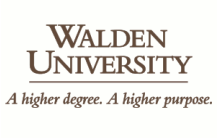

2015

Post Hysterectomy Discharge Destination and Risk of Hospital Readmission in Elderly Women

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Abstract

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by

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MS, Public Health, Walden University

MS, Nursing, Yale University

BS, Nursing, Carlow College

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Walden University

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Abstract

In elderly women, discharge after gynecologic surgery is often associated with increased morbidity. Little information exists about elderly women's discharge destination after gynecologic surgery and the outcome of early hospital readmission. The purpose of this study, conceptualized using the quality health outcomes model, was to examine whether post hysterectomy discharge destination is an independent predictor of 30-day hospital readmission in women age 65 and older. Examination of covariates included patient age, race, medical comorbidity and complications of care, as well as surgical anatomic approach and operative technique. This study involved use of a retrospective cohort design and data from 10,598 cases contained in the Healthcare Cost and Utilization Project 2010 and 2011 California State Inpatient Databases. Results of the bivariate analysis showed a statistically significant association between discharge destination after hysterectomy and 30-day hospital readmission. Additionally, the results of multivariate logistic regression revealed the odds of readmission after discharge with home care were 2.99, $p < .001$, 95% CI [2.29, 3.67] times greater when compared with discharge home for self-care and 5.99, $p < .001$, 95% CI [4.68, 7.43] times greater with discharge to continuing inpatient care versus home for self-care. This study may lead to positive social change for elderly women by informing health care providers about the odds of early hospital readmission associated with discharge destination after hysterectomy. Further, this information may stimulate development of interventions to improve health care practices for elderly women preparing for hospital discharge after hysterectomy.

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Dedication

With love and gratitude, I dedicate this work to my husband Paul, and our children Jana and Paul. Your implacable encouragement propels and inspires me.

Acknowledgments

Completing doctoral study and a dissertation is a collective effort. I enjoyed the privilege and benefits of working with experienced and talented faculty. I extend heartfelt thanks to Dr. Hadi Danawi, my Dissertation Committee Chair, for his consistent mentoring, direction, and encouragement during this entire dissertation process and the multiple life altering events that occurred along the way. I am additionally grateful for the opportunity to work with Dr. Amany Refaat, my Dissertation Committee Member. I appreciated Dr. Refaat's insightful comments and recommendations that challenged me to strive for a higher level of professionalism. Finally, I offer thanks to the Walden University faculty, staff, and administration for providing the structures and processes necessary for this Olympian feat.

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Chapter 1: Introduction to the Study

After gynecologic surgery, women age 65 and older may experience early hospital readmission within 30 days of discharge. Jencks, Williams, and Coleman (2009) reported that early hospital readmission occurred in approximately 20% of Medicare beneficiaries, resulting in an estimated $17.5 billion in annual health care expenditures. With early hospital readmission, patients face interruption in the recovery process and risk of additional hospital associated complications (Horwitz et al., 2011; Krumholz, 2013). Currently there is a gap in health care literature about early hospital readmission occurring in elderly women after hysterectomy surgery. Exploring post hysterectomy discharge destination and the rate of 30-day hospital readmission in women age 65 and older is essential to address this knowledge gap. For health care professionals, new insights about discharge destination after hysterectomy and hospital readmission may stimulate recommendations to improve post hysterectomy discharge care practices for elderly women. Additionally, a decrease in post hysterectomy readmissions may contribute to reduction in health care expenditures associated with early hospital readmission.

In Chapter 1, I provide an overview regarding the need for examining information about discharge destination after hysterectomy surgery and early hospital readmission in elderly women. Next, I present the problem statement; the purpose and nature of the study; and the research questions. Further, I describe the quality health outcomes model, the conceptual foundation for the study, and conclude with a narrative of the scope, limitations, and significance of the study.

Background

The term discharge disposition is a reference to a patient's expected discharge destination and status after an acute care encounter in a hospital or medical facility (United States Health Information Knowledgebase [USHIK], 2009). A patient's discharge destination status may be home for self-care, home with home health care, or to a continuing supervised inpatient care setting (USHIK, 2009). After a hospital admission, the physician's judgment, along with input from the health care team, regarding the patient's physical and cognitive capacity for self-care or need for professionally assisted care drives the decision about discharge destination (Popejoy, Moylan, & Galambos, 2009; Spector, Mutter, Owens, & Limcangco, 2012).

Hysterectomy is a commonly performed procedure in U.S. women; surgeons treat a variety of gynecologic conditions with this intervention (American College of Obstetricians and Gynecologists [ACOG], 2009; Whiteman et al., 2008). Generally, women's discharge destination after hysterectomy is home for self-care (HCUPnet, 2009). Often family members, referred to as informal care givers in health care literature, are the first line of support to augment the patient’s self-care functions (Popejoy, Moylan et al., 2009). When self-care is not viable, professionally assisted care delivered in the individual’s home through a home health care agency, or admission to an inpatient facility for continuing management of care are commonly employed alternatives.

Home health care services, provided intermittently during a day or week, may include assistance with therapeutic treatments, condition monitoring, medication

management, and activities of daily living (Caffrey, Sengupta, Moss, Harris-Kojetin, & Valverde, 2011). For individuals requiring sustained inpatient treatment or monitoring, but at a lower intensity than acute hospital care, admission to a subacute care unit or hospital, a skilled nursing facility, or a rehabilitation setting may be necessary (Popejoy, Galambos, Moylan, & Madsen, 2012). These alternative discharge destinations offer options to deal with discharge care needs beyond the patient's and informal caregiver's personal capacities. However, alternative discharge destinations are not necessarily benign options and may be associated with adverse outcomes.

Legner, Massarweh, Symons, McCormick, and Flum (2009) reported increased 30-day, 90-day, and one-year mortality after abdomiopelvic surgery in adults age 65 and older released to continuing inpatient care facilities, compared with those released home for self-care. Massarweh, Legner, Symons, McCormick, and Flum (2009) identified increased 90-day morbidity, as well as increased 90-day mortality, with each 5 year age increment in patients 65 years and older discharged after abdominal surgery. These investigators did not provide specific information about discharge destination after hysterectomy and hospital readmission in elderly women, although hysterectomy was a surgery included with other abdominal and pelvic procedures in their research.

Women age 65 and older comprise an expanding portion of the U.S. population (Vincent & Velkoff, 2010). Many elderly women require hysterectomy surgery to treat benign, premalignant, or malignant gynecologic conditions (Bellanger & Horlan, 2011). In addition, elderly women frequently have one or more concomitant medical conditions or comorbidities (Caffrey et al., 2011) and functional limitations associated

with the aging process that may contribute to risk of hospital readmission (Erekson, Yip, Ciarleglo, & Fried, 2011; Mains, Magnus, & Finan, 2007). Early hospital readmission interrupts the patient's healing process and creates risk for complications, such as hospital acquired infection and medical error (Horwitz et al., 2011; Krumholz, 2013; Marks, Loeher, & McCarthy, 2013). Additionally, hospital readmission within 30 days of discharge disrupts the lives of the patient's family members creating psychological distress for these individuals (Horwitz et al., 2011; Marks et al., 2013).

Discharge planning with a focus on the patient's post discharge return home has been a mainstay of hospital services for decades (Nosbusch, Weiss, & Bobay, 2010). However, discharge planning with preemptive patient and family or informal caregiver education has not staved off the problem of early hospital readmissions. Investigators using recent information from the Healthcare Cost and Utilization Project (HCUP) databases reported 30-day readmissions to U.S. hospitals by diagnosis (Elixhauser & Steiner, 2013) and procedure (Weiss, Elixhauser, & Steiner, 2013). The investigators verified that early hospital readmissions remain a major health care problem, despite efforts to address transitions in care between providers and care destinations (Bradley et al., 2012).

