurse practitioner (NNP) studies seem to be the gold standard for acute care setting research. Much of the research that has been conducted to measure the roles and competencies of APNs as care providers has taken place since the 1970s in the context of neonatal intensive care units, where the APNs are called NNPs (Watts, Hanson, Burke, Gallagher, & Foster, 1996). In 2 retrospective studies, researchers compared cost and quality outcomes of 2 matched groups of infants who were cared for by either NNPs or medical house staff physicians (Bissinger et al., 1997; Schultz, Liptak, & Fioravanti, 1994). The quality of care indicators were length of stay, days on ventilator support, days on oxygen therapy, mortality, and morbidity. Cost of care was determined by charges accrued during the hospitalization. Researchers for both of these studies found that quality of care delivered by the 2 groups of health care providers was not significantly different, but the cost of care provided by the NNPs was less than the care provided by the medical house staff. It

was interesting to note in the Bissinger et al. study that, although not statistically significant, patients cared for by NNPs spent an average 14 days less in the neonatal intensive care unit (NICU), 5 days less on ventilator support, and 10 days less on supplemental oxygen therapy. Although this is not statistically significant, it is clinically significant because there were no differences identified by the researchers between infants cared for by the NNPs and those cared for by the medical house staff physicians. The major weakness of these studies was the fact that length of stay did not include time infants spent in transitional units prior to discharge and cost/charge ambiguity.

Another neonatal study was a randomized, controlled trial to compare a clinical nurse specialist/NP team with a pediatric resident physician team in the delivery of care to infants in the NICU (Mitchell-DiCenso et al., 1996). The sample included 821 infants admitted to the NICU in a 12-month study period. The 414 infants cared for by the clinical nurse specialist/NP team during the day had pediatric resident caregivers at night. The 407 infants cared for by the pediatric resident team had pediatric residents around the clock. Neonatologists supervised both teams. Outcome measures for this study were mortality, number of neonatal complications, length of stay, quality of care and parent satisfaction with care, long-term outcomes as measured by the Minnesota Infant Development Inventory, and costs. Results indicated that clinical nurse specialist/NP and resident teams were similar with respect to all outcome measures, and the authors suggested that this research supported the use of clinical nurse specialist/NPs as an alternative to pediatric residents in caring for critically ill neonates. One weakness of this study was that the CNS/NPs took care of their infants 8 hr a day, and resident physicians took care of those same infants 16 hr each day. The 2 sample groups are only different in care delivered 8 hr a day, otherwise

it can be assumed all care was the same. Under such conditions it would be logical to assume that both groups might have similar outcomes, but whether this translates into these authors' conclusion is questionable. Mitchell-DiCenso et al. discussed the fact that all previous research evaluating the role of NNPs was methodologically weak. Mitchell-DiCenso et al. stated that the strength of their study was in the random allocation of neonates to independent groups and that having residents follow infants at night made this study "directly applicable to the real-world situation" (p. 1148). One must question if this study accurately captured whether the process of care was actually the reason these groups had similar outcomes or whether they had similar outcomes because they had similar care providers who were the resident physicians who provided care for the majority of time each day. With 24 hr a day coverage, a truer measure of difference would be better identified.

The three studies presented on NNP practice revealed that NNPs provided the same quality of care as medical house officer physicians (Bissinger et al., 1997; Mitchell-DiCenso et al., 1996; Schultz et al., 1994). This was evidenced by similar patient outcomes with respect to all outcome measures. The quantitative indicators used to measure quality of care included (a) length of stay, (b) days on a ventilator, (c) days on supplemental oxygen, (d) readmission rates within 30 days of discharge, (e) complication rates, and (f) satisfaction with care. When cost of care was included in the evaluation, the empirical indicator was hospital charges.

Studies of Collaborative Practice

Baggs et al. (1999) and Wells et al. (1998) defined physician-nurse collaboration as doctors and nurses working together, sharing responsibility for problem solving, and shar-

ing decision making about patient care. These authors explained that, as nurses reported more collaboration, patient outcomes were better.

Professional collaboration brings together the skills and talents of both disciplines, creating an enhanced environment for better patient outcomes (Neale, 1999). Improved patient outcomes can ultimately translate into improved quality of care, quality of life, and cost-effective health care delivery. The Balanced Budget Act (1997) clarified collaboration as working as a team, frequent consultation, shared ideas and knowledge, and consistent interaction regarding patient needs that results in enhanced patient care and satisfaction. Neale elaborated that collaboration is more effective and comprehensive than independent practice, is more cost effective than independent practice, and is a more effective delivery mode that results in comprehensive quality care.

Collaborative practice and the positive patient outcomes resulting from collaborative care have been reported in the literature in critical care settings such as emergency rooms (Blunt, 1998; Pardee, 1993), laparoscopic operations (Caballero, 1998), and pediatric ambulatory surgery cardiac programs (Kirkpatrick, 1989). Managers of outpatient settings have also utilized and studied results of collaborative practice. Some of the outpatient settings have included gastroenterology (Hillier, 2001; Horton, Reffel, Rosen, & Farraye, 2001), occupational health (Dowrick & Rezents, 1993; Ferguson, 1996), women's health services where NPs as midwives collaborate with physicians (Welch, 1996), psychiatry (Cornwell & Chiverton, 1997), mobile clinics (Lee & O'Neal, 1994), and student health primary care centers (Hale, Harper, & Dawson, 1996). Other settings in which research findings have documented positive patient outcomes include settings for chronically ill patients, such as an HIV infection clinic (Aiken et al., 1993), geriatric patients in long-term

care (Burl, Bonner, Rao, & Khan, 1998), and a chronic congestive heart failure clinic (Cintron, Bigas, Linares, & Hernandez, 1983).

Summary

Researchers have compared the quality of care, cost of care, and length of stay by different health care providers in a variety of health care settings (Bissinger et al., 1997; Callahan, 1996; Giacalone et al., 1995; Ingersoll, 1995; Knaus et al., 1997; Mitchell-DiCenso et al., 1996; Rudy et al., 1998; Schultz et al., 1994; Spisso et al., 1990). Although findings indicated that quality of care provided by physicians and NPs, APNs, ACNPs, and NNPs was comparable, cost of care and length of stay were significantly less when provided by NPs, APNs, ACNPs, and NNPs. Skills possessed by ACNPs uniquely qualify them to coordinate care processes in acute care settings such as a postoperative cardiovascular unit. Collaborative care between physicians and NPs has been documented as producing positive patient outcomes (Aiken et al., 1993; Blunt, 1998; Burl et al., 1998; Caballero, 1998; Cintron et al., 1983; Cornwell & Chiverton, 1997; Dowrick & Rezents, 1993; Ferguson, 1996; Hale et al., 1996; Hillier, 2001; Horton et al., 2001; Kirkpatrick, 1989; Lee & O'Neal, 1994; Pardee, 1993; Welch, 1996). Because of the unique cognitive and clinical expertise of the ACNP, it was hypothesized that cardiovascular surgeon and ACNP collaborative care processes would increase quality of patient care and patient satisfaction with care in the postoperative cardiovascular care unit while also decreasing the cost to the health care system.

CHAPTER 3

METHODOLOGY

Introduction

The purposes of this retrospective, 2-group comparison study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. All cardiovascular postoperative patients at the hospital where this study took place were admitted to the CVICU from the OR and transferred to the PCV when extubated and stable. The sample included a control group of patients who were cared for by cardiovascular surgeons alone during one time period and a comparison group of patients who were collaboratively cared for by cardiovascular surgeons and ACNPs during another time period. Outcomes were examined retrospectively through review of health care facility computerized records for several months in the year before cardiovascular surgeon and ACNP collaborative practice was initiated (1998) and the year when cardiovascular surgeon and ACNP collaborative practice was firmly established (2001).

The same group of physicians operated on both groups of patients and managed medical care postoperatively. The difference between the 2 groups was the postoperative care directed by cardiovascular surgeons alone and the postoperative care directed collaboratively by cardiovascular surgeons and ACNPs. It was assumed that any difference in pa-

tient and economic outcomes would be the result of cardiovascular surgeon and ACNP collaborative care. The 2 patient groups were described using descriptive statistics to verify between-group similarities. These variables included age, gender, race, weight, height, surgeon, and type of cardiovascular surgery or DRG. Comorbidity was calculated and utilized as the measure of patient preoperative status. The stable environment or structure for this study included (a) the same group of physicians doing the surgeries for all patients, (b) critical pathways or care maps remained unchanged between the 2 time periods, and (c) hospital administration and the management team were similar at both times.

Data Sets

Data were collected from sources within the hospital records. Demographics, such as gender. age (in years at time of surgery), race, date of surgery, date of discharge, preoperative risk factors. previous interventions, preoperative cardiac status, preoperative medications. preoperative hemodynamics. type of coronary surgery, number of minutes intubated. number and type of postoperative complications (in hospital), mortality status at discharge and 30 days postoperatively, and readmission status, were gathered from The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database, which is a national database that interfaces with the health care system's computer system.

Use of supplemental oxygen was identified as oxygen utilization per hour. This information was obtained from the health care facility's respiratory care department. Patient satisfaction information, gathered from *Press, Ganey Associates, Inc.*, was examined as group data utilizing a monthly mean as tabulated and reported to the health care system. The satisfaction information was provided by the health care system's marketing depart-

ment. From a telephone conversation with M. Sharon at Press, Ganey Associates, Inc., the Press, Ganey instrument was reported as having reliability supported by a Cronbach's alpha of .98 (personal communication, July 23, 1999).

Total cost per patient was examined by total cost to the health care system for the episode of hospitalization under investigation. Cost comparisons were made between the 2 different times being studied to compare total cost. To control for inflation when comparing the different years, a cost index was developed. The cost index was used to inflate (multiplied by) the 1998 costs that resulted in costs that were used for comparison with the 2001 costs. The cost index was constructed by a political economist assisting with this project. The formula for the hospital cost index was as follows:

$$I = \frac{P_{01.1}}{P_{98.1}}(w_1) + \frac{P_{01.2}}{P_{98.2}}(w_2) + \frac{P_{01.n}}{P_{98.n}}(w_n)$$

For actual numbers utilized for construction of the cost index, see Appendix C.

Study Population/Sample

The population for this cardiovascular surgeon and ACNP collaborative care comparison study was all of the adult patients over the age of 18 years admitted to the CVICU setting at a north Alabama health care system for postoperative cardiovascular care in 1998 and 2001. The health care setting was chosen for several reasons. The first reason for choosing this facility was because the administration began utilizing the ACNPs and cardiovascular surgeon collaborative practice in the CVICU and PCV settings. Because this collaborative practice had been in place for some time, the health care system's administration was interested in whether there was a difference in patient and economic outcomes

with collaborative practice as compared to when surgeons alone directed postoperative cardiovascular surgery care. Secondly, this health care setting was chosen because it was convenient to the researcher and because it served the entire northern region of the state of Alabama as well as surrounding states.

Inclusion criteria for eligible subjects were (a) having a cardiovascular surgery of one of the four DRGs being investigated, (b) being admitted to the CVICU directly from the OR, (c) having one of the four usual cardiovascular surgeons perform the surgery, (d) having cardiovascular surgeon alone direct postoperative care in 1998 and cardiovascular surgeon and ACNP collaboratively directed care in 2001, and (e) having a complete computerized record for retrieval. Exclusion criteria included (a) having a cardiovascular surgery other than the four DRGs being investigated or (b) having an incomplete computerized record for retrieval. This nonprobability, convenience sample comprised 2 independent groups; one group was from the 1998 population, and one group was from the 2001 population. Permission to conduct this study was obtained from the Institutional Review Board (IRB) of The University of Alabama at Birmingham and the Institutional Review Committee (IRC) of the selected health care system.

Power Calculation

An a priori power calculation was utilized using effect size of .25 (for small effect size), alpha level of .05, and a desired power of .76 that resulted in a sample size of 145 subjects needed for each group (Stevens, 1996, p. 180). For group 1998, information about 145 patients was gathered from all patients with the DRGs being treated between July 15, 1998, and October 1998. For group 2001, information for patients treated from May 15, 2001, through December 2001 were reviewed for the outcomes under investigation. Based

on the ideal goal of 145 patients in each group from the power calculation, for group 1998, 145 patients were available because all complete patient records of patients cared for by the four cardiovascular surgeons with the DRGs being studied could be used. For 2001, examining all complete patient records for patients during a 7-month period, only 70 patients were available. There were several reasons for only 70 patients from the 2001 database. Due to lower census in the CVICU in 2001, there were fewer patient records eligible for data collection. Also, the hospital hired an FNP to work in the CVICU and PCV. Because this was to be strictly a study of ACNP collaboration, all patients for whom the FNP intervened were excluded from this study. Also, this study examined data from 1998 and 2001; therefore, continuing to collect data into another year was not possible. Using analysis with ANCOVA, observed power was evaluated to ensure adequate power to find a difference in groups if a difference was present, because the a priori goal of 145 patients in each group was not achievable. Observed power indicates the strength of the *F* test for each effect. The power gives the probability that the *F* test will detect a difference between groups (*SPSS*, 1999).

Setting

Two units in a north Alabama health care system were the setting for this study. This health care system was chosen because it is a regional medical center that serves the entire northern region of the state of Alabama as well as surrounding states and because it provides the setting for postoperative cardiovascular care to a significant number of people each year. This comprehensive health care system is a 901-bed facility. The mission for this community health care system is service. Charity care for the less fortunate is an inte-

gral part of the community service. This health care system is governed locally by a health care authority, which is a nine-member volunteer board. The board members live in the north Alabama community within which the health care system is located. Within this health care system is a 14-bed CVICU and a 24-bed PCV, which is a step-down unit where patients are transferred after their stay in the CVICU and where they remain until the day of discharge from the health care system.

The staffing plans or skill mixes for the CVICU and the PCV remained relatively unchanged from 1998 through 2001, as shown in Table 1, although staff to patient ratios were slightly lower in 2001. The CVICU utilized 50% of staff on days and 50% of staff on nights with 95% of the staff being registered nurses and 5% of the staff being nursing assistants/clerical staff. The PCV utilized 60% of staff on the day shift and 40% of staff on the night shift with 90% of the staff being registered nurses and 10% of the staff being nursing assistants/clerical staff. In 2001, there were 2 ACNPs staffing both of these units on the day shift, and one ACNP worked nights. One ACNP worked both days on the weekend.