Weiss et al. (2013) reported that approximately 4.7% of all women with hysterectomy experienced 30-day hospital readmission in 2010. Elixhauser and Steiner (2013) noted that the principal diagnosis−complications of surgical procedures or medical care−accounted for 17.9% of hospital readmissions in 2010. Additionally, information obtained from an on-line query of HCUP data indicated that approximately

15% of elderly women were released with home health care or to continuing inpatient care facilities after hysterectomy (HCUPnet, 2009). However, there is a lack of information about the rate of post hysterectomy hospital readmission in elderly women after discharge with home health care or to a continuing inpatient care setting. Thus, it is necessary to explore the possible association between post hysterectomy discharge destination and 30-day hospital readmission in elderly women.

Problem Statement

As longevity increases, the population of women over age 65 who may need hysterectomy as a surgical intervention to treat a gynecologic condition will expand. After surgery and hospital discharge, patients are at generalized risk for a wide range of adverse events. Early hospital readmission is an adverse event that interrupts a patient's recovery process and leaves the patient vulnerable for additional complications related to rehospitalization. Currently, there is a lack of evidence and a gap in the literature regarding the association between discharge destination after hysterectomy in elderly women and the risk of 30-day hospital readmission, which I intend to address with this study.

Purpose of the Study

The purpose of this quantitative epidemiologic study is to explore the association between post hysterectomy discharge destination in elderly women and early hospital readmission. Although the professional literature contains reports about outcomes of hysterectomy surgery in all women, there is a dearth of analysis regarding post hysterectomy discharge destinations and 30-day hospital readmissions in women

age 65 and older. In addition to examining the possible association between discharge destination after hysterectomy surgery and early hospital readmission in elderly women, I plan to explore the possible relation between confounding patient and surgical intervention covariates and 30-day readmission using a cohort design and data contained in HCUP 2010 and 2011 California State Inpatient Databases (SID).

The predictor variable, post hysterectomy discharge destination, includes patient release home for self-care, home with home health care, or to a continuing inpatient care setting. The outcome variable is hospital readmission within 30 days of discharge following a patient's index admission for hysterectomy surgery. Patient covariates include age, race, medical comorbidity, and complications of care during hospitalization. Surgical intervention covariates are anatomic approach and surgical technique.

Research Questions and Hypotheses

I posed an overarching research question for this study; whether discharge destination after hysterectomy surgery in women age 65 and older is an independent predictor of 30-day hospital readmission. To address this overarching research question, I formulated subquestions related to associations between discharge destination and 30-day hospital readmission, as well as between each patient and each surgical intervention covariate, and 30-day readmission. The research questions along with statements of the null and alternative hypotheses follow.

Research Question 1

Is there an association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission?

Null Hypothesis 1: There is no association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Alternative Hypothesis 1: There is a significant association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Research Question 2

Is there an association between age in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 2: There is no association between age in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 2: There is a significant association between age in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 3

Is there an association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 3: There is no association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 3: There is a significant association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 4

Is there an association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 4: There is no association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 4: There is a significant association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 5

Is there an association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 5: There is no association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 5: There is a significant association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 6

Is there an association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 6: There is no association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 6: There is a significant association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 7

Is there an association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 7: There is no association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 7: There is a significant association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Variable Measurement

To examine the associations identified in the research questions and test the null hypotheses, I plan to use the Statistical Package for the Social Sciences (SPSS) version 21.0 software (IBM, 2012) for data analysis. To explore bivariate associations between post hysterectomy discharge destination and 30-day hospital readmission, as well as between each patient and each surgical intervention covariate, and 30-day hospital readmission, I intend to use Pearson's chi-square tests of independence. Further to address the overarching research question, I plan to conduct logistic regression analysis to calculate the odds ratio as a measure of association between post hysterectomy discharge destination, each patient and surgical intervention covariate, and 30-day hospital readmission.

Nature of the Study

For the study, I intend to use a retrospective cohort design, which is appropriate for hypothesis testing and estimating the risk of an outcome in a population without exposing individuals to an invasive intervention (Carlson & Morrison, 2009; Michigan Center for Public Health Preparedness, 2010). Risk is an indication that an association exists between a factor and an outcome; risk does not imply a causal pathway between a factor and an outcome (Carlson & Morrison, 2009). A cohort design is a safe, ethical, and efficient approach to use when a randomized clinical trial is not feasible due to the type of procedure being studied, limited resources, and requirements for a large sample. With a retrospective cohort design, researchers can examine outcomes of an invasive procedure without intentionally imposing the procedure on a subject (Bibb, 2007; Carlson & Morrison, 2009; Mann, 2003).

For the data source, I plan to use the HCUP California 2010 and 2011 SID which contain well defined and uniformly coded data elements. The HCUP partners in California make databases available for investigator use through the HCUP Central Distributor (Social & Scientific Systems, Inc., Silver Springs, MD). Sponsored by the Agency for Healthcare Research and Quality (AHRQ) and developed through federal, state, and industry partnerships (see Appendix A), HCUP is a national information resource for health care research (HCUP, 2010). HCUP was designed to enable research on a broad range of health policy such as the quality of health services, medical practice patterns, and outcomes of treatments (HCUP, 2010). The HCUP resources include a collection of databases, tools, and products created to support

researchers as they investigate health care issues (HCUP, 2010). In Appendix A, there is a list of the 47 states currently involved in HCUP partnerships for data gathering (HCUP, 2012).

California, a large state with a diverse population, is one of the 18 HCUP state partners that track patient readmission data through use of a synthetic patient identifier applied to the patient episode of care (HCUP, 2008). The data contained in HCUP core files undergo numerous automated quality control monitoring procedures applied to each discharge record to assess the validity and the internal consistency of values, as well as the consistency of values with established norms (HCUP, 2011). Furthermore, independent external contractors provide additional quality monitoring of HCUP statistics for numeric, categorical, and closely related data elements for each year and each data source (HCUP, 2011).

Conceptual Framework for the Study

To guide conceptualization of this study and formulation of the study questions, I employed the quality health outcomes model (QHOM) developed by Mitchell, Ferketich et al. (1998). The QHOM is a nursing conceptual model derived from Donabedian's (1980) quality of medical care model. Mitchell, Ferketich et al. (1998) depicted the constructs of the QHOM and the interactions among the constructs in a graphic representation displayed in Figure 1. Mitchell, Ferketich et al. provided the following descriptions of the QHOM constructs and interactions.

In the QHOM, the client or patient interacts directly with the health care system; these interactions affect the outcome and the intervention. An intervention provided by

a health care professional interacts through the patient and system to influence the outcome (Mitchell, Ferketich et al., 1998). The outcome experienced by the patient may affect future client and system interactions, which in turn may shape the need for a prospective intervention (Mitchell & Lang, 2004). Investigators can apply the constructs of the QHOM at the individual, group, or population level to examine interactions among variables and outcomes.

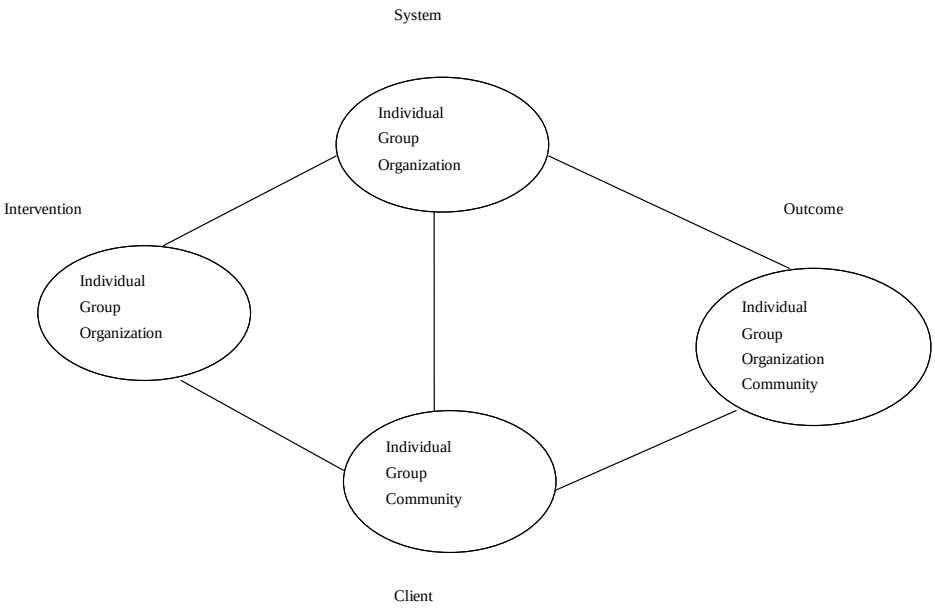

Figure 1. The quality health outcomes model. The model depicts patient and system interactions which mediate and moderate the interactions between the intervention and the outcome. Reprinted with permission from "Quality Health Outcomes Model" by P. H. Mitchell, S. Ferketich et al., 1998, *Journal of Nursing Scholarship, 30,* p. 43. Copyright 1998 by John Wiley & Son Inc.