The ACNPs obtained medical histories; performed physical assessments and examinations; ordered and interpreted diagnostic studies; diagnosed, treated, and monitored chronic and common acute illnesses; made referrals to other health care providers to provide multidisciplinary health services; counseled and taught health promotion and nutrition; prescribed and managed medication therapies; provided follow-up care; and called patients after they had been discharged to ask them to complete and mail in the Press, Ganey questionnaire on patient satisfaction. The ACNPs maintained these functions 24 hr

Table 1

Summary of Staffing Plans/Skill Mixes per Day by Unit and Group

PCV				CVICU			
1998		2001		1998		2001	
Census	Staff	Census	Staff	Census	Staff	Census	Staff
1-7	2	1-9	2	1-3	2	1-5	2
8-11	3	10-13	3	4	3	6-7	3
12-15	4	14-15	4	5-6	4	8-9	4
16-17	5	16-17	5	7-8	5	10-11	5
18-19	6	18-21	6	9-10	6	12-13	6
20-23	7	22-23	7	11	7	14	7
24	8	24	8	12	8		
				13-14	9		

Note. PCV = progressive cardiovascular unit; CVICU = cardiovascular intensive care unit.

a day, 5 days a week. On weekends, the ACNPs performed these functions for 12-hr days Saturday and Sunday. Cardiovascular surgeons alone were on-call for patient needs on weekend nights, which were 12-hr shifts.

There were no written protocols specific to patient management for these ACNPs in these units, although a care map (Appendix B) was utilized at each patient's bedside. In Alabama, every ACNP must have a collaborating physician based on the state's nurse practice act.

Protection of Human Subjects

The IRB at The University of Alabama at Birmingham and the IRC of the north Alabama health care system were presented with a detailed proposal of research to be conducted. Permission to pilot study the data collection process was obtained from The University of Alabama at Birmingham on August 15, 2000 (Appendix D) and the north Alabama health care system IRC on June 13, 2000 (Appendix E). Permission from both facili-

ties was obtained in January 2001 before data collection began (Appendices F and G). Because of retrospective data collection, informed consent from patients would have been difficult to obtain. All patient information collected for this study was analyzed as group data to protect anonymity.

Because both groups of patients in this study received the standard practice of care at the time of hospitalization in the CVICU and PCV, approval of the protocol was requested from the IRC and IRB for collection of data specific to the study from the computerized data base system. Because all information was collected from existing records, expedited reviews were requested and granted.

Data Collection and Management Procedures

The investigator collected and managed all data. Because the pilot study identified numerous incomplete medical records, only those records with complete data were retrieved and utilized for the study. All information entered into a medical record by professionals withstands the scrutiny of legal examination in a court of law as the truth and, as such, was considered reliable for this study.

The Outcomes Management Department personnel at the health care facility where this study was conducted downloaded patient information from the computerized records contained in STS into a Microsoft Excel file for the researcher to utilize, including total cost per DRG per patient. The Excel file was searched for complete records, and from those complete records the first 145 patients beginning July 15, 1998, and all 70 patients beginning May 15, 2001, for a total of 215 records, were utilized for the study sample.

The investigator utilized the Microsoft Excel file provided by the health care facility's Outcomes Management Department and entered data into the SPSS (Version 10.0) statistical program for data analysis.

A codebook identifying variables (see Appendix H), including computer name for variables, descriptive label, range of possible values for each variable, and source of each variable, was developed before data collection began and was utilized during data collection. Patient identifier information used to collect records was secured in a locked, fireproof safe, separate from the study data until all data were collected. Once the study was completed, all patient identifier information was shredded at the health care system.

Data Analysis

Data analysis included descriptive statistics and exploratory procedures that were completed to familiarize the researcher with the data set. Data analysis consisted of ANCOVA and *t* tests where appropriate with a correlation matrix produced to identify covariates. ANCOVA utilizes a combination of regression analysis and analysis of variance. The purposes of ANCOVA are to eliminate systematic bias when random assignment is not possible and to reduce within group or error variance due to individual subject differences. To determine whether the independent variable is indeed having an effect, the influence of an extraneous variable (covariate) on the dependent variable is statistically controlled during the analysis. There were four assumptions for ANCOVA (*SPSS*, 1999) in this study that were met:

1. Scores for both the dependent variable and the covariate should be independent of those scores for all other individuals.

2. The dependent variable should have a normal distribution of scores as should the covariate, but ANCOVA is robust to violations of this assumption.

3. A linear relationship should exist between the dependent variable and the covariate for each group.

4. The relationship of the dependent variable to the covariate in each group should be the same or slopes should be parallel.

Covariates can be any variable that theoretically correlates with the dependent variable (Stevens, 1996) or are variables that are identified utilizing a correlation matrix that had a linear relationship (positive correlation) with the dependent variable. Ideally, variables should be chosen that are statistically correlated with the dependent variable (Stevens). The simple bivariate correlation or zero-order correlation refers to the correlation between 2 continuous variables and is the most common measure of linear relationship. There are five assumptions for correlation analysis (*SPSS*, 1999):

1. Data must be collected from related pairs.

2. Data should be interval or ratio in nature.

3. Scores for each variable should be normally distributed.

4. The relationship between the 2 variables must be linear.

5. Variability in scores for one variable should be roughly the same at all values of the other variable, or scores should cluster uniformly about the regression line.

Because these assumptions were not violated, the correlation procedure was performed. The covariates identified by the correlation matrix and used for analysis of length of stay (Appendix I) included group, complications, reoperations, minutes intubated, hours of supplemental oxygen, infections, and comorbidity. Covariates used for cost (Appendix

J) included group, length of stay, complications, reoperations, minutes of intubation, hours of supplemental oxygen, and intensive care unit readmissions. For summary of specific aims, hypotheses, levels and types of data, and statistical tests to be performed for each hypothesis, please see Table 2.

Statistical Analysis

Descriptive statistics, for instance, mean, standard deviation, and range, were calculated to describe sample characteristics. Comorbidity was calculated (see definition in Definitions of Terms) to describe the condition of groups before they entered the operating room or how sick each group was. ANCOVA was utilized for analysis of the patient outcome of length of stay. Group means were compared for patient satisfaction. ANCOVA was also used for analysis of the economic outcome of cost.

Summary

In this retrospective, 2-group comparison, study effects of ACNP collaborative care on postoperative cardiovascular patient and economic outcomes were examined. The 2 groups of postoperative cardiovascular patients included a group of patients who were cared for by cardiovascular surgeons alone and a group of patients who were cared for by cardiovascular surgeons and ACNPs collaboratively during 2 time periods. Outcomes were examined retrospectively. It was assumed that any difference in patient and economic outcomes were the result of cardiovascular surgeon and ACNP collaborative care.

Table 2

Summary of Specific Aims, Hypotheses, Levels and Types of Data, and Statistical Tests by Hypothesis

Specific aims	Hypotheses	Level & type of data	Statistical tests for analysis
1. To compare patient outcomes between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed care.	1a. Postoperative cardiovascular patients who are cared for by cardiovascular surgeon and ACNP collaboratively will have a shorter length of stay in the hospital than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.	Interval • # of days	ANCOVA
	Covariates utilized:	Interval • minutes intubated • hours on supplemental oxygen • # of infections • # of reoperations • # of complications • # of readmissions • comorbidity	
	1b. Postoperative cardiovascular patients who are cared for by cardiovascular surgeon and ACNP collaboratively will have a higher level of patient satisfaction than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.	Interval • monthly means	None, means reported
2. To compare economic outcomes between the 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed care.	2. Collaborative care by cardiovascular surgeons and ACNPs will result in lower health care system total costs by DRG compared to total cost when care was directed by cardiovascular surgeons alone.	Interval • dollar amount of total cost	ANCOVA with cost index included

Note. ACNP = acute care nurse practitioner; DRG = diagnostic related group; ANCOVA = analysis of covariance.

Information was gathered from a variety of medical and financial sources at the north Alabama health care system. The sample of 215 records was obtained from all pa-

tients admitted into the CVICU for the 2 study times. Human subject protection was maintained, and appropriate internal review committee approvals were attained. Data collection, analysis techniques, and limitations were described.

CHAPTER 4

FINDINGS AND INTREPRETATIONS

Introduction

The purposes of this study were to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. It was hypothesized that patient length of stay would decrease when collaborative practice was used to direct postoperative cardiovascular care and that patient satisfaction with care in the health care setting would increase with collaborative care. It was also hypothesized that this decrease in length of stay would be reflected in a reduction in the total cost of that care. Thus, the premise was that if patients were in the hospital for less time it would also cost less. This chapter includes findings and interpretations of the data. All statistical analyses were conducted using the alpha level of .05.

Findings

Description of the Sample

The subjects of the study included only adult patients, over the age of 18 years who were admitted to the CVICU setting at a north Alabama health care system for postoperative cardiovascular care ($N = 215$). Because DRG coding changed in 1998 and comparison was made based on definition of DRG and not the number, this study looked at

primary DRG 104, 105, 106, or 107 in 1998 and DRG 104, 105, 107, or 109 in 2001. In 1998 and 2001, DRG 104 was a valve replacement with catherization and DRG 105 was a valve procedure without a cardiac catherization. What was DRG 106 in 1998 became 107 in 2001 (a cardiac bypass with catherization), and what was DRG 107 in 1998 became 109 in 2001 (a cardiac bypass without catherization). The "typical" CVICU patient for this total sample ($N = 215$) was a 62-year-old White male, who weighed 181 lb and was 5 ft-7 in. tall and had Surgeon 1, with discharge code DRG 107. The 1998 and 2001 group demographics as to gender, race, surgeon, and DRG are presented in Table 3.

Table 3

Demographic Characteristics by Group

	1998 ($N = 145$)		2001 ($N = 70$)		Total ($N = 215$)	
Characteristic	*n*	%	*n*	%	*n*	%
Gender						
Female	46	31.7	17	24	63	29
Male	99	68.3	53	76	152	71
Race						
Black	8	6	3	4	11	5
White	137	94	67	96	204	95
Surgeon						
1	36	24.4	21	34	57	27
2	29	20.0	14	20	43	20
3	44	30.3	13	19	57	27
4	36	24.8	19	27	55	26
DRG						
104	8	5.5	1	1	9	4
105	13	9.0	7	10	20	9
106 (107 in 2001)	58	40.0			58	27
107 (109 in 2001)	67	46	35	50	102	47
109			27	39	27	13

Note. DRG = diagnostic related group.

The 1998 sample consisted of 31.7% ($n = 46$) women, 68.3% ($n = 99$) men, 6% ($n = 8$) Blacks, and 94% ($n = 137$) Whites. Surgeon 1 operated on 24.8% ($n = 36$) of the sam-

sample, Surgeon 2 operated on 20% (n = 29), Surgeon 3 operated on 30.3% (n = 44), and Surgeon 4 operated on 24.8% (n = 36). The 1998 sample included 5.5% (n = 8) DRG 104, 9% (n = 13) DRG 105, 40% (n = 58) DRG 106, and 46% (n = 67) DRG 107. The "typical" 1998 patient was a 64-year-old White male, who weighed 177 lb, was 5 ft-7 in. tall, and was operated on by Surgeon 3 for discharge code DRG 107. The 2001 sample included 24% (n =17) women, 76% (n = 53) men, 4% (n = 3) Blacks, and 96% (n = 67) Whites. Surgeon 1 operated on 34% (n = 24) of the 2001 sample, Surgeon 2 operated on 20% (n = 14), Surgeon 3 operated on 19% (n = 13), and Surgeon 4 operated on 27% (n = 19). DRG 104 made up 1% (n = 1), DRG 105 made up 10% (n = 7), DRG 107 (which was recoded from 106 in 1998) made up 50% (n = 35), and DRG 109 (which was recoded from 107 in 1998) made up 39% (n = 27) of the 2001 sample. The "typical" 2001 patient was a 59-year-old White male, who weighed 190 lb, was 5 ft-7 in. tall, and was operated on by Surgeon 1 for discharge DRG 107. Table 4 shows a comparison of typical patients.

Table 4

Typical Patient by Group

	Total sample	1998	2001
Age (years)	62	64	59
Gender	Male	Male	Male
Race	White	White	White
Height	181 lb	177 lb	190 lb
Weight	5'7"	5'7"	5'7"
Surgeon	Surgeon 1	Surgeon 3	Surgeon 1
DRG	107	107	107

Note. DRG = diagnostic related group.

For comparison of similarities between groups, there was no statistical difference in the 2 groups, despite the variation in group size (1998 = 145, 2001 = 70); they were homogeneous, as evidenced by the Levene statistic using ANCOVA procedures. Looking at comorbidity or whether the 2 groups were equally sick as they entered surgery, a *t* test was utilized to compare group means. Comorbidity was found to be statistically different between groups with Group 1998 ($M = 4.66$) being sicker than Group 2001 ($M = 3.99$, $p = .008$). The groups were found to be similar on demographics but different on comorbidity status. Because comorbidity logically affects length of stay clinically, a Group x Comorbidity interaction was tested and found to be not significant ($F = .094$, $p = .759$); homogeneity of regression slopes were parallel, and comorbidity was used as a covariate in the ANCOVA analysis for length of stay. A significant *F* reveals that at least some of the difference among group means is not caused by chance but by the independent variable (Stevens, 1996), which in this study was cardiovascular surgeon and ACNP collaborative care.

There were several variables that were found in the literature and supported in clinical practice to have an influence on length of stay. These variables included the number of complications, number of readmissions into the CVICU, number of reoperations, minutes intubated, hours of supplemental oxygen, mortalities, and number of infections. These variables were included in a correlation matrix that was utilized to identify whether all of these variables would correlate with length of stay (Appendix I). It was found that readmission to the CVICU and comorbidity did not correlate with length of stay and should not be used as covariates in the ANCOVA analysis. However, comparison of groups needed to include comorbidity because the groups were different on comorbidity.

Therefore, comorbidity was used in the final analysis of length of stay, but readmission into the CVICU was not. All other covariates were found to be linearly related to length of stay using a correlation matrix with alpha level at .05, except for comorbidity. The final list of covariates for length of stay included complications, reoperations, infections, minutes of intubation, hours of supplemental oxygen, group, and comorbidity. For cost, the correlation matrix (see Appendix J) showed that group, length of stay, complications, reoperations, minutes of intubation, hours of supplemental oxygen, and CVICU readmission were related to cost. Comorbidity and infections did not relate, although comorbidity was included in the final analysis. It is interesting to note that both groups took the same number of preoperative medications ($M = 2$). It is also interesting to note that for the total sample there was only one death (<.5%), which occurred in group 1998.

Description of the similarities and differences by covariate between groups will be described. Findings will be presented by research question and the hypothesis related to that research question. For patient and economic outcomes by group, see Table 5.