I used the constructs of the QHOM as the basis for developing the study questions noted previously and for identifying the following study variables: (a) the system predictor variable—discharge destination; (b) the client or patient covariates—age, race, medical comorbidity, and complications of care during hospitalization; (c) the surgical intervention covariates—anatomic approach and surgical technique; and (d) the outcome variable—30-day hospital readmission. From the direction of the associations among the constructs displayed in the QHOM, I determined that bivariate and multivariate analyses were appropriate. In Table 1, I display the conceptual linkage of the constructs of the QHOM with study variables and variable characteristics.

Table 1

Quality Health Outcomes Model Constructs Linked With Study Variables and Characteristics

Construct	Study variable	Variable characteristics
	Predictor/independent variable	
System	Discharge destination	Home for self-care Home with home health care Continuing inpatient care
	Dependent variable	
Outcome	30-day hospital readmission	Readmission (Yes/No)
	Covariates	
Client	Patient	Age in years on admission Race/ethnicity Any medical comorbidity Any surgical complication
Intervention	Hysterectomy surgery	Anatomic approach Surgical technique

Definitions

Anatomic approach: The surgeon's proposed anatomic route for performing the hysterectomy−abdominal or vaginal (ACOG, 2009).

Comorbidity: A preexisting medical condition or diagnosis in addition to the patient's current presenting problem. Comorbid conditions of interest for this study are congestive heart failure, chronic pulmonary conditions, uncomplicated diabetes, diabetes with chronic complications, renal failure, and other neurologic disorders or neurologic disorders not directly related to a vascular condition (HCUP, 2008; Legner et al., 2009).

Complication: Any injury or problem event associated with the surgical intervention and hospital stay. In this study problem events include: operative injury to internal organs and structures (bladder, intestine, blood vessels, and ureters); postoperative infection (urinary, wound, pulmonary, and sepsis); hemorrhage or post hemorrhagic anemia; venous thromboembolic events (phlebitis, deep vein thrombosis, or pulmonary embolism); and delayed return of gastrointestinal function, exhibited by nausea and vomiting (Wright, Hershman, Burke et al., 2012; Wright, Lewin, Deutsch et al., 2011; Wright, Lewin, Medel et al., 2011).

Early hospital readmission: Any subsequent admission to the same or a different hospital−regardless of diagnosis−that occurred within the 30-day interval after discharge for the index hysterectomy admission (Barrett, Raetzman, & Andrews, 2012).

Hysterectomy: Surgical removal of the uterus. With a supracervical hysterectomy, the surgeon removes the body of the uterus while leaving the cervix

intact (ACOG, 2011). With a total hysterectomy, the surgeon removes the entire uterus and cervix (ACOG, 2011). With a radical hysterectomy, the surgeon removes the uterus and supporting pelvic ligaments, as well as the cervix, and the upper part of the vagina (ACOG, 2011).

Index admission: The initial starting point admission used to determine whether a patient experiences 30-day hospital readmission (Barrett, Raetzman et al., 2012).

Post hysterectomy discharge destination: A patient's expected discharge location for care after release from the hospital−home for self-care, home with home health care services, or to a continuing inpatient care facility (USHIK, 2009).

Surgical intervention: Abdominal and vaginal hysterectomy procedures are the surgical interventions.

Surgical technique: The method used by a surgeon to create an incision and gain access to internal organs for a surgical procedure. With an open abdominal laparotomy, the surgeon creates a large incision through abdominal skin, muscle, and fascia to gain access to the uterus (ACOG, 2011). With minimally invasive laparoscopy, the surgeon uses small abdominal incisions and special miniaturized instruments inserted through the incisions into the abdominal cavity to perform hysterectomy without exposing internal organs (ACOG, 2011).

Assumptions and Limitations

Foremost, I assumed that HCUP databases contained accurate and reliable information based on the supporting materials available in HCUP reports and in HCUP on-line documentation. This assumption is important because the potential limitations

of a retrospective cohort study may involve selection bias and misclassification bias. However, the identified biases are less of an issue with reliable records and data (Bibb, 2007). Information in HCUP databases is thoroughly documented and standardized because the databases were designed to facilitate research at the national, state, and local levels (HCUP, 2010). Further, HCUP databases undergo internal automated and external quality control scrutiny to make the databases as accurate as possible, and useful to researchers, practitioners, and policy makers with minimal need for editing (HCUP, 2011).

The core information in a SID consists of 100% of patient discharges from all HCUP participating hospitals in the state (HCUP, 2010). Use of the California SID may diminish selection bias. The sample of women age 65 and older will be representative of those throughout the state, treated by a variety of surgeons in hospitals of different sizes. To limit misclassification bias, I plan to examine patient cases with hysterectomy identified as a primary or a secondary procedure in women age 65 and older. Further, I plan to examine possible confounding patient and surgical intervention factors that may also be associated with 30-day hospital readmission. Nevertheless, selection bias could exist because therapeutic decisions for hysterectomy and discharge destination are predicated on a physician's clinical judgment regarding a patient's diagnosis and discharge status. In addition, human error in data entry may result in misclassification of patients. These errors would most probably be random rather than systematic errors in HCUP databases.

Scope and Delimitations

My choice of the HCUP California SID circumscribes the scope of this study. California is a state with a large land mass and a diverse urban, suburban, and rural population. In addition, California is one of 18 HCUP state partners to implement a method for tracking patient readmission and one of 15 state partners to make databases available for researcher use through the HCUP Central Distributor (HCUP, 2008). Further, the 2010 and 2011 SID were the most currently available HCUP databases at the time of study design.

I will select data from women age 65 and older who underwent hysterectomy for inclusion in this study because discharge destination and early hospital readmissions previously has not been examined in this group. Women under age 65 will be excluded from the study, as well as those over age 65 who died during hospitalization or were discharged with destination unknown. Additionally, women who had hysterectomy surgery in an ambulatory facility, a federal hospital, or a facility not included in the HCUP state inpatient databases will not be represented in this study (HCUP, 2009). Because the California databases are the source of information for the study, the potential generalizability of study results are constrained to elderly women in California.

Significance of the Study

Early hospital readmission is a health care issue that can result in physical, psychological, and economic burdens for patients and their families, as well as increased utilization of societal health care resources. The implications for positive

social change that may arise from this study evolve from a potential new awareness of the risk for early hospital readmission associated with discharge destination after hysterectomy—a common gynecologic surgery in elderly women. Information about early hospital readmission after hysterectomy important for health care providers, administrators, and policy makers interested in appropriate use of resources and aligning patient care services with individual and population needs. Findings from this study may stimulate development of interventions to improve discharge practices for elderly women who undergo hysterectomy.

Summary

Currently, there is a lack of information in health care literature about the association between post hysterectomy discharge destination in elderly women and risk of 30-day hospital readmission. Hysterectomy is a commonly performed surgical procedure to treat a variety of gynecologic conditions in women age 65 and older. Discharge destination after hysterectomy is usually home for self-care. However, about 15% of women age 65 and older who underwent hysterectomy were released home with home health care and to continuing inpatient care settings. Previously, researchers reported adverse outcomes in older adults discharged after abdominal and pelvic surgery. Older adults released from the hospital with home health care and to continuing inpatient care facilities were more likely to experience hospital readmission than those released home for self-care. Although there is information about early hospital readmission after hysterectomy in all women, currently there is a lack of information that specifically focuses on post hysterectomy discharge destination and

early hospital readmission in elderly women. In this study I will address the current knowledge gap.