Similarities and Differences of Groups by Variable

Length of Stay

Length of stay was calculated from day of surgery to day of discharge from the health care facility because the focus of this study was postoperative length of stay. Length of stay for the total sample ranged from 1 day to 21 days. Twenty-five percent stayed less than 4 days, 50% stayed less than 5 days, and 75% stayed less than 7 days. Group 1998 had a mean stay of 6.62 days with a range of 1-21 days. Group 2001 had a mean stay of

Table 5

Patient and Economic Outcomes by Group

	1998			2001		
	range	*M*	*SD*	range	*M*	*SD*
Patient Outcomes						
Length of stay	1-21	6.62	3.20	3-13	4.71	1.69
Minutes intubated	93-7495	546.3	744.29	105-715	322.57	133.24
Hours on supplemental oxygen	29-332	94.07	57.13	20-316	62.79	43.2
Number of complications	0-3	.3	.57	0-1	.19	.39
Number of infections	0-1	.001	.008	0-2	.001	.12
Number of readmissions	0-1	.16	.37	0-1	.005	.23
Number of reoperations	0-1	.004	.22	0		
Economic outcome						
Cost in dollars		$21,023.97			$15,985.06	

4.71 days with a range of 3-13 days. Utilizing ANCOVA procedures, the length of stay between these 2 groups was significantly different ($F = 4.24$, $p = 0.041$). Group 2001 had a significantly shorter length of stay than did group 1998.

Complications

Number of complications was a sum of several types of complications (see Table 5). These complications included prolonged ventilation, pulmonary embolism, postoperative renal failure, vascular-aortic dissection, iliac/femoral dissection, acute limb ischemia, heart block, cardiac arrest, anticoagulant complications, tamponade, gastrointestinal complications, multisystem failure, and atrial fibrillation. The number of complications for the total sample ranged from 0 to 3, although 75% of the sample had no complications at all. Complications for Group 1998 ranged from 0 to 3 complications, and complications for Group 2001 ranged from 0 to 1 complication.

all. Complications for Group 1998 ranged from 0 to 3 complications, and complications for Group 2001 ranged from 0 to 1 complication.

Readmissions

The number of readmissions was a sum of all readmissions, which included readmissions to the CVICU and to this health care facility, within the first 30 days postoperatively (see Table 5). The number of readmissions for the total sample was 27 (12%). For Group 1998 the number of readmissions was 23 (16%), and Group 2001 had 4 (6%) readmissions. It is important to differentiate between readmissions to the CVICU and to the health care facility within 30 days postoperatively because readmissions into the CVICU were the only ones included in the final analysis looking at length of stay and total cost. Group 1998 had four (3%) readmissions to the CVICU, and Group 2001 had 1 (< 1%) readmission into the CVICU. Group 1998 had 19 (13%) readmissions to the health care facility within 30 days postoperatively, and Group 2001 had 3 (4%). Readmissions totaled are interesting to look at because Group 2001 had fewer CVICU readmissions and fewer health care facility readmissions within 30 days postoperatively.

Reoperations

Reoperations was a sum of all reoperations (see Table 5). Reasons for reoperations included bleeding problems, valve problems, graft problems, and other cardiac problems or a noncardiac problem. The number of reoperations for the total sample was 7 (3.3%). Reoperations for Group 1998 was 7 (5%), and Group 2001 had no reoperations.

Intubation Minutes

Intubation minutes included the total number of minutes the individual was intubated intraoperatively and postoperatively (see Table 5). Minutes of intubation for the total sample ranged from 93 min (1.5 hr) to 7,495 min (5.2 days). Twenty-five percent of the sample were intubated less than 260 min (4.3 hr), 50% were intubated less than 360 min (6 hr), and 75% were intubated less than 480 min (8 hr). It is interesting to note that 16 individuals were intubated more than 765 min (12.75 hr), and only 4 individuals were intubated more than 1,440 min (24 hr). Group 1998 had a mean of 546.3 min of intubation (range 93-7,495 min), and Group 2001 had a mean of 322.57 min of intubation (range 105-715 min).

Supplemental Oxygen

Supplemental oxygen usage was calculated per unit of use, which was 1 hr, and included all units for which the patient was charged for oxygen by the respiratory care department at this health care facility (see Table 5). Charge was used only to capture units of oxygen used. Hours of supplemental oxygen use for the total sample ranged from 20-332 hr. Twenty-five percent used less than 48 hr of supplemental oxygen, 50% used less than 66 hr, and 75% used less than 99 hr. Hours of supplemental oxygen for Group 1998 was a mean of 94.07 hr (range of 29-332 hr), and Group 2001 used a mean of 62.79 hr (range 20-316 hr).

Infections

Infections were a sum of all infections, which included infected sternum, infected thoracotomy, infected leg incision, septicemia, a urinary tract infection, and pneumonia, as shown in Table 5. The number of infections for the total sample was only 2 (<1%). Group 1998 had no infections, and Group 2001 had 2 infections (3%).

Comorbidity

Comorbidity was a sum of preexisting conditions that an individual had prior to entering the cardiovascular operating room. These factors included a history of hypercholesterolemia; diabetes; renal failure; dialysis; hypertension; cerebrovascular accident; infectious endocarditis; immunosuppressive therapy; peripheral vascular disease; cerebrovascular disease; previous cardiovascular intervention, including previous bypass graft, valve replacement, or non-surgical intervention; myocardial infarction; congestive heart failure; angina; cardiogenic shock; and arrhythmia, which most commonly was atrial fibrillation/flutter. A mean was calculated for comorbidity for each group: Group 1998 had a higher mean ($M = 4.66$) than Group 2001 ($M = 3.99$). Group 1998 had more medical problems or was generally sicker prior to surgery than was group 2001.

Cost

For the purpose of this study, the economic outcome was defined as the health care system's total cost for the DRG encounter being investigated (see Table 5). Utilizing the cost index (Appendix C), the 1998 cost was inflated to make it comparable to the 2001 cost. Once the values were transformed, cost could be analyzed utilizing ANCOVA proce-

dures. A correlation matrix was performed using cost as the dependent variable. All variables used in analysis for patient outcomes were included in the cost correlation matrix because it was thought that the same variables that influenced length of stay would also affect cost. The variables that correlated with cost included length of stay, complications, reoperations, minutes of intubation, hours on supplemental oxygen, group, and readmission into the CVICU. These variables were then used in ANCOVA procedures as covariates, and analysis revealed that the groups were similar by Levene's statistic ($p = .208$), but cost was significantly different ($p = .019$) between the 2 groups with Group 1998 having higher cost ($M = \$21,023.97$) than Group 2001 ($M = \$15,985.06$). Total cost for the DRGs investigated decreased by $5,038.91 per patient when cardiovascular surgeons and ACNPs collaboratively directed postoperative care.

Findings and Interpretations by Research Question and Hypothesis

Analysis of Research Questions 1 and 2 utilized ANCOVA statistical procedures. Research Question 1 examined the dependent variable that was length of stay utilizing several covariates. These covariates included complications, reoperations, infections, minutes intubated, hours on supplemental oxygen, group, and comorbidity. Research Question 2 examined the dependent variable cost utilizing covariates length of stay, complications, reoperations, minutes of intubation, hours of supplemental oxygen, group, and readmissions to CVICU.

Research Question 1

What is the difference in patient outcomes between 2 groups of patients, 1 group of patients for whom cardiovascular surgeons alone directed postoperative care and 1 group

of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care?

Hypothesis 1a

Postoperative cardiovascular patients who are cared for by cardiovascular surgeons and ACNPs collaboratively will have a shorter postoperative length of stay in the hospital measured in days than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.

Findings and Interpretations for Hypothesis 1a

Length of stay was analyzed utilizing the covariates that were identified by the use of the correlation matrix to be significant to length of stay at the .05 level and had homogeneity of regression slopes. The covariates included as significant were complications, reoperations, infections, minutes of intubation, hours of supplemental oxygen, group, and comorbidity. The Levene statistic of equality of error variance revealed that the 2 groups were homogeneous ($F = .456$, $p = .5$) except for comorbidity with Group 1998 being sicker than Group 2001. Mortality statistics were collected, but, because mortality did not correlate with length of stay ($r = -.093$, $p = 0.172$), mortality was not utilized as a covariate. Also, number of CVICU readmissions ($r = .127$, $p = .064$) was not significantly correlated with length of stay and, therefore, was not used as a covariate in the length of stay ANCOVA procedures. Group 1998 had a mean length of stay of 6.6 days, and Group 2001 had a mean length of stay of 4.7 days. Despite the fact that Group 1998 was sicker than Group 2001, the difference in length of stay between groups was significant ($F = 4.3$, $p =$

.039); Group 1998 stayed almost 2 days longer than did Group 2001. Therefore, Hypothesis 1a was accepted; postoperative cardiovascular patients who were cared for by cardiovascular surgeons and ACNPs collaboratively had a significantly shorter postoperative length of stay in the hospital measured in days than postoperative cardiovascular patients who were cared for by cardiovascular surgeons alone.

Hypothesis 1b

Postoperative cardiovascular patients who are cared for by cardiovascular surgeons and ACNPs collaboratively will have increased patient satisfaction with care than postoperative cardiovascular patients who are cared for by cardiovascular surgeons alone.

Findings and Interpretations for Hypothesis 1b

Patient satisfaction was reported as a monthly mean, and 5 months from each year were investigated. The months used for analysis were July through November for both years. July was the starting point because July 1998 was the beginning point for data collection for this study. For Group 1998, July, August, and September were the 3 months used for patient data, and, for Group 2001, May through December were the months (7 months) used for patient data. An average of 5 months (3 months and 7 months) was chosen to use for patient satisfaction data. Group 1998 ($N = 145$) had a mean patient satisfaction score of 90, and Group 2001 ($N = 70$) had a mean patient satisfaction score of 86. It is unknown to the investigator how many patients returned the patient satisfaction questionnaires each month because raw data were not available to the researcher, only monthly means for 1998. It is unclear whether one patient or even if half of the patients returned the

forms used for analysis in any given month. Based on these limited findings, postoperative cardiovascular patients who were cared for by cardiovascular surgeons and ACNPs collaboratively did not have increased patient satisfaction with care. Hypothesis 1b was rejected.

Research Question 2

What is the difference in total cost between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care?

Hypothesis 2

Collaborative care by cardiovascular surgeons and ACNPs will result in lower health care system total cost compared to total cost when care was directed by cardiovascular surgeons alone.

Findings and Interpretations for Hypothesis 2

Health care system total cost for the entire sample ranged from $8,788.00 per patient to $51,722.00 per patient. Twenty-five percent of the sample's cost was less than $13,658.00 per patient, 50% was less than $15,704.00 per patient, and 75% was less than $19,957.00 per patient for the total hospital stay. It was interesting to note that 24% (n = 52) had costs more than $20,000.00, 3% ($n$ = 6) had costs more than $30,000.00, and 4% ($n$ = 1) had costs more than $50,000.00. For cost in dollars per DRG by group see Table 6.

Table 6

Cost Per DRG by Group

	1998		2001	
DRG 104	$n = 8$	$25,143.30 - $60,514.74	$n = 1$	$19,957.00
DRG 105	$n = 13$	$20,460.96 - $42,359.85	$n = 7$	$15,240.00 - $21,797.00
DRG 106	$n = 57$	$12,770.55 - $32,304.87		
DRG 107	$n = 67$	$10,281.96 - $40,680.90	$n = 35$	$12,864.00 - $23,951.00
DRG 109			$n = 27$	$ 9,004.00 - $29,163.00

Note. DRG = diagnostic related group. DRG 106 (98) is the same as DRG 107 (01), and DRG 107 (98) is the same as DRG 109 (01).

Utilizing the cost index (Appendix C), 1998 cost was inflated to account for inflation over the 3-year period and to make costs comparable for 1998 and 2001. Once the values were transformed, cost was analyzed utilizing ANCOVA procedures. A correlation matrix was utilized to identify appropriate covariates to include in analysis, and those were length of stay, complications, reoperations, minutes of intubation, hours on supplemental oxygen, group, and readmission into the CVICU. These variables were then used in ANCOVA procedures as covariates, and analysis revealed that, despite the groups being similar, cost was significantly different ($p = .019$) between the 2 groups with Group 1998 having higher cost ($M = $21,023.97) than Group 2001 ($M = $15,985.06), which was a difference of $5,038.91. Collaborative care by cardiovascular surgeons and ACNPs appeared to have resulted in lower health care system total cost than when cardiovascular surgeons alone directed postoperative care. Hypothesis 2 was accepted.

Other Findings and Interpretations

In the process of analyzing the data, additional findings were discovered that were interesting and related to the purposes of the study, but were not identified as research questions or hypotheses. These will now be discussed.

Preoperative Factors

A family history of coronary artery disease was reported in 45.6% of the total sample. It was interesting to note that both groups took the same number of preoperative medications. Even though Group 1998 had more comorbidity, neither group took more preoperative medications than the other.

Mortality

For the total sample, there was only 1 death and that patient had a relatively short length of stay, but not the shortest length of stay. The patient who died (Group 1998) had been readmitted to the CVICU, did not have a reoperation, did not have an infection, used relatively few hours of supplemental oxygen, had relatively few minutes of intubation, and had relatively low costs.

Readmissions and Complications

It was surprising to find that a readmission into the CVICU did not increase length of stay. Clinically it would be expected that a readmission into the CVICU might make the length of stay increase. There were three patients who had reoperations during their initial stays and who were readmitted to the health care facility within 30 days postoperatively.

There were 19 patients who were readmitted to the health care facility within 30 days postoperatively who had not had reoperations during their initial stays. Group 1998 had four (3%) readmissions to the CVICU, and Group 2001 had 1 (<1%) readmission into the CVICU. Group 1998 had 19 (13%) and Group 2001 had 3 (4%) readmissions to the health care facility within 30 days postoperatively. Group 1998 had 23 total readmissions and 7 reoperations. Group 2001 had 4 total readmissions and no reoperations. For the entire sample, there were 2 patients readmitted who also had infections (1 patient in each group). Readmission generally did not increase cost, except the patient with the highest cost had been readmitted into the CVICU. It was interesting to find that patients with only 1 complication had a shorter length of stay than patients with no complications. For the most part, oxygen usage did not increase with complications. Complications tended to increase cost.

Length of Stay

Having had a reoperation or having an infection did not increase length of stay. Generally, as hours of supplemental oxygen use increased, length of stay also increased. But, the patient with the longest length of stay used little oxygen, and the patient who used the most oxygen had a relatively short length of stay. In general, as minutes of intubation increased, length of stay increased as well. And generally as length of stay increased, cost increased. But it is interesting to note that the patient with the longest length of stay was not the patient with the highest cost.

Cost

Having an infection increased cost somewhat but was not a factor in the patient with the highest cost. Reoperation generally increased cost, although the highest cost did not involve a reoperation.

Minutes of Intubation and Oxygen Usage

In general, as hours of supplemental oxygen increased, minutes of intubation did not increase. The patients with the highest supplemental oxygen usage generally had less than 100 min (1.6 hr) of intubation. It was usual that, as oxygen use increased cost also increased, but the patients who used the most oxygen were not the patients with the highest cost. Minutes of intubation generally increased cost, although the patient with the most minutes of intubation and the patient with the highest cost were not the same.

Summary

In summary, despite the variation in group sizes (1998 = 145, 2001 = 70), there was no statistical difference between the 2 groups. Groups were similar on demographics but different on comorbidity status.

It was found that length of stay was significantly different between the 2 groups, holding constant the effects of complications, reoperations, infections, minutes intubated, hours of supplemental oxygen, group, and comorbidity. Group 2001, when cardiovascular surgeons and ACNPs collaboratively directed postoperative care, had a significantly shorter length of stay than did Group 1998 (4.7 days as compared to 6.6 days, respectively). Hypothesis 1a, which stated that the presence of cardiovascular surgeon and ACNP collaboratively directing postoperative cardiovascular care would result in a shorter

length of stay, was accepted. Hypothesis 1b, which stated that the presence of cardiovascular surgeon and ACNP collaboratively directing postoperative cardiovascular care would increase patient satisfaction, was rejected. Hypothesis 2, that collaborative care by cardiovascular surgeons and ACNPs would result in lower health care system total cost compared to total cost when care was directed by cardiovascular surgeons alone, was also accepted. Utilizing a cost index to inflate 1998 cost to a level comparable to 2001 cost and using ANCOVA procedures, it was found that Group 2001 had a lower total cost of $5,038.91 per patient than Group 1998.

CHAPTER 5

DISCUSSION, CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

The final chapter presents a discussion of research questions and major conclusions of the results. Implications and recommendations for further study are also included, as is a final summary of the study.

Discussion of Research Questions

Research Question 1

The first research question was "What is the difference in patient outcomes between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care?" Patient outcomes for this investigation were length of stay and patient satisfaction; each will be discussed separately.

Length of Stay

The answer to the first part of Research Question 1 (1a) was found through the use of ANCOVA procedures using length of stay as the dependent variable. It was found that the variables that contributed to length of stay were complications, reoperations, infections, minutes of intubation, hours of supplemental oxygen, and group. The 2 groups were found to be similar on demographics, but they were not the same on comorbidity. Group 1998

was sicker (based on higher comorbidity) going into the operating room than was Group 2001. The ANCOVA procedures used for analysis of length of stay controlled for the difference in comorbidity. Results of the ANCOVA analysis revealed that, despite the difference in comorbidity, Group 2001 was found to have a significantly shorter length of stay (1.91 days) than Group 1998. Therefore, when cardiovascular surgeons and ACNPs collaboratively directed postoperative cardiovascular care in this north Alabama health care facility, length of stay decreased from when cardiovascular surgeons alone directed postoperative care. It is important to note here that no other research studies with purposes similar to the ones in this study have been found in the literature to date. Therefore, these research findings can only be compared to other studies that have looked at NPs. Rudy et al. (1998) found that a group of ACNPs and PAs together and a group of resident physicians provided comparable patient care with the same outcomes. Although Rudy and colleagues did not study collaborative practice, they found comparable patient outcomes between 2 groups of patients, one group who had ACNP and PAs working together directing care and the other group who had resident physicians directing care. Another study looked at primary care NPs in acute care settings and showed that NPs working with house staff decreased length of stay with resulting decreased care costs with associated increased quality of care (Spisso et al., 1990). The current study supports the findings of the two studies and expands the concept of working together with physicians to show that ACNP-physician collaboration significantly decreased length of stay from 6.6 days in 1998 to 4.7 days in 2001.

In previous research, Callahan (1996) described the use of FNPs, acting as ACNPs, in a cardiac surgical program and how NPs provided continuity and skilled management of

cardiac surgical patients. Results reported by Callahan were decreased length of stay and low patient morbidity and mortality. The current study was built on Callahan's work by studying actual ACNPs in cardiac settings, both the CVICU and PCV. The use of ACNPs in collaboration with cardiovascular surgeons provided continuity and skilled management of this sample of patients as evidenced by decreased length of stay.

The current study most closely resembled a study reported in the literature by Mitchell-DiCenso et al. (1996) who compared clinical nurse specialists and NP teams with a pediatric resident team for delivery of care in a NICU. Neonatologists supervised both teams. Outcomes they measured were mortality, complications, quality of care and patient/parent satisfaction with care, long-term outcomes, and cost. Results of the study were comparable outcomes for both groups of neonates. The main flaw of the study was the fact that the neonatal residents cared for all infants the majority of every day, thus diluting the clinical nurse specialists and NP effect on outcomes. It is not surprising that infants had similar outcomes because they had residents caring for them 16 hr of every day. In the current study the ACNPs provided the majority of care for patients throughout the 24-hr day; therefore, the results better document collaborative care by ACNPs.

Other authors have reported findings about APN practice and the effect APN practice has had on patient outcomes (Dahl & Penque, 2000; Giacalone et al., 1995). Research results all showed decreased length of stay and decreased mortality statistics when APNs were managing care in specific settings. NPs in nurse managed centers have provided care to vulnerable populations since the inception of such clinics, and research findings have demonstrated that NP care in nurse managed centers is safe and cost-effective. Benkert, Bucholz, and Poole (2001) reported on a study in which NPs were able to implement a

process of care that controlled blood pressure in high-risk patients who lacked resources for antihypertension prescriptions. Other study findings have shown that NPs can manage hypertensive care in ethnic minority populations with equivalent outcomes as compared to physician-managed care (Mundinger et al., 2002). Utilization of NPs has been shown to be diagnostically effective in preventive health care (Welch, 1996) when APNs prepared as nurse midwives were able to provide obstetrical and gynecological health care for women from puberty to postmenopausal years with a focus on wellness and health education that is far more cost effective than care provided by an obstetrcian/ gynecologist (OB/GYN). Welch further reported that, when care directed by OB/GYNs was compared to care directed by NPs, the NP patients had less fetal distress and therefore lower caesarean birth rates with no significant difference in outcomes between the groups.

Positive effects of collaborative practice between physicians and NPs have been reported repeatedly in the literature. Findings of the current research study support what other researchers have reported. The authors of 2 emergency department studies reported on NPs, working in collaboration with physicians, the NPs saw as many patients in 1 year as physicians with good patient outcomes in both groups (Blunt, 1998; Pardee, 1993). Blunt and Pardee both reported that collaborative practice in the emergency department benefited patient care and was cost effective. Reports of collaborative practice in other settings have shown high quality health care in a cost-effective manner. For example, in gastroenterology, Hillier (2001) and Horton et al. (2001) reported on data from 9,500 screening flexible sigmoidoscopies, and the conclusions were that in comparison to gastroenterologists, trained NP endoscopists perform screening flexible sigmoidoscopies with similar accuracy and safety as the gastroenterologists, but for less cost. This implies that screening

flexible sigmoidoscopies performed by NPs may increase availability and decrease cost of flexible sigmoidoscopies for colorectal cancer screenings and collaborative practice benefits patients. In occupational health, Dowrick and Rezents (1993) reported that NPs provide quality care as measured by comparison with physicians in process and outcome activities and also in patient satisfaction, but NPs provided cost-effective care. Ferguson (1996) reported on a meat packing plant that, because of early interventions and aggressive treatment by NPs, decreased worker time off and workers' compensation payouts. Again, collaborative practice benefits patients. Another example of collaborative practice benefiting patients is in laparoscopic operations reported on by Caballero (1998), where one hospital had more cholecystectomy operations, but fewer patients required open surgery or inpatient admissions, which resulted in substantial cost savings to patients. These same positive outcomes were also reported for geriatric patients in long-term care by Burl et al. (1998). In a NP-managed student health primary care center reported on by Hale et al. (1996), NPs provided cost-effective, quality primary care services to students and other university members. In an NP-operated mobile clinic reported on by Lee and O'Neal (1994), the NPs provided cost-effective education, early detection, and referrals for low-income, rural populations and served as an approach to improving access to health care for underserved populations which resulted in improved outcomes. Aiken et al. (1993) reported similar results of NP collaborative practice in an HIV infection clinic, and Cintron et al. (1983) reported similar results in a chronic congestive heart failure clinic. All of these research studies build on and document the patient and economic benefits of physician and NP collaborative practice.

Patient Satisfaction

The answer to the second part of Research Question 1 (1b) was explored through comparison of means for the 2 time periods. Means reported for these time periods included all patients who occupied the CVICU and PCV units during the chosen study months and may not have been patients included in the other patient outcomes data because of DRG. Also, there may have been patients in the 2001 data who returned Press, Ganey surveys but would not have been included in the means reported because they were in the hospital in one of the 2 months not included in patient satisfaction data collection times. In retrospect, the patient satisfaction means are probably not an accurate measure of actual patient satisfaction, but these data were the only measure of patient satisfaction that this health care facility collected for both of the study time periods. Another limitation of these data were that the number of forms used for calculation of the mean score is unknown; therefore, scores reported may have been for one form or for any number of forms. It is unknown and not available from the health care facility because no raw data were obtainable. Because the raw data were not available and items of interest related to collaboration were not present on the tool, the Press, Ganey Questionnaire was not an appropriate tool for this study but was utilized because it was of interest to the health care facility.

Patient satisfaction has been shown to be directly related to patient expectations and may not correlate with the level of clinical outcome (Nettleman, 1998). Zimmermann (2000) stated that patient satisfaction surveys are poor indicators of care because patient satisfaction is not objective and straightforward, not easily measured, and not accurately measured. Zimmermann went on to say that an underlying assumption of the surveys is that responses are fair and objective evaluations, and she believed it was shown that pa-

tients do not always know good care. Patients value a service, because service delivers a desired consequence. Patient satisfaction is the patient's feeling about the value that was received. In our quick-fix society, Zimmermann stated, it is easy for patients not to value quality health care when the desired goal of an immediate cure is not achieved. Acorn and Barnett (1999) described patient satisfaction as the most difficult patient outcome to measure.

The most frequently used method of collecting patient satisfaction information is self-administered questionnaires, such as the Press, Ganey utilized by the health care facility in this study. Some researchers report that there is currently not a good standardized instrument available with which to measure patient satisfaction (Acorn & Barnett, 1999; Zimmermann, 2000). With a lack of consensus on the measurement of patient satisfaction and with such a variety of instruments available and what they measure; Press, Ganey [overall satisfaction with a hospital stay], How Are You Doing? [overall satisfaction and length of stay], Measuring Up! [opinion of care received with most recent hospital stay from admission to discharge], The Nursing Care Questionnaire [satisfaction with nursing care and the physical environment], Newcastle Satisfaction with Nursing Scales [satisfaction for nine areas related to nurses and two refer to the facility], Patient Satisfaction Instrument [overall satisfaction with care], and LaMonica-Oberst Patient Satisfaction Scale [overall satisfaction with care], this investigator questions the reliability of the Press, Ganey results found for this particular study. The Press, Ganey tool does not include questions about APNs or collaborative care. Perhaps another tool is needed, one that encompasses the specific skills related to advanced practice and collaborative practice. Or perhaps another method of measuring patient satisfaction would be more reliable for the is-

sues related to this study and could be investigated in the future. Even though the 1998 mean was higher than the 2001 mean, because of the limitations imposed by the health care system and the weaknesses of the information obtained, no conclusions can be drawn.

Research Question 2

The second research question asked, "What was the difference in economic outcomes between 2 groups of patients, one group of patients for whom cardiovascular surgeons alone directed postoperative care and one group of patients for whom cardiovascular surgeons and ACNPs collaboratively directed postoperative care?" The answer was found through the use of ANCOVA procedures, this time using cost as the dependent variable. Findings revealed that the factors contributing to cost included length of stay, complications, reoperations, minutes of intubation, hours of supplemental oxygen, group, and readmissions to CVICU. Group 2001 was found to have a significantly lower cost per patient than Group 1998. This means that when cardiovascular surgeons and ACNPs collaboratively directed postoperative cardiovascular care in this north Alabama health care facility, cost was less than when cardiovascular surgeons alone directed care.

No prior studies were found that specifically addressed costs associated with care by ACNPs. However, previous studies have addressed costs when other APNs collaboratively provided care, and all reported cost effectiveness of NP practice in a variety of health care settings, including Aiken et al. (1993), in an NP-managed HIV infection clinic; Benkert et al. (2001), in high-risk hypertension management by NPs; Cintron et al. (1983), in an NP-managed congestive heart failure clinic; Burl et al. (1998), in NP-managed geriatric long-term care; Caballero (1998), in laproscopic surgeries by NPs; Dahl and Penque

(2000) and Dahle, Smith, Ingersoll, and Wilson (1998), in NP-directed heart failure programs; Dowrick and Rezents (1993) and Ferguson (1996), in occupational health care settings such as factories; Hale et al. (1996), in an NP-managed university student health clinic; Hillier (2001) and Horton et al. (2001), in gastroenterology screening flexible sigmoidoscopies; Kirkpatrick (1989), in pediatric ambulatory surgery; Lee and O'Neal (1994), in an NP-managed mobile health clinic; Mitchell-DiCenso et al. (1996), in a neonatal intensive care unit; Spisso et al. (1990), on NPs in trauma settings; and Welch (1996), in NP-managed obstetrics and gynecology health care settings. Findings from the ACNP study compared to findings from APN research studies revealed that ACNPs provided quality care at decreased cost as other APN studies have shown. In this time in the health care industry when focus is on decreasing cost, use of ACNPs in acute care settings may be at least one way of decreasing cost to health care settings, insurance companies, and individual patients.

Relevance of Findings to Conceptual Framework

Donabedian's (1980) structure, process, outcome trilogy was an appropriate framework to guide this outcomes research study. Outcomes cannot be measured without a prior intervention or process, and the process cannot take place outside of a structure. The trilogy described by Donabedian has both antecedents and descendents and is useful for evaluation research. Donabedian defined structure as the first piece of the trilogy, which in this case was a north Alabama health care system's CVICU and PCV that served as the relatively stable environment within which patient care was provided. Structure was relevant to quality of care in that the resources available to provide care could increase or de-

crease the probability of providing good care. The second part of the trilogy described by Donabedian was the process, which was defined as the set of activities of care that takes place between the health care provider and the patient. In this study the cardiovascular surgeon and ACNP collaborative care was an integral part of the process being evaluated. The final part of the trilogy was outcomes, and it was by evaluating patient outcomes and associated cost changes that the effectiveness of the process of collaborative care of the cardiovascular surgeon and ACNP was measured. The outcomes related to the process of collaborative care were length of stay, patient satisfaction, and total cost for the discharge DRG.