In Chapter 1, I introduced the study specific research questions and the theoretical base for the study. Next in Chapter 2, I offer a comprehensive literature review with a focus on discharge destination and hospital readmission in elderly women. In Chapter 3, I will present the details of the study design and data analysis methods. Further in Chapter 4, I will report the results of data analysis. In Chapter 5, I will discuss study findings and offer recommendations for further research.

Chapter 2: Literature Review

Despite hysterectomy ranking as the second most frequently performed surgical procedure in all U.S. women (ACOG, 2011; Whiteman et al., 2008), and hospital readmissions gaining prominence as a national health care priority for the Medicare program (Horwitz et al., 2011; Stone & Hoffman, 2010), there is little clear information about post hysterectomy discharge destination and 30-day hospital readmission in women age 65 and older (Elixhauser & Steiner, 2013; Weiss et al., 2013). For the patient, early hospital readmission interrupts the recovery process and creates risk of further physical deterioration (Krumholz, 2013). For the patient's family, early readmission results in psychological stress (Marks et al., 2013). For society, return to the hospital within 30-days of discharge increases utilization of health care resources (Bradley et al., 2012; Jencks et al., 2009).

Currently, there are published research findings about short- and intermediate-term outcomes of hysterectomy surgery such as inpatient length of stay, mortality, and morbidity in women. There are no large scale studies available that examine post hysterectomy discharge destination and early hospital readmission in women age 65 and older. In this chapter, I provide a review of the literature regarding post hysterectomy discharge outcomes and early hospital readmission. I describe the QHOM and its relevance to the study design. I end the chapter by identifying major issues indicating the need for analysis of the association between post hysterectomy discharge destination and early hospital readmission in elderly women.

Literature Search Strategy

I used multiple terms, individually and in combination to search the current literature. The terms included: *hospital discharge after hysterectomy, hysterectomy in elderly women, discharge disposition and hysterectomy, discharge destination and hysterectomy, hysterectomy discharge outcomes, hospital readmission, home health care, continuing care after discharge, subacute care, skilled nursing care, health outcomes models, quality of care models, transitional care, rehospitalization,* and *quality health outcomes model*. The search strategy that I employed included exploration of the following medical, health sciences, and nursing databases: U.S. National Library of Medicine PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), Cochrane Database of Systematic Reviews, Google Scholar, EBSCO journal database, ProQuest Dissertations and Theses database, and Dissertations and Theses at Walden University. Additionally, I explored U.S. governmental agency websites such as the Centers for Disease Control and Prevention, the National Institutes of Health, the U.S. Census Bureau, and the Healthcare Cost and Utilization Project sponsored by the U.S. Department of Health and Human Services Agency for Healthcare Research and Quality. I also conducted manual search for source articles from reference lists and bibliographies provided in publications used for preparing this study.

In my preliminary search parameters, I established a limit on literature published in the English language over the past 5 years with a focus on women age 65

and older. When few publications surfaced using the primary search criteria, I expanded the 5-year search limit. Search for publications regarding the theoretical foundation for the study and study methods extended beyond the 5-year criterion. Because this study focused on U.S. women age 65 and older with hysterectomy, I eliminated publications describing populations from other countries.

Theoretical Foundation

Through outcomes research, investigators examine the results of patient care and the quality of that care (Krumholz, 2009). Alken and Christie (2004) suggested that evaluation theory is the basis for outcomes research, and the desire for accountability is the stimulus for evaluation. The authors explained that accountability requires more than reporting about actions and outcomes; accountability includes improving conditions that influence actions and outcomes. Burns and Grove (2006) noted that health care outcomes research with a focus on patient care results often employed concepts borrowed from evaluation, epidemiology, and economic theory.

Outcomes Research: Quality of Medical Care

Burns and Grove (2006) suggested that the theoretical basis of health outcomes research was Donabedian's (1980) framework for defining and evaluating the quality of medical care actions and results. Donabedian (2005), a physician and public health academic, acknowledged that the property of the quality of medical care was complex and somewhat elusive to define. Nevertheless, he pursued a conceptual exploration of a unified model for identifying and understanding the scope of factors involved in examining and evaluating the quality of medical care. Burns and Grove referred to

Donabedian's (1980) conceptualization of medical care quality as a theory because he defined and explored complex inter-related constructs of the phenomenon of the quality of medical care. Other authors (Mitchell, Ferketich et al., 1998) described Donabedian's model as a functional conceptual framework for examining quality of care.

Donabedian (1980) identified structure, process, and outcomes as the core constructs of the quality of medical care model. He indicated that organizational structure created the environment for the process of care delivery which resulted in medical and patient outcomes. Donabedian explained that a stable structure, with adequate resources and appropriate systems design, was essential for promoting and protecting care processes−all diagnostic and therapeutic interventions that transpired between the physician provider and patient (Donabedian, 1980). Both beneficial and undesirable patient outcomes were the result of the diagnostic and therapeutic process.

Donabedian (1980) indicated that attempts to measure quality outcomes presented methodological challenges. For example, a quantifiable outcome such as length of stay may offer little insight into the process of treatment interventions that could affect the patient's functional ability (Donabedian, 1980). Nevertheless, Donabedian's model of structure leading to process resulting in outcomes has provided the conceptual underpinnings for examining medical care quality for many years. Recognizing the value of Donabedian's model, Mitchell, Ferketich et al. (1998) proceeded to suggest the application of the constructs to the larger issue of quality of health outcomes.

Conceptual Framework: Quality Health Outcomes Model

Mitchell along with colleagues from the American Academy of Nursing Expert Panel on Quality Healthcare (1998) developed the quality health outcomes model (QHOM) depicted in Figure 1. The QHOM expanded the concept of medical care to the realm of health care allowing for inclusion of other disciplines in provider-patient interactions. Additionally, Mitchell, Ferketich et al. (1998) separated Donabedian's process construct into two unique components that became the distinct constructs of client and intervention in the QHOM. The nursing panel of experts recast Donabedian's structure construct as system and maintained the outcome construct.

In the QHOM, the construct client rather than patient implied that the individual could interact with the health care system outside of the traditional hospital setting. Mitchell, Ferketich et al. (1998) explained that the client and system interact to mediate and moderate the intervention and the resulting outcome. There was no direct interaction between the intervention and the outcome; rather the intervention interacted through the client or system to affect the outcome. Mitchell, Ferketich et al. described the elements of the QHOM as dynamic, interactive, and reciprocal, exerting influence through feedback loops via the various constructs.

In addition, Mitchell, Ferketich et al. (1998) noted that the representation of the dynamic interaction among the constructs of the QHOM more accurately demonstrated the complexity of the relation when examining the quality of health care. In Appendix B, I superimpose the variables examined in this study on the QHOM framework. The

QHOM depicts the hypothesis that an intervention acts through both the client and system to produce outcomes (Mitchell, Ferketich et al., 1998).

In 2004, Mitchell and Lang provided a limited overview of the application of the QHOM rather than a formal systematic review of published and unpublished literature. The authors noted gradually increasing use of the model for examining specific interventions and their quality outcomes in relation to health care system and client factors, identifying specific nursing studies in obstetrics and oncology. However in recent years, there has been limited application of the QHOM for research.

Wilson, Effken, and Butler (2010) used the QHOM to explore the relation between labor induction and the likelihood of cesarean delivery taking into account the influences of maternal sociodemographic characteristics in combination with provider and hospital factors. The authors noted that the QHOM was the ideal conceptual base for their study because it offered the structure for examining multiple interacting variables involved in care delivery that influenced outcomes (Wilson et al., 2010). Similarly, I used the constructs of the QHOM to examine the association between post hysterectomy discharge destination in elderly women and risk of 30-day hospital readmission taking into account patient and surgical intervention covariates.