Conclusions

Several conclusions have been drawn based on the statistical findings of this study.

1. Collaborative postoperative care directed by cardiovascular surgeons and ACNPs resulted in significantly decreased patient length of stay when compared to when cardiovascular surgeons directed care alone.

2. No conclusion can be drawn about patient satisfaction due to major flaws with the data available for measurement of patient satisfaction.

3. Total cost for the episode of care that was investigated by DRG was significantly less when cardiovascular surgeons and ACNPs collaboratively directed postoperative care than when cardiovascular surgeons alone directed care. In this setting, collaborative care was more cost effective than surgeon alone directed care for a cardiac valve procedure and other major cardiothoracic procedures with a cardiac catherization (DRG 104),

a cardiac valve procedure and other major cardiothoracic procedures without cardiac catherization (DRG 105), a coronary bypass with cardiac catherization (DRG 106 in 1998 and 107 in 2001), and a coronary bypass without cardiac catherization (DRG 107 in 1998 and 109 in 2001).

Limitations of the Study

Several limitations were identified in the design of this study.

1. Reliability and validity of the results from the Press, Ganey Questionnaire results are questionable because the tool was a self-report instrument and because the information provided by the health care facility was not precise regarding number of patients used in tabulating the monthly means. As discussed earlier in this chapter, there were many limitations of the patient satisfaction tool used for this study. Patient satisfaction was included as a patient outcome in this study at the request of the health care facility and because it was the only patient satisfaction data available for both time periods. Also, the questions on the tool did not address ACNPs or collaborative care. Interestingly, after data collection was completed for this study, the health care facility stopped using the Press, Ganey Questionnaire.

2. Because all data were collected from one institution, generalizations are limited.

3. Some data utilized for this study were collected for other purposes. Because this study was conducted retrospectively, there was no way to verify reported results.

4. Because historical events occurred between data collection times, there may have been factors influencing cost other than inflation, even utilizing the cost index to correct for these that were not identified in the design.

5. If information was entered incorrectly into the computerized medical records that were used for data collection, results may be erroneous, and outcome results attributed to ACNP collaborative practice may, in fact then, be due to something outside the study.

Implications

With the current circumstances of the health care industry, health care systems are encouraged to use less expensive care providers for routine medical management responsibilities while at the same time maintaining or increasing the quality of care provided to patients. The findings of this research study support cardiovascular surgeon and ACNP collaborative practice as one way of maintaining quality patient outcomes as indicated by length of stay and cost effectiveness. This has implications for nursing research, nursing practice, and nursing education.

This study supports and expands on findings regarding NP practice settings and results of APN care. More specifically this study provided information on patient and economic outcomes resulting from cardiovascular surgeon and ACNP collaborative practice. Collaborative practice in this study resulted in significantly shorter length of stay and lower cost for an episode of care, and this added to the literature related to the body of knowledge documenting ACNP collaborative outcomes. It would also seem from these findings that cardiovascular surgeon and ACNP collaborative practice had an impact on patient outcomes not only when the patient was in the health care setting but also after the patient was discharged from the hospital as evidenced by fewer readmissions to the health care facility less than 30 days postoperative.

Regarding nursing practice, cardiovascular surgeon and ACNP collaboratively directed postoperative care is one way to support a positive patient outcome such as shorter length of stay and the resulting positive economic outcome of decreased cost for an episode of cardiovascular surgery. Because the ACNPs in this study were prepared as clinical experts for the integration of care across the acute care continuum and were familiar with the health care system, the ACNPs in collaboration with cardiovascular surgeons streamlined the care delivery process that resulted in minimal length of stay and minimized costs. These ACNPs were all employees of the health care system. Total cost savings by the health care system was achieved by the utilization of ACNPs for collaborative direction of care for postoperative cardiovascular patients. Because length of stay decreased by 1.91 days per patient with collaborative care, the total cost savings to the health care system for each patient with collaborative care was $5,038.91. The physicians in this study typically operated on a total of three patients per day resulting in 60 patients per month that were admitted into the CVICU. By decreasing length of stay by 1.91 days per patient, this resulted in 114.6 fewer days of hospitalization per month and 1,375.2 fewer days of hospitalization per year. Financially this is a total cost savings for the health care setting of $5,038.91 per patient; operating on 60 cases a month results in a total cost savings of $302,334.60 per month, and in a year that would result in a total cost savings to the health care system of $3,628,015.20. The health care system paid each of the ACNPs an annual salary of $60,000.00. There were four ACNPs working in the CVICU and PCV at the time of this study which resulted in annual salaries of $240,000.00. That breaks down to $5,000.00 per ACNP per month in salary for a total of $20,000.00 per month in salaries. Remembering that the total cost savings per patients for a month was $302,334.60 and sub-

tracting out the ACNP salaries for the month resulted in a remaining total cost savings to the health care setting of $282,334.60 per month. Multiplied by 12 months for the year would potentially result in a total cost savings to the health care system of $3,388,015.20 per year. Results of this study are a useful tool for marketing the ACNP position. For physicians involved in this study, collaborative care resulted in positive benefits to their patients in decreased length of stay. For ACNPs, this study on collaborative care documented their benefits to patient length of stay and cost and supports the effect of cardiovascular surgeon and ACNPs collaborative practice in settings such as the CVICU and PCV.

The positive results of this collaboratively directed care model may be useful in planning the educational process of ACNPs. Documentation of the positive effect ACNP collaborative care has on patient and economic outcomes supports current educational programs as preparing effective, efficient directors of care in acute care settings such as post-operative cardiovascular units.

Recommendations

Based on the findings of this study, the following recommendations are made for further study:

1. Repeat this study and include all patients that the FNP intervened with to look for a difference in length of stay. This would reveal if the decrease in length of stay was indeed due to the ACNP expertise or if any NP would also decrease length of stay and by how much.

2. Repeat a similar study in other settings where ACNPs or other NPs are utilized, to document patient outcomes such as length of stay and patient satisfaction and economic outcomes such as total cost.

3. Develop tools to better measure patient satisfaction regarding collaborative practice. Perhaps patient and family interviews in the CVICU and PCV to evaluate patient satisfaction with cardiovascular surgeon and ACNP collaborative practice would be useful.

4. Study more than one method of investigating patient satisfaction with care delivery methods. A study involving matched pairs of patients could provide better results.

5. Conduct a multisite research design, which would be more generalizable.

6. Conduct a prospective study so all data could be verified, which would strengthen the study design.

Summary

This retrospective 2-group comparison study was designed to examine patient and economic outcomes between 2 groups of adult patients for whom postoperative cardiovascular care was directed by either cardiovascular surgeons alone or cardiovascular surgeons in collaboration with ACNPs. The conceptual framework was the structure, process, outcome trilogy described by Donabedian (1980). All cardiovascular postoperative patients at the health care system where this study took place were admitted to the CVICU postoperatively and transferred to the PCV. The sample included a control group of patients who were cared for by cardiovascular surgeons alone, Group 1998, and a comparison group of patients who were collaboratively cared for by cardiovascular surgeons and ACNPs, Group

2001. Outcomes were examined utilizing data retrieved from health care facility computerized records.

It was anticipated that any difference in patient and economic outcomes would be the result of cardiovascular surgeon and ACNP collaborative care. The 2 patient groups were demographically similar but differed on comorbidity. Utilizing ANCOVA procedures, it was found that Group 2001, when care was directed collaboratively, had a significantly shorter length of stay (1.91 days per patient) and significantly lower total cost ($5,038.91 per patient) when compared to Group 1998. It was also found that the tool used for evaluating patient satisfaction at the health care facility was ineffective for measuring ACNP influences on care or collaborative care; therefore, results on patient satisfaction are inconclusive.

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APPENDIX A

PRESS, GANEY, PATIENT SATISFACTION TOOL

PATIENT SURVEY

Instructions

Please fill in the background questions, then rate the services you received while in our hospital. Circle the number that best represents your experience. If you did not receive a service, skip to the next question. When you've completed the survey, please mail it in the enclosed envelope. Thank you.

1. Was this your first stay here? ____Yes ____No
2. Were you admitted through the Emergency Room? ____Yes ____No
3. Did you have a roommate? ____Yes ____No
4. Were you placed on a special or restricted diet during most of your stay? ____Yes ____No
5. Did someone offer you information about extended life support (living will) options? ____Yes ____No
6. Did someone offer you information about the Patient's Bill of Rights? ____Yes ____No
7. Main source of payment for hospital stay (choose only one)
   ___Private Insurance (e.g. Blue Cross/Blue Shield, Prudential, etc.)
   ___Medicare ___Medicaid
   ___Worker's Compensation ___Self-pay
8. Room Number? _____
9. Days in hospital? _____
10. Date of discharge? _____
11. Patient's sex? ___Male ___Female
12. Patient's age? _____
13. Compared to others your age, would you typically describe your health as:

very poor	poor	fair	good	very good
1	2	3	4	5

	very poor	poor	fair	good	very good
1. Speed of the admission process	1	2	3	4	5
2. Courtesy of person who admitted you	1	2	3	4	5
3. Rating of pre-admission process (if any)	1	2	3	4	5

	very poor	poor	fair	good	very good
1. Promptness of room clean	1	2	3	4	5
2. Room cleanliness	1	2	3	4	5
3. Courtesy of the person who cleaned your room	1	2	3	4	5
4. Room temperature	1	2	3	4	5
5. Noise level in and around the room	1	2	3	4	5
6. How well things worked (TV, call button, lights, bed, etc.)	1	2	3	4	5

	very poor	poor	fair	good	very good
1. If you were on a special/restricted diet, how well was it explained	1	2	3	4	5
2. Temperature of the food (cold foods cold, hot foods hot)	1	2	3	4	5
3. Quality of the food	1	2	3	4	5
4. Courtesy of the person who served your food	1	2	3	4	5

	very poor	poor	fair	good	very good
1. Friendliness/courtesy of the nurses	1	2	3	4	5
2. Promptness in responding to the call button	1	2	3	4	5
3. Nurses' attitude toward your requests	1	2	3	4	5
4. Amount of attention paid to your special or personal needs	1	2	3	4	5
5. How well the nurses kept you informed	1	2	3	4	5
6. Skill of the nurses	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. Waiting time for tests or treatments	1	2	3	4	5
2. Concern shown for your comfort during tests or treatments	1	2	3	4	5
3. Explanation about what would happen during tests or treatments	1	2	3	4	5
4. Skill of the person who took your blood (e.g. did it quickly, with minimal pain)	1	2	3	4	5
5. Courtesy of the person who took your blood	1	2	3	4	5
6. Skill of person who started the IV (e.g. did it quickly, with minimal pain)	1	2	3	4	5
7. Courtesy of the person who started the IV	1	2	3	4	5
8. Waiting time for imaging (x-ray, MRI, cat scan, etc.) procedures	1	2	3	4	5
9. Concern shown for your comfort during imaging (x-ray, MRI, cat scan, etc.) procedures	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. Your rating of Physical/Occupational/Speech Therapy, if applicable	1	2	3	4	5
2. Your rating of Respiratory Therapy, if applicable	1	2	3	4	5
3. Your rating of Social Services, if applicable	1	2	3	4	5
4. Your rating of Staff who transported you to and from your room	1	2	3	4	5
5. Your rating of Security	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. Helpfulness of the people at the information desk	1	2	3	4	5
2. Accommodations and comfort for visitors	1	2	3	4	5
3. Staff attitudes toward your visitors	1	2	3	4	5
4. Information given to your family about your condition and treatment	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. Time physician spent with you	1	2	3	4	5
2. Physician's concern for your questions and worries	1	2	3	4	5
3. How well the physician kept you informed	1	2	3	4	5
4. Friendliness/courtesy of physician	1	2	3	4	5
5. Skill of physician	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. Extent to which you felt ready to be discharged	1	2	3	4	5
2. Speed of discharge process after you were told you could go home	1	2	3	4	5
3. Instructions about how to care for yourself at home	1	2	3	4	5
4. Help with arranging home care services (if needed)	1	2	3	4	5

[redacted]

Which Intensive Care Unit (ICU) are you *rating*?

___ Surgical (SICU) ___ Pediatric (PICU) ___ Cardiac (CCU1) ___ Neurological (NICU)
___ Medical (MICU) ___ Cardiovascular (CVICU) ___ Cardiac (CCU2) ___ Neonatal (RNICU)

	very poor	poor	fair	good	very good
1. Technical skill of the ICU nurses in providing you care	1	2	3	4	5
2. How well the ICU nurses helped you understand your treatment and condition	1	2	3	4	5
3. Information the ICU nurses gave your family about your treatment and condition	1	2	3	4	5
4. Accommodations and comfort for visitors of intensive care patients	1	2	3	4	5

	very poor	poor	fair	good	very good
1. [illegible]	1	2	3	4	5
2. [illegible]	1	2	3	4	5
3. [illegible]	1	2	3	4	5
4. [illegible]	1	2	3	4	5
5. [illegible]	1	2	3	4	5
6. [illegible]	1	2	3	4	5

[redacted]

	very poor	poor	fair	good	very good
1. [illegible]	1	2	3	4	5
2. [illegible]	1	2	3	4	5
3. [illegible]	1	2	3	4	5
4. [illegible]	1	2	3	4	5

APPENDIX B

CLINICAL PATHWAY

Form No. [illegible]
Rev. 6/89

Cardiac Surgery
Clinical Pathway

DRG 104, 105, 106, 107

Pre-op Weight_____ **Progressive Cardiovascular Trend Record** **Addressograph Information** Page 1

DATE/POD #																		
HOUR	12MN	4A	8A	12N	4P	8P	12MN	4A	8A	12N	4P	8P	12MN	4A	8A	12N	4P	8P
103°																		
102°																		
101°																		
100°																		
99°																		
Normal 98°																		
97°																		
96°																		
Blood Pressure																		
Heart Rate																		
Respirations																		
SaO_2																		
FIO2/LPM																		
Weight																		
24 hr. Total Intake																		
24 hr. Total Output																		

DATE/POD #													DISCHARGE CHECKLIST
HOUR	12MN	4A	8A	12N	4P	8P	12MN	4A	8A	12N	4P	8P	1. ___TEACHING ___ Nursing ___ Pharmacy ___ Diet 2. ___PRESCRIPTIONS ___ Written Prescriptions and Discharge Medication List coincide ___ Patient has been given prescriptions 3. ___FOLLOW UP APPOINTMENT GIVEN 4. ___DEVICES D/CD ___ Pacing Wires ___ Subclavian ___ Peripheral IV ___ Telemetry 5. ___STAPLES ___ D/CD before discharge ___ Plans for Removal ___ HH Nurse ___ Office Visit 6. ___HOME HEALTH CARE ARRANGED IF ORDERED NURSE DISCHARGING PATIENT _____ DATE _____
103°													
102°													
101°													
100°													
99°													
Normal 98°													
97°													
96°													
Blood Pressure													
Heart Rate													
Respirations													
SaO_2													
FIO2/LPM													
Weight													
24 hr. Total Intake													
24 hr. Total Output													

Page 2

Progressive Cardiovascular Patient Assessment

	ICU	PCVU			
	POD ____ Date ____/____/____	POD ____ Date ____/____/____		POD ____ Date ____/____/____	
	7A-7P Time:	7A-7P Time:	7P-7A Time:	7A-7P Time:	7P-7A Time:
Cardiovascular (describe)	Rhythm: ____ Ectopy: ____ Heart sounds: ____ Pacing wires: At ____ Vt ____ insulated & secured ☐ MA ____ Mode ____ (of pacer) DP PT Radial R [ ][ ][ ] L [ ][ ][ ] Scale (0-4+) Mediastinal Drains x ____ D/CD @ ____ Chest tubes: L ____ R ____ H_2O Seal ☐ Suction ☐ air leak: ☐ Yes ☐ No	Rhythm: ____ Ectopy: ____ Heart sounds: ____ Pacing wires: At ____ Vt ____ insulated & secured ☐ MA ____ Mode ____ (of pacer) DP PT Radial R [ ][ ][ ] L [ ][ ][ ] Scale (0-4+)	Rhythm: ____ Ectopy: ____ Heart sounds: ____ Pacing wires: At ____ Vt ____ insulated & secured ☐ MA ____ Mode ____ (of pacer) DP PT Radial R [ ][ ][ ] L [ ][ ][ ] Scale (0-4+)	Rhythm: ____ Ectopy: ____ Heart sounds: ____ Pacing wires: At ____ Vt ____ insulated & secured ☐ MA ____ Mode ____ (of pacer) DP PT Radial R [ ][ ][ ] L [ ][ ][ ] Scale (0-4+)	Rhythm: ____ Ectopy: ____ Heart sounds: ____ Pacing wires: At ____ Vt insulated & secured MA ____ Mode ____ DP P R [ ][L [ ][
Invasive Lines appropriate waveform dsg dry & intact sites without redness sites without drainage	Meets Standard ____ Art Line: Radial: Rt ____ Lt ____ D/CD @ ____ Femoral: Rt ____ Lt ____ D/CD @ ____ Swan Ganz: Subc/Int. Jug: Rt ____ Lt ____ D/CD @ ____	Chest tubes: L ____ R ____ H_2O Seal ☐ Suction ☐ air leak ☐ Yes ☐ No	Chest tubes: L ____ R ____ H_2O Seal ☐ Suction ☐ air leak ☐ Yes ☐ No	Chest tubes: L ____ R ____ H_2O Seal ☐ Suction ☐ air leak ☐ Yes ☐ No	Chest tubes: L ____ H_2O Seal ☐ Suctio air leak ☐ Yes ☐ N
Respiratory Regular & non-labored Lung sounds clear bilaterally	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Gastrointestinal Soft & non-distended Bowel sounds present	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Neuromuscular Alert & oriented Speech clear & coherent Moves all four extremities	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Skin warm & dry	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Surgical wound (Describe)					
Urinary Foley intact or voiding & continent Clear yellow urine	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Edema Non-pitting	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
IV therapy Patent: flushes easily/ good blood return No redness No swelling No tenderness	Meets Standard ____ ☐ N/A Site ____ Fluid ____	Meets Standard ____ ☐ N/A Site ____ Fluid ____	Meets Standard ____ ☐ N/A Site ____ Fluid ____	Meets Standard ____ ☐ N/A Site ____ Fluid ____	Meets Standard ____ Site ____ Fluid ____
IV site care Subclavian dressing change M-W-F Peripheral IV site rotated ≤ 3 days	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Discomfort Tolerates ambulation Tolerates T, C & DB Pain medication ≤ 3-4 hours provides comfort	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Describe pain on discomfort scale: 0 = No pain 10 = Constant pain	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:
Environmental: Siderails up Call bell in reach Bed in low position	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____	Meets Standard ____
Signature/Title					
Intake and Output	In: Oral ____ IV ____ ____ Other: ____ Total: ____ Out: Urine ____ Chest tube ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____ Out: Urine ____ Chest tube ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____ Out: Urine ____ Chest tube ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____ Out: Urine ____ Chest tube ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____ Out: Urine Chest BM Other Total

Page 3

Progressive Cardiovascular Patient Assessment

POD ____ Date ____/____/____		POD ____ Date ____/____/____		POD ____ Date ____/____/____	
7A-7P Time: ____	7P-7A Time: ____	7A-7P Time: ____	7P-7A Time: ____	7A-7P Time: ____	7P-7A Time: ____
Rhythm: ____	Rhythm: ____	Rhythm: ____	Rhythm: ____	Rhythm: ____	Rhythm: ____
Ectopy: ____	Ectopy: ____	Ectopy: ____	Ectopy: ____	Ectopy: ____	Ectopy: ____
Heart sounds: ____	Heart sounds: ____	Heart sounds: ____	Heart sounds: ____	Heart sounds: ____	Heart sounds: ____
Pacing wires:	Pacing wires:	Pacing wires:	Pacing wires:	Pacing wires:	Pacing wires:
Ax ____ Vx ____	Ax ____ Vx ____	Ax ____ Vx ____	Ax ____ Vx ____	Ax ____ Vx ____	Ax ____ Vx ____
insulated & secured ☐	insulated & secured ☐	insulated & secured ☐	insulated & secured ☐	insulated & secured ☐	insulated & secured ☐
MA ____ Mode: ____	MA ____ Mode: ____	MA ____ Mode: ____	MA ____ Mode: ____	MA ____ Mode: ____	MA ____ Mode: ____
DP PT Radial	DP PT Radial	DP PT Radial	DP PT Radial	DP PT Radial	DP PT Radial
R ☐☐☐	R ☐☐☐	R ☐☐☐	R ☐☐☐	R ☐☐☐	R ☐☐☐
L ☐☐☐	L ☐☐☐	L ☐☐☐	L ☐☐☐	L ☐☐☐	L ☐☐☐
Chest tubes: L ____ R ____	Chest tubes: L ____ R ____	Chest tubes: L ____ R ____	Chest tubes: L ____ R ____	Chest tubes: L ____ R ____	Chest tubes: L ____ R ____
H2O Seal ☐ Suction ☐	H2O Seal ☐ Suction ☐	H2O Seal ☐ Suction ☐	H2O Seal ☐ Suction ☐	H2O Seal ☐ Suction ☐	H2O Seal ☐ Suction ☐
air leak ☐ Yes ☐ No	air leak ☐ Yes ☐ No	air leak ☐ Yes ☐ No	air leak ☐ Yes ☐ No	air leak ☐ Yes ☐ No	air leak ☐ Yes ☐ No
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____ ☐ N/A	Meds: Standard ____ ☐ N/A	Meds: Standard ____ ☐ N/A	Meds: Standard ____ ☐ N/A	Meds: Standard ____ ☐ N/A	Meds: Standard ____ ☐ N/A
Site: ____	Site: ____	Site: ____	Site: ____	Site: ____	Site: ____
Fluid: ____	Fluid: ____	Fluid: ____	Fluid: ____	Fluid: ____	Fluid: ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:	Intensity (0-10): Location:
Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____	Meds: Standard ____
In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____
In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____	In: Oral ____ IV ____ ____ Other: ____ Total: ____	Out: Urine ____ Chest tube: ____ ____ BM ____ Other: ____ Total: ____

Name:

Clinical Pathway	Cardiac Surgery DRG 104, 105, 106, 107 (Anticipated LOS 106-8 days/107-6.5 days)	Label
Physician	Consulting Physician	
Case Manager	Consulting Physician	
Admit Date	Discharge Date	

Significant Other: **Phone:** **Alternate Family Contact:** **Phone:**

Patient Problems	#4 Lack of Knowledge	#8 Alteration in nutrition
#1 Alteration in Cardiac Output: Decreased	#5 Alteration in Skin Integrity	#9
#2 Impaired Mobility	#6 Alteration in Comfort	#10
#3 Impaired Gas Exchange related to post-operative course	#7 Anxiety related to surgery	#11

	Date: / / Pre-admit/ Pre-op	PV	C 7A-7P/7P-7A	I	Date: / / Day of Surgery	PV	C 7A-7P/7P-7A	I	ICU Date: / / Day of Transfer or POD#____	PV	C 7A-7P/7P-7A	I	PCVU Date: / / Day of Transfer or POD#____	PV	C 7A-7P/7P-7A	I
Patient/Family Education Discharge Planning	Pre-op teaching (learning needs assessed)				Call from surgery: at start & at off bypass				Orient Pt/Fam to PCV staff, environment, monitor, call light, IV pump, chest tubes & O2				Orient Pt/Fam to PCV staff, environment, monitor, call light, IV pump, chest tubes & O2			
	CV orientation (V/S, activity, diet, drainage, equipment, SMT's, pain control, unit tour, visiting, cough, turn, d/b, I&O)				Orient family to patients environment.				Activity education				IV & chest tube Box Choice provided. Activity education			
	Assess discharge/ financial needs				Orient to unit-pulmonary toilet, T C & DB				SMIC & DB technique				SMIC & DB technique			
	Sign permits				Begin teaching prep for transfer				Pain control education				Pain control education			
	Status under-standing				Pt./Family questions and answers				I&O/Daily weight education				I&O/Daily weight education			
	Input received from pt/family to develop plan of care. Patient pathway given				Pt and/or family assessed as ready and able to learn prior to teaching				Pt and/or family assessed as ready and able to learn prior to teaching				Pt and/or family assessed as ready and able to learn prior to teaching			
Consults	CV Surgeon												Nutrition (assessment & education planning)			
	Anesthesiologist												PT/OT/SD/PRN			
	Respiratory Therapy															
	Consider (PRN) Pulmonologist Social Services															
Assessments	Pre-op nursing assessment				ECG monitoring				Continue ECG				Continue ECG per telemetry			
	Assessment q 4 hours & prn vs qid				Assess cardiovascular and pulmonary parameters per CVICU standards of care				Assess parameters q2 hr and PRN changes documented vs q 4 hrs [illegible] transfer order received				Assess parameters q2 hr and PRN changes documented vs q 4 hrs [illegible] transfer			
	Height & weight				U/O >30cc/hr (notify MD if <)											
	Assess for fall prevention				Bed alarms on								Hemo stable w/o vasoactive med			
									Begin Daily Weights				Daily Weight			
	I&O				I&O				I&O				I&O			
Procedure/Test	**SMA 7, type & screen x 3 units, CXR, EKG.				ABG with Ca-Os after adm., on IMV of 4, and 30 min after extubation ABG's PRN **notify				Lab work & CXR as ordered							
	Consider pulmonary function assessment if CO2 >45 & ABG's				CXR on admit from OR											
					Recheck needed lab values											

The Clinical Pathway is not an inflexible, mandatory plan of treatment and is not a substitute for independent clinical judgment with respect to the care and treatment of any individual. 4/97

	Date: / /			Date: / /			ICU Date: / /			PCVU Date: / /		
	Pre-admit/ Pre-op	PV	C 7a-3p 3p-11p 11p-7a	Day of Surgery	PV	C 7a-3p 3p-11p 11p-7a	Day of Transfer or POD#____	PV	C 7a-3p 3p-11p 11p-7a	Day of Transfer or POD#____	PV	C 7a-3p 3p-11p 11p-7a
Treatment/Intervention	Shave and prep			Suction q 2 hrs & prn while intubated								
	Hibiclens shower x2 1.___time____ 2.___time____						[illegible]			[illegible]		
				Chest tubes —mediastinal —pleural			MCT's D/C'D by charge nurse. Pleural tube to H2O seal			Pleural tube to H2O seal		
							Change CT dsg q day			Change CT dsg q day		
				Arterial line & Swan-Ganz monitor per CVICU guidelines			D/C art line, D/C Swan Ganz per order Time____					
				Pacemaker prn			Pacemaker prn			Pacemaker prn		
				Foley			Continue Foley			Continue Foley		
				[illegible]			Inc. & site care BID (leg wraps off)			Inc. & site care BID		
Medications/IV	[illegible] H.S.			Pre-op medications per MD order 1 hr on call								
	Review home meds and cont. appropriate			Pre-op antibiotics per MD order 1 hr on call Time____			IV antibiotics per MD order			IV antibiotics per MD order		
				IV analgesia prn			p.o. analgesia prn			p.o. analgesia prn		
	D/C antihypertensive meds			[illegible] KCL [illegible]								
	D/C coumadin & Ticlid			[illegible]								
				Inotropic support/vasodilators per MD order						[illegible]		
				Anti-arrhythmics as needed			Anti-arrhythmics as needed			Anti-arrhythmics as needed		
				Heparin for hypercoagulation (do not exceed [illegible])								
				Acetaminophen per protocol								
				KCL to keep K+ ≥ 4.0 per protocol						pre-op medications resumed		
	Daily medications per MD order			Daily medications per MD order			Daily medications per MD order			Daily medications per MD order		
Nutrition	Regular diet (no added salt) NPO p midnight			NPO May have ice chips after extubation			Clear liquids lunch ___%			Clear liquids lunch ___% 2 Gm Na, low fat, low cholesterol, no [illegible] (plus 1800 cal ADA if diabetic) Dinner____%		
Activity	As prescribed or tolerated			Bedrest/Turn q 2 hrs Elevate H.O.B. 30 degrees			Dangle then ambulate: ambulate to PCV OR wheelchair to PCV			If transferred by wheelchair: ambulate 1-2 laps before 5 pm		
										In chair x 2		
Psychosocial/Emotional/Spiritual/Cultural Needs	Begin psychosocial assessment (plan of care adapted to cultures)			Continue to orient to environment and answer questions of pt/fm			Clergy to visit if requested Spiritual needs identified			Clergy to visit if requested Spiritual needs identified		
	Listen to Pt/Fm concerns			Provide family visiting time			Education related to emotional changes after surgery			Education related to emotional changes after surgery		
	Verbalizes feelings related to surgery						Pt/Fm aware of support services/ discharge options available			Pt/Fm aware of support services/ discharge options available		