Predictor Variable: Discharge Destination

Traditionally, clinicians evaluated outcomes of care by examining the results of diagnostic processes and therapeutic interventions on the physical status of the patient. Investigators frequently used retrospective cohort designs to explore outcomes because data existed in patients' medical records and in organizational, regional, or national

databases. Measures commonly employed to examine short- and intermediate-term outcomes of therapeutic interventions included hospital length of stay, inpatient mortality, and morbidity or complications arising from clinical events. In all U.S. women, these short and intermediate post hysterectomy outcomes have a favorable profile. Length of hospital stay for hysterectomy is less than 3 days for all women (HCUPnet, 2009). Ninety-seven percent of all women return home for self-care after hysterectomy (HCUPnet, 2009). Inpatient mortality with hysterectomy is less than 1% in all women (HCUPnet, 2009).

However, investgators' reports of morbidity associated with hysterectomy ranged from 3% to more than 40% among retrospective cohort studies, and varied widely with patient age, medical comorbidity, surgical complications, and surgical technique (Boggess et al., 2008a, 2008b; Giep, Giep, & Hubert, 2010; Mains et al., 2007; Wright, Hershman, Burke et al., 2012; Wright, Lewin, Deutsch et al., 2011; Wright, Lewin, Medel et al., 2011). Because hysterectomy possesses the aura of a relatively safe major surgery and over 95% of all women return home for self-care after hysterectomy, there is little specific information about post hysterectomy discharge destination and risk of early hospital readmission in elderly women. In this literature review, I examine published information relating to study variables.

Hospital Admission and Discharge Destination

Patient discharge destination following hospitalization for a health care event is an indication of the patient’s health status and need for additional assistance or services at the time of discharge (Spector et al., 2012; USHIK, 2009). Spector et al. (2012)

commented that elderly individuals are admitted disproportionately more often to hospitals than younger individuals and comprise the majority of nursing home residents. Further, Spector et al. explained that in 2009 adults in the United States age 65 years and older comprised 12.5% of the population, but accounted for 34.3% of community hospital admissions and 89.7% of all nursing home occupancies. The authors examined reasons for hospital admissions and post hospitalization discharge destinations in community dwelling individuals and nursing home residents using a subset of data from 22 HCUP 2009 state inpatient databases (Spector et al., 2012).

Spector et al. (2012) explained that 97.6% of hospital admissions occurred in the population of nursing home residents (N = 291,000) and 2.4% of hospital admissions occurred in the population of community dwelling individuals (N = 8,878,000). Over half (63.6%) of the nursing home residents who became hospital patients were female, as were 56.5% of community dwelling individuals. Infections (29.8%) and circulatory disorders (20.6%) were the most common reason for hospital admission in nursing home residents; inversely these same disorders were the reason for admission in community dwellers—circulatory disorders (28.6%) and infections (16.2%). Injuries ranked third and fourth respectively, as reasons for hospitalization in community dwellers and nursing home residents (Spector et al., 2012).

When patients were released from the hospital, Spector et al. (2012) reported that 78% of the nursing home residents returned to the nursing home for care, while 7.0% were discharged home for self-care and 4.8% home with home health care. Of community dwelling elderly adults, 49.0% were discharged home for self-care, 17.3%

home with home health care, and 27.2% to a nursing home (Spector et al., 2012). For 44.5% of community dwelling patients, the discharge destination signaled a change in self-care capacity after a hospital admission, primarily due to injury, infection, musculoskeletal disorder, or stroke. Spector et al. concluded that a high percentage of elderly community dwelling and nursing home residents required assisted care in a continuing inpatient care facility or with home health care services at hospital discharge. These results suggested the need to more closely examine discharge destination outcomes in elderly women after a common surgical intervention such as hysterectomy.

Discharge Home for Self-Care

Between 2000 and 2009, HCUP post hysterectomy discharge destination summary data for women age 65 and older revealed that about 85.5% of women went home for self-care, 8% home with home health care, and 6% to a continuing inpatient care setting (HCUPnet, 2009). Making the transition from the hospital to a discharge destination after hysterectomy involves discharge planning that integrates patient and caregiver education in the process of preparing for hospital release (Foust, Vuckovic, & Henriquez, 2012). In addition, the transition of care from hospital to discharge location requires communication from the hospital care providers who delivered the inpatient care to the primary care physician who directs the patient's care in the community, as well as to home care agencies or continuing inpatient care facilities that may be used to provide post discharge care (Foust et al., 2012; Nosbusch et al., 2010). Discharge planning and education processes as well as transitional care communication processes

offer opportunities for the patient and family members or informal caregivers to become active partners with physicians in guiding care for recovery (Popejoy, Moylan et al., 2009). However, when discharge planning and transitional care processes are disrupted or inadequate, integrated partnerships do not evolve and post discharge care becomes problematic for the patient and informal caregivers (Marks et al., 2013).

Discharge Planning

Discharge planning is a process that begins prior to or at admission and continues throughout the hospitalization (Nosbusch, Weiss, & Bobay, 2010). Preparing the patient for self-care at home and educating family members or informal caregivers to assist the patient with self-care efforts are the designated goals of discharge planning (Nosbusch et al., 2010). Generally, the nurses involved in discharge planning provide verbal and printed information about a broad spectrum of topics including pain management; rest and activity; medications; nutrition, hydration, and elimination; physician contact after discharge; wound care; signs of infection; and action in the event of an urgent problem (Foust et al., 2012). Each topic may require differing amounts of elaboration for patients and informal caregivers depending on their previous health care and surgery experiences. Discharge planning has been linked to patient outcomes at discharge and to hospital readmission (Nosbusch et al., 2010).

In an integrative review of publications between 1999 and 2009 about bedside staff nurses' practices, perceptions, and experiences with discharge planning, Nosbusch et al. (2010) noted that communication; systems and structures; and temporal issues contributed to barriers for adequate discharge planning. The authors indicated nurse-to-

nurse, as well as interdisciplinary communication and feedback loops within hospitals were often fragmented. Misunderstandings and omissions in communication occurred among the numerous care providers giving instruction to patients and family caregivers resulting in fragmented discharge planning efforts (Nosbusch et al., 2010). For nurses, barriers to their attempts to provide comprehensive discharge planning included lack of standard systems, standardized processes, and reliable assessment tools to facilitate transitional care planning (Nosbusch et al., 2010). In addition, Nosbusch et al. identified that short length of hospital stay and rapid patient turnover limited the time for nurses to gain adequate knowledge about the patient's and family caregivers' strengths and skills; this limited the time available to develop and implement a comprehensive discharge plan.

Discharge planning has been the primary method for facilitating post hospital care transitions for decades. However, problems with effective and efficient discharge planning and patient discharge education identified by Nosbusch et al. (2010) suggested that patients and families may be inadequately prepared for returning home for self-care and maintaining a positive trajectory for recovery. The multiple system difficulties encountered during the discharge planning process could contribute to problems with transitions from the hospital to discharge destination and could have an impact on hospital readmission (Nosbusch et al., 2010).

Popejoy, Moylan et al. (2009) analyzed research about hospital discharge planning from 1990-2009 in an integrative review of the literature. The time frame was a period during which public policy changes had an impact on health care services,

service delivery, and service utilization. The authors noted that older adults, who comprised about 40% of all hospital discharges, presented unique challenges to the discharge planning process. Popejoy, Moylan et al. indicated that the health care environment with shortened length of hospital stay and changes in reimbursement to hospitals, home health care agencies, and other continuing inpatient care settings leave the patient's family members or informal caregivers as the first line of support or defense for post discharge care. Post discharge care may be particularly difficult when an older adult has care needs beyond those that can be managed through self-care or informal caregiver efforts and the patient encounters reduction or restriction in benefits for home care and continuing inpatient care services (Popejoy, Moylan et al., 2009).

Popejoy, Moylan et al. (2009) noted that although there were studies in which outcomes such as hospital readmission rates, emergency room visits, cumulative days of rehospitalization, and average length of stay for readmissions were examined, there were few studies about patient centered discharge interventions and outcomes. Of the three discharge planning and transitional care intervention studies conducted in the 1990s and early 2000s that Popejoy, Moylan et al. reviewed, they noted that patients in discharge planning intervention groups had fewer hospital readmissions, longer durations between hospital readmission, and lower costs of care than patients who did not receive an intervention. Popejoy, Moylan et al. identified that discharge planning was an often inconsistent and missed opportunity for elderly patients and their family care givers to become partners in decisions regarding discharge care interventions and destinations.

Discharge With Home Health Care

Discharge with home health care services becomes an option for women unable to function independently—or with family support—at home after hospitalization (Caffrey et al., 2011). In a descriptive analysis reporting information on patients who received home health care and hospice care in the United States, Caffrey et al. projected that by 2050, about 27 million individuals will require some type of assisted care, and the majority of this care will be provided in the patient's residence in the community. Using data from the 2007 National Home and Hospice Care Survey, the authors estimated that 1.5 million patients received community based home care services each day, about a 7% increase from almost 1.4 million care recipients in the previous 2000 survey. Further, the investigators reported that 64% of home health patients were female; 81.7% were white; 68.7% were age 65 or older; and 68.5% lived with a family member or another individual. Caffrey et al. (2011) also noted that patients receiving home health care had an average of 4.2 diagnoses per patient. Twenty-one percent of patients experienced at least one overnight hospital readmission during involvement with home health care (Caffrey et al., 2011). The authors did not identify the duration between entry into home care and hospital readmission or the frequency of 30-day hospital readmissions in the report. However the demographic data and information about comorbidities offer suggestion for investigation of patient characteristics associated with post hysterectomy discharge destination and 30-day hospital readmission.

Foust et al. (2012) conducted a qualitative study using semi-structured interviewing to obtain information about the experiences of 40 patients, 35 informal caregivers, and 15 home health professionals during post hospital transition to home health care. The authors reported the mean age of patients was 64.8 years and that patients were taking a mean number of 7.9 prescribed medications. Over half of the patients were from a minority population, and 72.5% were female (Foust et al., 2012). The investigators indicated that patients and caregivers recalled receiving discharge instructions but minimal details and limited information about follow-up actions if a problem developed. Further, Foust et al. noted that when asked by the home health nurse, patients were able to produce the written discharge instructions provided by the inpatient nurse at discharge. Most patients and caregivers had not used the instructions as a reference for care (Foust et al., 2012). However, the home health care nurses stated they found the written discharge instructions helpful and used the discharge instructions to guide discussion with patients and their informal caregivers about post discharge care (Foust et al., 2012). Home health nurses emphasized that inadequate preparation of informal caregivers during the discharge process was a pervasive issue (Foust et al., 2012). Although the study by Foust et al. was small, it validated similar themes that were identified in the previous studies reviewed and synthesized by Nosbusch et al. (2010). Foust et al. (2012) did not report whether any of the participants receiving home health services experienced hospital readmission after discharge.

Heeke, Wood, and Schuck (2014) reported about a pilot project conducted by a multi-hospital health care system in conjunction with home health agencies to focus on

the discharge transition process for the elderly population of patients with heart failure, individuals at high risk for hospital readmission. The authors, with an interdisciplinary team, formulated a standardized order template for home care nurses and remote telemonitoring to improve communication and patient care management among care providers (Heeke et al., 2014). The order template was implemented as a paper form with the intention of future integration into an electronic interactive communication tool to be used between hospitals and home health agencies. Although the pilot project was small, the designers assessed the project as beneficial because it resulted in standardized orders to direct patient care (Heeke et al., 2014). In addition, nurses involved in the project found that the structure of the order template promoted communication between the hospital care providers and home care agency caregivers, and enhanced closer patient monitoring and management. The standardized care management plan helped to maintain patients in their homes and reduced readmissions (Heeke et al., 2014).

Discharge to Continuing Care in an Inpatient Setting

Continuing care in an inpatient setting may be necessary when a patient requires a higher level of treatment and supervised care. Buntin et al. (2005) examined 1999 claims data from the Centers for Medicare and Medicaid Services (CMS) for elderly hospitalized patients with joint replacement, hip fixation, and stroke. The investigators' objective was to identify factors that influenced post-acute care utilization in a skilled nursing facility or inpatient rehabilitation facility (Buntin et al., 2005). The authors concluded that clinical characteristics, such as diagnosis, surgical procedure, medical

comorbidities, and complications during hospitalization were important determinants of whether a patient used a skilled nursing facility versus an inpatient rehabilitation facility for post-acute care (Buntin et al., 2005). However, the authors did not address patient demographics that may have influenced choice of setting or hospital readmission. This study offered insights into clinical factors that influenced use of post discharge continuing inpatient care settings after surgical and medical hospitalizations. Similar clinical factors such as comorbidities and complications could also be relevant influences when examining post hysterectomy discharge destination outcomes.

Popejoy, Galambos et al. (2012) noted that discharge planning is an important component to successful transitional post discharge care. They conducted a cross-sectional descriptive web based survey study about challenges to hospital discharge planning for older adults with complex postacute care needs. The authors reported that it was difficult to find residential care beds for patients with special and complex needs, such as hemodialysis, isolation for infections, and care for mental illness. Popejoy, Galambos et al. suggested that health care policy changes might be required to promote adequate reimbursement to postacute care settings such as skilled nursing and long term care facilities to assure adequate and appropriate staffing levels for management of care for complex patients. The authors addressed issues with post discharge placement, not hospital readmission in this study.

King et al. (2013) conducted a qualitative study using grounded dimensional analysis to obtain information about transitions from hospital to continuing inpatient care in skilled nursing facilities. The investigators used focus groups and individual

interviews to obtain information from 27 registered nurses representing 5 skilled nursing facilities in 3 counties in a Midwestern state. The nurses in continuing inpatient care facilities indicated that transition from the hospital to a skilled care facility was difficult for patients and their family members (King et al., 2013). Nurses in the skilled care facilities identified common problems with incomplete, fragmented, and inaccurate discharge communication about patient care management issues. The nurses indicated that the problems in communication placed the patient at risk for delayed care which could result in deteriorating health status. In addition, the poor communication with hospital care providers often resulted in family dissatisfaction with care at the transfer facility (King et al., 2014). Further, the nurses in skilled care facilities explained that they sought, reviewed, gathered, and reconciled hospital information mainly by making personal contacts with physicians and nurses involved in the patient's hospital care (King et al., 2014). Much of the information needed by nurses in skilled care facilities could be communicated more efficiently and effectively through access to shared information documented in an electronic health record, rather than a paper copy of a discharge summary that inadequately reflected the entirety of the patient's experience (Cipriano et al., 2013; Marcotte et al., 2014).

Cipriano et al. (2013) summarized recommendations from the American Academy of Nursing (AAN) policy statement about the importance of health information technology for achieving the aims of better care, better health, and reduced cost outlined in the National Strategy for Quality Improvement in Health Care (National Quality Strategy [NQS]). The AAN sent the policy statement to the Secretary

of Health and Human Services, the National Coordinator for Health Information Technology, and the Administrator for the Centers for Medicare and Medicaid Services. The authors noted that the AAN policy statement contained a recommendation for adoption of electronic health records and information systems that reflected the complex collaborative nature of patient care coordination, particularly during transitional periods in hospital care and at discharge (Cipriano et al., 2013). Additionally, Cipriano et al. explained that for care implementation and continuity, the AAN recommended inclusion of a framework for an individualized, consensus based, longitudinal patient centered plan of care to enable coordinated communication among all care providers and the patient and the patient's family members as appropriate. Further, the authors indicated that the AAN policy statement stressed that it was essential to allow patients access to their individual personal information and health records (Cipriano et al., 2013). The AAN recommendations extended beyond the insular hospital strategy of having a computerized hospital based medical record to a strategy of developing an integrated and protected system of shared health information beyond organizational boundaries (Cipriano et al., 2013).

In a similar vein, Marcotte et al. (2014) indicated that information technology is valuable in improving care transitions or handoffs as patients move from one care setting to another. The authors stated that there were several promising and successful clinical transitional care intervention projects underway, but indicated that the role of information technology in facilitating optimal care transitions was underutilized. There have been gaps in developing and implementing electronic health records across the

country. In addition, Marcotte et al. acknowledged that the interoperability among electronic medical record systems is poor thereby limiting information exchange among hospital and community based care providers.