RN/LPN								
RN/LPN								
RT/PT								
Dietitian								
Social Worker								
Pharmacist								
Rehab								
Home Health								

Name:________________ MR#________________

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Clinical Pathway

Cardiac Surgery
DRG 104, 105, 106, 107

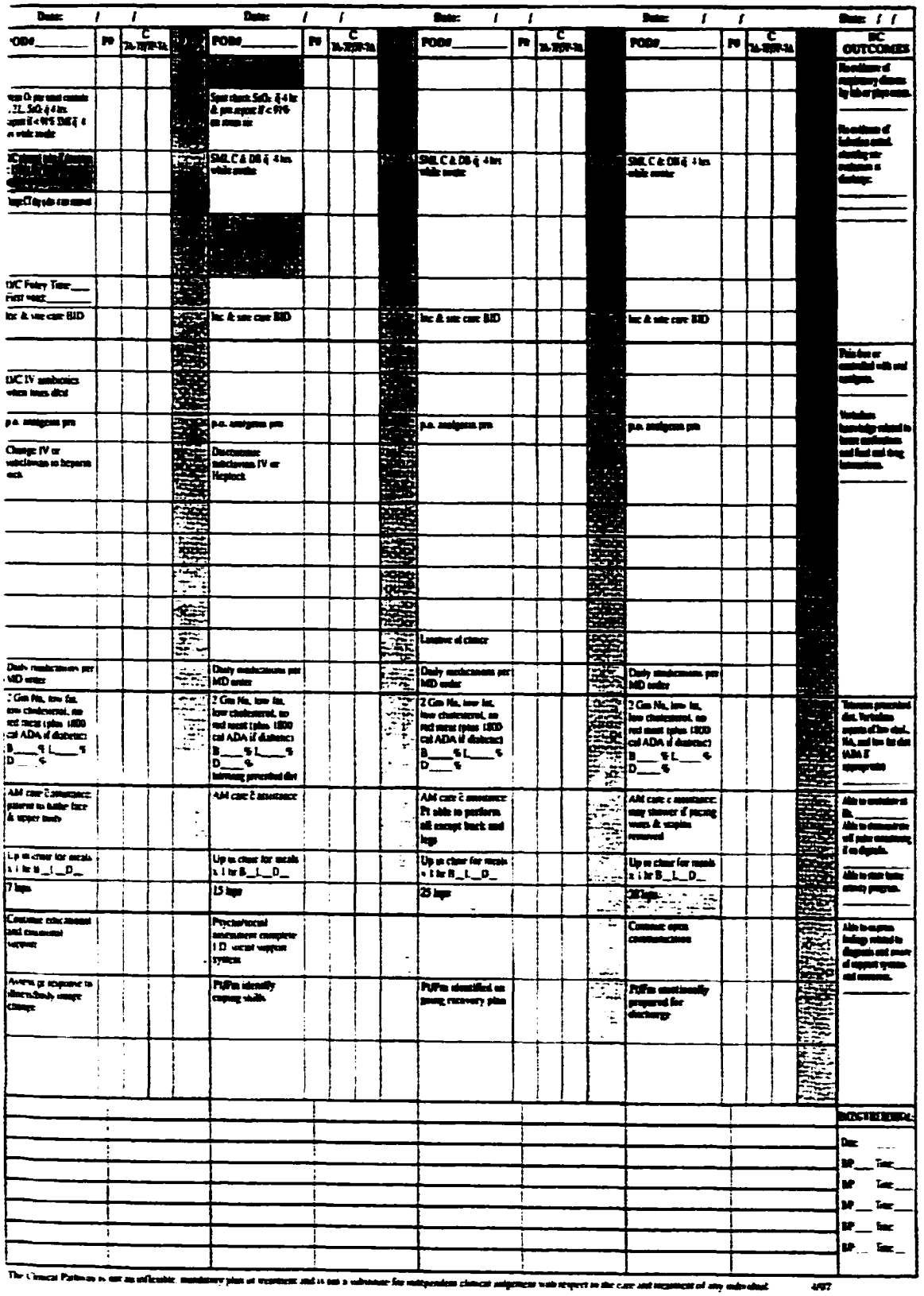
Label

Instructions:
1. For completed items, time and initials are entered in 'C' column under appropriate shift.
2. For uncompleted items, time and initials are entered into 'I' column. Shaded goals not met to documented on back of pathway with rationale and intervention. Other variations to be documented on additional variance record with rational and intervention.
3. Individualize patient problems by deleting or adding appropriate. Identify in the "P" column.

ACUTE DIAGNOSES	CHRONIC DIAGNOSES

Date: / / POD#____	P#	C 7A-7P/7P-7A	Date: / / POD#____	P#	C 7A-7P/7P-7A	Date: / / POD#____	P#	C 7A-7P/7P-7A	Date: / / POD#____	P#	C 7A-7P/7P-7A	Date: / / DC OUTCOMES
Continue orientation to environment			D/C teaching, activity instructions, wound care, s/s of infection & follow-up with physician.			Reinforce all teaching			Reinforce all teaching			Able to function independently or with family support in ADLs.
Activity education continued with explanation of daily step goals			Dietary instructions, incl pt food/drug interactions						Able to discuss: signs & symptoms of infection, wound care, medication side effects, activity instructions			Understands medication schedule, [illegible], and side effects.
Reinforce SMI/C & DB technique			Medication instructions									Able to verbalize and demonstrate wound care.
Continue												
			Incision care instruction						Incision & site care return demo			
pt and/or family assessed as ready and able to learn prior to teaching			pt and/or family assessed as ready and able to learn prior to teaching			pt and/or family assessed as ready and able to learn prior to teaching			pt and/or family assessed as ready and able to learn prior to teaching			
			Notify Dietitian if nutritional intake <50%									All questions for condition answered.
			Rx written for DC									
Telemetry monitoring			Telemetry monitoring			Telemetry monitoring			Telemetry monitoring			Vital Signs stable__ Rhythm stable. Rhythm at time of Discharge:
Assess parameters q2-3 hr and PRN, ? changes document VS q 4 hours			Assessment q4 hr and PRN, ? changes document VS q 4 hours			Assessment q4 hr and PRN, ? changes document VS q 4 hours			Assessment q4 hr and PRN, ? changes document VS q 4 hours			
			Bowel movement									Bowel movement prior to discharge.
Free of nausea/ vomiting			Communicates discomfort			Heart rhythm stable. Not req. temp PRN						Weight stable.
Daily AM Weight			AM Weight			AM Weight			AM Weight			Evidence of adequate C.O.
I&O			I&O			I&O			I&O			
			SMA 7									
			CBC with differential									
			EKG									
			CXR									

The Clinical Pathway is not an inflexible, mandatory plan of treatment and is not a substitute for independent clinical judgement with respect to the care and treatment of any individual. 4/97



Label

MULTIDISCIPLINARY NOTES

Page 8 of 8

Date	Time	

The Clinical Pathway is not an inflexible, mandatory plan of treatment and is not a substitute for independent clinical judgment with respect to the care and treatment of any individual. 8/98

APPENDIX C

COST INDEX CALCULATIONS WITH FORMULA

Cost Index Calculations With Formula

The cost index reflected a "basket of goods" that, in this case, reflected 47% of the total cost for an average postoperative cardiovascular stay. Surgery represented 21% of the total cost, an intensive care unit (CVICU) bed cost per day represented 14% of the cost, and a progressive/step-down (PCV) room cost per day represented 12% of the total cost. The only other item that contributed to more than 10% of total cost was pharmacy (13%), but, because pharmacy costs could not be broken down into preoperative cost, intraoperative cost, and postoperative cost (the focus of this study), pharmacy cost was not included in the cost index. Using this index allowed for inflating the costs of the earlier year (1998) to use in comparison of cost between the 2 times examined.

The hospital cost index :

Calculate: (cost for surgery in 2001 + cost of ICU bed for 1 day in 2001 + cost for PCV bed for 1 day in 2001)

Divide by: (cost for surgery in 1998 + cost of ICU bed for 1 day in 1998 + cost for PCV bed for 1 day in 1998)

This provided a number, in this case 1.173, which meant prices went up 17 % in 3 years. Subsequently, the index was then used to "inflate" the earlier (1998) cost to account for inflation called the "real" cost : real cost for 1998 = (nominal 1998 cost)(index)

The formula for the hospital cost index was

$$I = \frac{P_{01,1}}{P_{98,1}}(w_1) + \frac{P_{01,2}}{P_{98,2}}(w_2) + \frac{P_{01,n}}{P_{98,n}}(w_n)$$

where the subscripts 01 and 98 refer to the years, subscript 1, 2,..., n referred to the item in the "basket of goods" (surgery, CVICU bed, and PCV bed), and w_i was the weight of each item within the entire basket of goods. So in this case ($N = 3$)

$$I = \frac{14}{11}(.447) + \frac{686}{783}(.298) + \frac{316}{235}(.255) = 1.173$$

The weights were figured accordingly. Surgery was 21% of all costs, PCV was 12%, and CVICU was 14%. Thus, we are accounting for 47% of the total hospital cost (21% + 14% + 12% = 47%). So the weight that surgery had in this basket was $\frac{21}{47} = .447$ and so on. Then use the index number, 1.173, to inflate 1998 cost numbers, and the new "index" cost was used in analysis.

APPENDIX D

IRB APPROVAL FROM UAB FOR PILOT STUDY

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

The Institutional Review Board for Human Use (IRB) has an approved Multiple Project Assurance with the Department of Health and Human Services and is in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on January 1, 1999 and the approval period is for five years. The Assurance number is M-1149, identification number 01.

Principal Investigator: SUSAN C. MEYER

Protocol Number: M000620005

Protocol Title: Effect of Acute Care Nurse Practitioner-Collaborative Care on Postoperative Cardiovascular Patient and Economic Outcomes- Pilot Study of Data Collection Process

---

The IRB reviewed and approved the above named project on 8/5/00. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

__ is project received EXPEDITED review.

IRB Approval Date: 8-15-00

Date IRB Approval Issued: 8/5/00

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
934-3789
Fax 934-1301

The University of
Alabama at Birmingham
Mailing Address:
AB 470

APPENDIX E

IRB APPROVAL FROM HEALTH CARE SYSTEM FOR PILOT STUDY

Date: June 13, 2000

CERTIFICATION

This is to certify that the Institutional Review Committee at this hospital has taken the stated action.

NAME OF INVESTIGATION: Effect of Acute Care Nurse Practitioner – Collaborative Care Postoperative Cardiovascular Patient and Economic Outcomes

PRINCIPAL INVESTIGATOR: Susan C. Meyer, R.N., M.S.N.

ACTION TAKEN: Approval of New Protocol by the IRC on June 13, 2000.

NAME OF HOSPITAL OFFICIAL TO WHOM CORRESPONDENCE CONCERNING IRC AFFAIRS SHOULD BE ADDRESSED:

L. Joe Austin

John B. Cox, M.D.
IRC, Chairman

L. Joe Austin
Chief Executive Officer

APPENDIX F

IRB APPROVAL FROM UAB FOR DATA COLLECTION

UAB THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

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Projects Involving Human Subjects

The Institutional Review Board for Human Use (IRB) has an approved Multiple Project Assurance with the Department of Health and Human Services and is in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on January 1, 1999 and the approval period is for five years. The Assurance number is M-1149.

Principal Investigator:	MEYER, SUSAN C.
Co-Investigator(s):	
Protocol Number:	X001220007
Protocol Title:	*Effect of Acute Care Nurse Practitioner-Collaborative Care on Postoperative Cardiovascular Patient and Economic Outcomes*

The IRB reviewed and approved the above named project on 01/22/01. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project recieved EXPEDITED review.

IRB Approval Date: 1-22-01

Date IRB Approval Issued: 01/24/01

Marilyn Doss

Marilyn Doss, M.A.
Vice-Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

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701 20th Street South
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Alabama at Birmingham
Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

The Institutional Review Board for Human Use (IRB) has an approved Multiple Project Assurance with the Department of Health and Human Services and is in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on January 1, 1999 and the approval period is for five years. The Assurance number is M-1149.

Principal Investigator: MEYER, SUSAN C.

Co-Investigator(s):

Protocol Number: X991220007

Protocol Title: *Effect of Acute Care Nurse Practitioner-Collaborative Care on Postoperative Cardiovascular Patient and Economic Outcomes*

The IRB reviewed and approved the above named project on 11/15/01. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project recieved EXPEDITED review.

IRB Approval Date: 11/15/01

Date IRB Approval Issued: 11/16/01

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301

The University of
Alabama at Birmingham
Mailing Address:
AB 470

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Office of the Associate Provost for Research and Dean of the Graduate School

MEMORANDUM

TO: SUSAN MEYER

FROM Joan F. Lorden

Associate Provost for Research and Dean, The Graduate School

DATE: April 4, 2002

RE: Collaborative IRB Training Initiative (CITI) through the University of Miami Training Certificate.
Human Subjects Protection Training

This is to certify that you completed the Collaborative IRB Training Initiative (CITI) through the University of Miami on-line training site on Monday, April 1, 2002.

Your participation in this training program has been recorded in the Institutional Review Board (IRB) training database. You should retain a copy of this memorandum and use it to document your training when submitting applications for extramural funding or IRB applications.

770G Administration Building
701 20th Street South
205.975.8852
Fax 205.975.7877

Mailing Address:
AB 770G
1530 3RD AVE S
BIRMINGHAM AL 35294-0107

APPENDIX G

IRB APPROVAL FROM HEALTH CARE SYSTEM FOR DATA COLLECTION

Date: January 16, 2001

CERTIFICATION

This is to certify that the Institutional Review Committee at this hospital has taken the stated action.

NAME OF INVESTIGATION: Effect of Acute Care Nurse Practitioner – Collaborative Care on Postconvalescent Cardiovascular Patient and Economic Outcomes (Approval: 09/13/00) "Data Collection Phase"

PRINCIPAL INVESTIGATOR: Susan C. Meyer, D.S.N.(c), R.N.

ACTION TAKEN: Approval of Data Collection Phase by the IRC on January 16, 2001.

NAME OF HOSPITAL OFFICIAL TO WHOM CORRESPONDENCE CONCERNING IRC AFFAIRS SHOULD BE ADDRESSED:

L. Joe Austin

John B. Cox, M.D.
John B. Cox, M.D.
IRC Chairman

L. Joe Austin
L. Joe Austin
Chief Executive Officer

Date: June 12, 2001

CERTIFICATION

This is to certify that the Institutional Review Committee at this hospital has taken the stated action.