Marcotte et al. (2014) described several initiatives funded by the Office of the National Coordinator for Health Information Technology (ONC) to test use of information technology in addressing various aspects of transitional care. With some ONC initiatives the focus was on effective flow of information and alerts from hospital care providers to primary care physicians receiving the patient upon return to the community. The focus of other ONC projects was medication reconciliation and adherence, which included electronic medication ordering between hospital and community care settings. With information technology, access to the patient's most current medications could eliminate potential adverse medication interactions. Marcotte et al. indicated that information technology could offer patients and caregivers a renewed opportunity to take a more active role in learning about and managing their medical conditions through use of open source products for patient education and use of self-management software. Additionally, with discharge plans available on-line, the patient and family caregivers could maintain awareness of evolving issues and changes in plans for care (Marcotte et al., 2014).

Bradley et al. (2013) summarized a 2010-2011 web based survey from 599 hospitals, 91% of the hospital participating in the national strategy for quality improvement initiatives to reduce hospital readmissions. The investigators used multivariate linear regression modeling to identify strategies independently associated

with reduction in 30-day hospital readmission. The authors identified several strategies that included hospital activities and processes for partnering with community physicians, physician groups, and other local hospitals to focus on facilitating patient follow-up in the community (Bradley et al., 2013). The investigators noted that other successful strategies included conducting medication reconciliation prior to discharge using nursing and pharmacy staff to assure an accurate record of current medications; arranging follow-up appointments with care providers in the community prior to discharge; developing a process to send discharge information via paper or electronic summaries to the patient's primary care physician; and assigning staff to follow up on test results that were returned after the patient's discharge. Bradley et al. noted lower readmission rates with hospitals that incorporated more strategies.

Discharge Outcomes

Using the Washington State Comprehensive Hospital Abstract Reporting system, Legner et al. (2009) examined post discharge outcomes between 1987 and 2004 in 89,405 elderly men and women with abdominopelvic procedures. The investigators reported that 80.3% of the patients were released home for self-care, 6.4% home with home health care assistance, and 11.0% to continuing inpatient institutional care settings; 2.5% died while hospitalized. Legner et al. identified that postoperative complications were significantly associated with discharge to continuing inpatient care versus home for self-care (21.9% vs. 8.9%). Additionally the investigators noted that advancing age was associated with discharge home with home care assistance and to continuing inpatient care facilities. Further, Legner et al. reported that individuals

discharged to continuing institutional care facilities had 3.9 CI [3.6, 4.2] times greater odds of death within one year compared to those discharged home for self-care. Because the investigators (Legner et al., 2009) used a statewide sample, they noted that results were not necessarily representative of nationwide discharge patterns Although this study did not provide exclusive details about post hysterectomy discharge destination and hospital readmission, it drew attention to increased odds of mortality associated with discharge destination after abdominopelvic surgery in adults age 65 and older.

Similarly, Massarweh et al. (2009) used data from the Washington State Comprehensive Hospital Abstract Reporting System, to examine the risk of 90-day post operative morbidity and mortality in 101,318 patients age 65 and older who underwent a wide range of common gastrointestinal and genitourinary abdominal surgical procedures. The results of the study by Massarweh et al. supported the findings of Legner et al. (2009) regarding increased mortality associated with discharge destination in older adults after abdominal surgery. In addition, Massarweh et al. (2009) reported a 17.3% cumulative incidence of postoperative complication occurring within 90-days of discharge. The most common postoperative complications were pneumonia, acute renal failure, and surgical wound infection. The authors indicated that increased frequency of complications was significantly associated with advancing age, increasing with 5 year increments; 14.6% at 65-69 years; 16.1% at 70-74 years; 18.8% at 75-79 years; 19.9% at 80-84 years; and 22.6% at age 90 years and older. However, 30-day hospital readmission was not a specific area of investigation by Massarweh et al. (2009). The

authors indicated that the risk of morbidity associated with abdominal surgical procedures was greater than previously reported and should be discussed with older adults in relation to abdominal surgery.

Discharge after Gynecologic Surgery in Elderly Women

Parker, Burke II, and Gallup (2004) reported on one small scale medical record review ($N = 62$) of women in their 80's and 90's who underwent 49 major and 28 minor gynecological surgery procedures in a Southern university medical center between 1995 and 2000. Thirty-seven of the major procedures were abdominal or vaginal hysterectomy; some women had two or more concomitant interventions (Parker et al., 2004). The investigators indicated that 60 women were discharged to their homes, and two to nursing homes. The majority of women with minor procedures (57%) went home the same day, with another 21.4% released home the following day after a 23-hour stay. The remaining 24% with major surgery remained hospitalized for care for 3.6 days mean length of stay. Parker et al. did not distinguish whether the women discharged home after procedures required home health care assistance. The investigators reported 11 (14%) perioperative complications, which they considered minimal in number. However, several complications were clinically important, such as myocardial infarction, congestive heart failure, bleeding, pneumonia, and ileus.

Parker et al. (2004) concluded that patients in their 80's and 90's tolerated gynecologic surgery well and had minimal morbidity, therefore age should not be the major criterion for making a decision regarding gynecologic surgery. Instead, the investigators recommended careful preoperative treatment and control of any existing

medical comorbidities to maximize surgical outcomes. Given this caveat, the authors acknowledged that selection and reporting bias might have influenced the low incidence of complications in the study group. Nevertheless, there was not a clear indication of whether discharge home meant for self-care or included home health care.

Mains et al. (2007) conducted a retrospective review of patient medical records to determine perioperative morbidity and mortality from major gynecologic surgery for cancer, pelvic mass, and pelvic organ prolapse in 110 women in their 80's and 90's. Mean patient age was 83 years. Fifty patients (44.6%) experienced a postoperative complication. Eleven women (10%) were discharged to a skilled nursing facility. Fifteen women (13.6%) were readmitted after discharge. In contrast to Parker et al. (2004), Mains et al. (2007) concluded that complications occurred frequently after major gynecologic surgery in a population of women over age 80. Mains et al. (2007) indicated that the potential for increased perioperative morbidity should be considered when planning gynecologic surgery for women over age 80.

Outcome Variable: 30-day Hospital Readmission

Hospital readmission is a subsequent admission to the same or another hospital within 30 days following an original or index stay (Barrett, Raetzman et al., 2012; Elixhauser & Steiner, 2013). Control of hospital readmissions is an issue of national and public health concern due to the economic burden that readmissions place on patients, families, and the health care system (Bradley et al. 2012; Horwitz et al., 2011; Krumholz, 2013). Weiss et al. (2013) reported that hysterectomy ranked 8th out of 30 most frequently performed procedures during index stays in U.S. hospitals in 2010.

There were 409,674 index hysterectomy hospitalizations and 19,446 all cause hospital readmissions (4.7%) hospital readmissions in all women (Weiss et al., 2013). The rate of hospital readmission after hysterectomy in the sub population of women age 65 and older had not been reported.

Readmission by Age and Payer

In a descriptive benchmarking analysis, Wier, Barrett, Steiner, and Jiang (2011) examined 2008 HCUP state level data for all cause readmissions by age and payer. The authors were interested in identifying subpopulations with relatively high readmission rates that could become the focus for performance improvement efforts. Wier et al. reported that readmission rates increased with the number of post discharge days across all payer and age groups. The authors noted that cumulative readmission rates in Medicare covered adults age 65 and older increased over short incremental periods: 6.5% at 7 days, 11.1% at 14 days, and 19.0% at 30 days. Interestingly, Medicare beneficiary readmission rates were lower than other age groups. In adults between the ages of 18 through 64, readmission rates were 8.0%, 13.9%, and 24.1% for 7, 14, and 30-day readmissions respectively. This report by Wier et al. highlighted that the highest readmission rates for all groups and payers occurred at 30-days after discharge for the index hospitalization, reinforcing the rationale for examining 30-day hospital readmission.