NAME OF INVESTIGATION: Effect of Acute Care Nurse Practitioner (Nursing Study) (Approval: 09/13/00)

PRINCIPAL INVESTIGATOR: Susan C. Meyer, RN, MSN

ACTION TAKEN: Acceptance of Study Closure by the IRC on June 12, 2001.

NAME OF HOSPITAL OFFICIAL TO WHOM CORRESPONDENCE CONCERNING IRC AFFAIRS SHOULD BE ADDRESSED:

L. Joe Austin

John B. Cox, M.D.
IRC, Chairman

L. Joe Austin
Chief Executive Officer

Date: June 18, 2002

CERTIFICATION

This is to certify that the Institutional Review Committee at this hospital has taken the stated action.

NAME OF INVESTIGATION: Effect of Acute Care Nurse Practitioner – Collaborative Care & Data Collection Phase (Approval: 06/13/00)

PRINCIPAL INVESTIGATOR: Susan Meyer, R.N.

ACTION TAKEN: Acceptance of Request for Continuation of IRC Approval of Data Collection by the IRC on 06/18/02.

NAME OF HOSPITAL OFFICIAL TO WHOM CORRESPONDENCE CONCERNING IRC AFFAIRS SHOULD BE ADDRESSED:

L. Joe Austin

John B. Cox, M.D.
IRC, Chairman

L. Joe Austin
Chief Executive Officer

APPENDIX H

CODEBOOK

CODE BOOK

Patient Outcomes

A. Administrative

Individual study number developed from identifier that will be destroyed at the end of the study.

B. Demographics

1. age (in years)
   calculated from date of birth to date of surgery.
2. gender
   male = 2
   female = 1
3. race
   Black = 1
   White = 2
   Hispanic = 3
   Asian = 4
   Native American = 5
   Other = 6

C. Hospitalization

1. Date of surgery: __/__/__
2. Date of discharge: __/__/__
3. Length of stay calculated by days from surgery to discharge: a number

D. Pre-operative Risk Factors

1. Weight: ____(kg)
2. Height: _____(cm)
3. Smoker: no = 0 yes = 1
4. Current smoker: no = 0 yes = 1
5. Family history of coronary artery disease: no = 0 yes = 1
6. Diabetes: no = 0 yes = 1
7. Hypercholesterolemia: no = 0 yes = 1
8. Renal Failure: no = 0 yes = 1
9. Dialysis: no = 0 yes = 1
10. Hypertension: no = 0 yes = 1
11. Cerebrovascular Accident:
    no = 0 yes , recent (<=2 weeks) = 2 yes, remote (>2 weeks) = 3
12. Infectious Endocarditis: no = 0 yes = 1
13. Chronic Lung Disease: no = 0 mild = 2 moderate = 3 severe = 4
14. Immunosuppressive treatment: no = 0 yes = 1
15. Peripheral Vascular Disease: no = 0 yes = 1
16. Cerebrovascular disease: no = 0 yes = 1

E. Previous Interventions

1. Previous Cardiovascular Interventions: no = 0 yes = 1
2. Number of prior cardiac operations requiring bypass: a number
3. Number of prior cardiac operations without bypass: a number
4. Previous cardiovascular surgery
   -coronary artery bypass: no = 0 yes = 1
5. Previous cardiovascular surgery
   - valve: no = 0 yes= 2
6. Previous cardiovascular surgery
   - previous cardiac other: no = 0 yes = 1
7. Prior PTCA including balloon, cath, +/or Stent: no = 0 yes = 1
8. Thrombolysis: no = 0 yes = 1
9. Previous balloon valvuloplasty: no = 0 yes = 1

F. Pre-Operative Cardiac Status

1. Myocardial infarction:
   - 0 = no
   - 1 = yes
   - 2 yes <= 6 hours
   - 3 yes >6<24 hours
   - 4 yes>24hours
2. Congestive heart failure: no = 0 yes = 1
3. Angina: no = 0 yes = 1
4. Cardiogenic shock: no = 0 yes = 1
5. Resuscitation: no = 0 yes = 1
6. Arrythmia: no = 0 Sust VT/VF = 2 Heart Block = 3 Afib/Flutter = 4

G. Pre-Operative Medications

1. Digitalis: no = 0 yes = 1
2. Diuretics: no = 0 yes = 1
3. Beta blocker: no = 0 yes = 1
4. Inotropic agents: no = 0 yes = 1
5. Nitrates – IV: no = 0 yes = 1
6. Steroids: no = 0 yes = 1
7. Anticoagulants: no = 0 yes = 1
8. Aspirin: no = 0 yes = 1

H. Pre-Operative Hemodynamics and Cath

1. Number of diseased coronary vessels: a number

I. Operative

1. Surgeon: DST = 1 DRC = 2 DBW = 3 DC = 4
2. Status of procedure:
   - elective = 1 urgent = 2 emergent = 3 salvage = 4
3. Coronary Artery Bypass: no = 0 yes = 1

J. Coronary Surgery

1. Unplanned CABG: no = 0 yes = 1

K. Valve Surgery: no = 0 yes = 1

L. Post-Operative

1. Blood products used : no = 0 yes = 1
2. Number of minutes intubated: a whole number

M. Complications (in hospital): no = 0 yes = 1

operative

1. reop for bleeding: no = 0 yes = 1
2. reop for valvular dysfunction: no = 0 yes = 1
3. reop for graph occlusion: no = 0 yes = 1
4. reop for other cardiac problem: no = 0 yes = 1
5. reop for other non-cardiac problem: no = 0 yes = 1
6. perioperative MI: no = 0 yes = 1

infection

7. infection – sternum: no = 0 yes = 1
8. infection - thoracotomy: no = 0 yes = 1
9. infection – leg: no = 0 yes = 1
10. infection – septicemia: no = 0 yes = 1
11. infection – Urinary Tract Infection: no = 0 yes = 1

neurologic

12. stroke: no = 0 yes = 1
13. transient neurologic event: no = 0 yes = 1
14. continuous coma >=24 hours: no = 0 yes = 1

pulmonary

15. prolonged ventilation: no = 0 yes = 1
16. pulmonary embolism: no = 0 yes = 1
17. pneumonia: no = 0 yes = 1

renal

18. renal failure: no = 0 yes = 1

vascular

19. vascular-aortic dissection: no = 0 yes = 1
20. iliac/femoral dissection: no = 0 yes = 1
21. acute limb ischemia: no = 0 yes = 1

other

22. heart block: no = 0 yes = 1
23. cardiac arrest: no = 0 yes = 1

24. anticoagulant complication: no = 0 yes = 1
25. tamponade: no = 0 yes = 1
26. gastro-intestinal complication: no = 0 yes = 1
27. multi-system failure: no = 0 yes = 1
28. atrial fibrillation: no = 0 yes = 1

N. Mortality

1. Discharge status: alive = 0 dead = 1
2. Status at 30 days after surgery: alive = 0 dead = 1
3. Location of death:
   - operating room = 1 hospital = 2 home = 3 other = 4
4. Primary cause of death:
   - cardiac = 1 neuro = 2 renal = 3 vascular = 4 infection = 5 pulmonary = 6 valvular = 7 other = 8

O. Readmission into the hospital

1. readmit <=30 days from date of procedure: no = 0 yes = 1
2. reason for readmit:
   - Anticoagulant complication = 1
   - Arrythmias = 2
   - CHF = 3
   - Incisional complication = 4
   - MI/recurrent angina = 5
   - Pericardial effusion/tamponade = 6
   - Pneumonia or respiratory complication = 7
   - Valve dysfunction = 8
   - Other = 9

P. Readmit to CVICU: no = 0 yes = 1

Q. Hours on supplemental oxygen: a number

R. Patient satisfaction: reported as a monthly mean, a number

Economic Outcomes

S. Health care system actual total cost per DRG

1. Insurance provider:
   - Blue Cross Selections = 1
   - Medicaid = 2
   - Medicare = 3
   - Private/Corporate = 4
   - Uninsured = 5
2. Total cost: a number in dollars and cents
3. DRG code: a number

APPENDIX I

CORRELATION MATRIX FOR LENGTH OF STAY

Correlations

Correlations

		los	group	Comorbidity	Complications	Resp	Infe	Intu	o2	ICUreadmit
los	Pearson Correlation	1.000	-.306**	.091	.508**	.287**	.149*	.488**	.581**	.127
	Sig. (2-tailed)	.	.000	.183	.000	.000	.029	.000	.000	.064
	N	215	215	215	215	215	215	215	215	215
group	Pearson Correlation	-.306**	1.000	-.164*	-.106	-.127	.036	-.168*	-.266**	-.041
	Sig. (2-tailed)	.000	.	.016	.120	.062	.599	.013	.000	.546
	N	215	215	215	215	215	215	215	215	215
Comorbidity	Pearson Correlation	.091	-.164*	1.000	-.033	.026	-.122	.103	.154*	.013
	Sig. (2-tailed)	.183	.016	.	.627	.707	.074	.131	.024	.854
	N	215	215	215	215	215	215	215	215	215
Complications	Pearson Correlation	.508**	-.106	-.033	1.000	.106	.044	.300**	.260**	.278**
	Sig. (2-tailed)	.000	.120	.627	.	.113	.522	.000	.000	.000
	N	215	215	215	215	215	215	215	215	215
Resp	Pearson Correlation	.287**	-.127	.026	.106	1.000	.255**	.026	.217**	.146*
	Sig. (2-tailed)	.000	.062	.707	.113	.	.000	.572	.001	.033
	N	215	215	215	215	215	215	215	215	215
Infe	Pearson Correlation	.149*	.036	-.122	.044	.255**	1.000	-.033	.128	-.015
	Sig. (2-tailed)	.029	.599	.074	.522	.000	.	.628	.060	.827
	N	215	215	215	215	215	215	215	215	215
Intu	Pearson Correlation	.488**	-.168*	.103	.300**	.026	-.033	1.000	.122	.020
	Sig. (2-tailed)	.000	.013	.131	.000	.572	.628	.	.073	.766
	N	215	215	215	215	215	215	215	215	215
o2	Pearson Correlation	.581**	-.266**	.154*	.260**	.217**	.128	.122	1.000	.065
	Sig. (2-tailed)	.000	.000	.024	.000	.001	.060	.073	.	.215
	N	215	215	215	215	215	215	215	215	215
ICUreadmit	Pearson Correlation	.127	-.041	.013	.278**	.146*	-.015	.020	.065	1.000
	Sig. (2-tailed)	.064	.546	.854	.000	.033	.827	.766	.215	.
	N	215	215	215	215	215	215	215	215	215

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX J

CORRELATION MATRIX FOR COST

Correlations

Correlations

		INDEX	group	Comorbidity	los	Complicati ons	Recp	Infe	Infu	o2
INDEX	Pearson Correlation	1.000	-.315**	.112	.730**	.425**	.384**	.130	.371**	.559**
	Sig. (2-tailed)	.	.000	.102	.000	.000	.000	.057	.000	.000
	N	215	215	215	215	215	215	215	215	215
group	Pearson Correlation	-.315**	1.000	-.164*	-.305**	-.108	-.127	.036	-.166*	-.266**
	Sig. (2-tailed)	.000	.	.016	.000	.120	.062	.599	.013	.000
	N	215	215	215	215	215	215	215	215	215
Comorbidity	Pearson Correlation	.112	-.164*	1.000	.091	-.033	.026	-.122	.103	.154*
	Sig. (2-tailed)	.102	.016	.	.183	.627	.707	.074	.131	.024
	N	215	215	215	215	215	215	215	215	215
los	Pearson Correlation	.730**	-.305**	.091	1.000	.509**	.287**	.149*	.486**	.581**
	Sig. (2-tailed)	.000	.000	.183	.	.000	.000	.029	.000	.000
	N	215	215	215	215	215	215	215	215	215
Complications	Pearson Correlation	.425**	-.108	-.033	.509**	1.000	.108	.044	.300**	.260**
	Sig. (2-tailed)	.000	.120	.627	.000	.	.113	.522	.000	.000
	N	215	215	215	215	215	215	215	215	215
Recp	Pearson Correlation	.384**	-.127	.026	.287**	.108	1.000	.256**	.029	.217**
	Sig. (2-tailed)	.000	.062	.707	.000	.113	.	.000	.672	.001
	N	215	215	215	215	215	215	215	215	215
Infe	Pearson Correlation	.130	.036	-.122	.149*	.044	.256**	1.000	-.033	.128
	Sig. (2-tailed)	.057	.599	.074	.029	.522	.000	.	.628	.060
	N	215	215	215	215	215	215	215	215	215
Infu	Pearson Correlation	.371**	-.166*	.103	.486**	.300**	.029	-.033	1.000	.122
	Sig. (2-tailed)	.000	.013	.131	.000	.000	.672	.628	.	.073
	N	215	215	215	215	215	215	215	215	215
o2	Pearson Correlation	.559**	-.266**	.154*	.581**	.260**	.217**	.128	.122	1.000
	Sig. (2-tailed)	.000	.000	.024	.000	.000	.001	.060	.073	.
	N	215	215	215	215	215	215	215	215	215
ICUreadmit	Pearson Correlation	.202**	-.041	.015	.127	.278**	.146*	-.015	.020	.066
	Sig. (2-tailed)	.003	.546	.854	.064	.000	.033	.827	.766	.215
	N	215	215	215	215	215	215	215	215	215

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

GRADUATE SCHOOL
UNIVERSITY OF ALABAMA AT BIRMINGHAM
DISSERTATION APPROVAL FORM
DOCTOR OF SCIENCE IN NURSING

Name of Candidate Susan C. Meyer

Graduate Program Nursing

Title of Dissertation Effect of Cardiovascular Surgeon and Acute Care Nurse Practitioner Collaboration on Postoperative Outcomes

I certify that I have read this document and examined the student regarding its content. In my opinion, this dissertation conforms to acceptable standards of scholarly presentation and is adequate in scope and quality, and the attainments of this student are such that she may be recommended for the degree of Doctor of Science in Nursing.

Dissertation Committee:

Name	Signature
Linda J. Miers, **Chair**	Linda J. Miers
Marsha Dowell	Marsha Dowell
M. Gail Hill	M. Gail Hill
Anne M. Williams	Anne M. Williams
Joan Williamson	Joan Williamson

Director of Graduate Program Carol J. Lindop

Dean, UAB Graduate School Joan F. Lorden

Date 9/11/02