Readmission for Chronic versus Acute Conditions

Podulka, Barrett, Jiang, and Steiner (2012) conducted a companion follow-up to the Weir et al. (2011) benchmarking analysis of all cause readmission by age and payer.

The goal of the Podulka et al. (2012) analysis was to provide multi-state benchmarks for 30-day readmission rates following hospitalizations for chronic versus acute conditions, stratified by whether the patient underwent a surgical procedure during the index stay. The authors examined hospital readmissions using HCUP 2008 databases from 15 geographically dispersed states that provided a system to link hospital discharges with readmissions. Podulka et al. (2012) indicated the rate of 30-day readmissions after hospitalization for surgery in Medicare covered patient age 65 and older was lower for chronic conditions (14.3%) than for acute conditions (17.0%). With non-surgical Medicare covered patients age 65 and older, 22.5% of 30-day readmissions were for chronic conditions and 19.3% for acute conditions (Podulka et al., 2012). This analysis of 2008 data revealed substantial 30-day hospital readmission rates for individuals age 65 and older with chronic and acute conditions and a higher rate of readmission in those individuals hospitalized for non-surgical conditions.

Postoperative Readmissions Following Hysterectomy

Judd, Byrd, and Jiang (2007) conducted a retrospective case-control study using 2000-2007 data from a single site Obstetrics and Gynecology Department database. The authors' objectives were to identify readmission rates and risk factors for readmission within 6 weeks of undergoing minimally invasive total laparoscopic abdominal hysterectomy (n = 1,198) versus total open abdominal hysterectomy (n = 1,576) for benign gynecologic conditions. The investigators reported a statistically significant difference ($p < 0.004$) in readmission rates following abdominal hysterectomy (1.2%) versus laparoscopic hysterectomy (2.7%). Judd et al. stated that

readmissions occurred between postoperative day 2 and 34 with the mean and median readmission occurring at day 9. Judd et al. noted no statistically significant difference in risk factors for readmission between the laparoscopic and open abdominal surgery groups. There were noted no correlations between readmission and operative time, peritoneal adhesions, diabetic status, prior cesarean section delivery, prior open abdominal or laparoscopic procedures, postoperative antibiotic use, or postoperative hematocrit (Judd et al., 2007).

Judd et al. (2007) stated that the most common reasons for readmissions in both groups were associated with cervical wound closure, vaginal bleeding, and wound infection. The investigators explained that readmissions often were the result of problems not identified during the short length of hospital stay after laparoscopic hysterectomy (about 2 days) but manifested a few to several days after discharge. The researchers suggested that further investigation about surgical technique and post hysterectomy readmission was warranted due to the small study sample and selection bias. This study by Judd et al. was one of the few in which researchers examined readmission associated with hysterectomy surgical technique.

Covariates

Several researchers examined multiple patient and surgical intervention covariates within one investigation. Researchers reported that patient and surgical intervention factors were associated with outcomes such as inpatient morbidity and mortality. Although I organized the following patient and surgical factors into

categories, some of the factors have been examined within the context of an individual investigation.

Patient Age

Vincent and Velkoff (2010) prepared a U.S. Census Bureau report about the expected changes in the population. By 2020 the authors noted that the U.S. female population over 65 years of age will expand from the current estimate of 22.9 million to about 30.5 million. In addition, Vincent & Velkoff indicated that the greatest expected growth is in the number of women over age 80. With these projections, concern about women's health issues and outcomes will intensify. Pelvic mass, gynecologic cancers, and uterine prolapse are the most common conditions that require gynecologic surgical intervention in women age 65 and older (Whiteman et al., 2008).

Wright, Lewin, Medel et al. (2011) commented that gynecologic cancers affect elderly women disproportionately, particularly uterine or endometrial cancer and cervical cancer. In a cancer statistics report, Jemal, Siegel, Xu, and Ward (2010) noted that uterine cancer, often diagnosed during the 6th decade of life, was the most frequently discovered gynecologic cancer affecting over 42,000 U.S. women each year. Further, Jemal et al. indicated that there are about 12,000-14,000 cases of cervical cancer diagnosed each year, primarily in women under the age of 50 years. However, 20% of cervical cancer cases are discovered in women age 65 and older (American Cancer Society, 2012). Early diagnosis and treatment of gynecologic cancers improve outcomes in terms of disease free periods (CDC, 2012), thus the impetus for treating women of all ages. Hysterectomy remains the mainstay of surgical treatment for

women of all ages with gynecologic cancers of the uterus and cervix (Wright, Lewin, Medel et al., 2011). However, there is scant literature about hysterectomy for benign conditions in women age 65 and older, and less information about post hysterectomy discharge destination and early hospital readmission in women age 65 and older.

Using the most recently published study of data from the National Hospital Discharge Survey for the years 2000-2004 regarding national hysterectomy rates, Whiteman et al. (2008) reported the overall hysterectomy rate was 5.4 per 1,000 civilian women. The investigators noted that hysterectomy rates varied by age groups. During the study period, the authors indicated that the highest rates were in women under age 50, roughly about 12 per 1,000 women, while the rate for women 50-54 years of age was 6.7 per 1,000, with no rate reported for women over age 65. Whiteman et al. estimated that 90% of all hysterectomy surgery in all age groups during the period 2000-2004 was for benign conditions such as uterine fibroids, endometriosis, cervical dysplasia, menstrual disturbances, and vaginal bleeding. The authors explained that the rationale for their investigation was concern about the appropriate use of hysterectomy for benign conditions.

Wright, Lewin, Medel et al. (2011) examined morbidity and mortality of surgery for uterine cancer in women age 65 through 85 years and older using the HCUP Nationwide Inpatient Sample. The investigators indicated that there was a paucity of data describing surgical outcomes in women over age 65 treated with hysterectomy, particularly women they identified as the oldest old—age 80 and over. The authors noted that odds of perioperative and medical complications were increased in women

age 85 and older, with odds ratios of 1.53 CI [1.34,1.76] and 1.69 CI [1.52-1.89] respectively for perioperative and medical complications.

Race

Several investigators conducted large and small scale retrospective studies examining outcomes of hysterectomy performed for a wide a variety of benign and malignant indications. Researchers consistently reported greater prevalence of hysterectomy in white women than in women of other races and Hispanic ethnicity (Fleury, Ibeanu, & Bristow, 2010; Hollenbeck, Dunn, Gilbert, Strope, & Miller, 2008; Jacoby et al., 2009; Wright, Hershman, Burke et al., 2012; Wright, Lewin, Deutsch et al., 2011; Wright, Lewin, Medel et al., 2011). For example, Fleury, Ibeanu, and Bristow (2010) conducted a retrospective cohort study to examine the association between race and surgical care for uterine cancer in 5,470 women 18 years and older who underwent surgery in Maryland between 2000 and 2009. The main outcome was determining whether African American women received the standard of care—lymphadenectomy for disease staging—and secondarily whether the surgical method was minimally invasive. The investigators examined payer, surgeon volume, and hospital volume. There was no statistically significant difference in lymphadenectomy in Caucasian and African American women. However, African American women were less likely to undergo minimally invasive surgery than White women with an odds ratio of 0.60, 95% CI [0.45, 0.48]. Fleury et al. suggested that additional prospective study of perioperative factors may be useful to clarify reasons for the disparity that was not associated with surgeon or hospital surgical volume.

Hollenbeck et al. (2008) using data from the HCUP Nationwide Inpatient Sample examined the effects of laparoscopy on surgical discharge practice patterns in patients who underwent prostatectomy, nephrectomy, and hysterectomy. They reported on 70,258 cases of women having undergone hysterectomy in hospitals with low to high laparoscopic volume. The investigators noted that regardless of hospital laparoscopy volume, white women underwent laparoscopic hysterectomy significantly more frequently than women of other races or Hispanic ethnicity.

Wright, Lewin, Deutsch et al.(2011) used a voluntary fee-supported inpatient acute care database−Perspective (Premier, Charlotte, NC)−to examine the outcomes of abdominal hysterectomy for uterine cancer. The investigators compared surgeon volume and hospital volume effects on morbidity and mortality of abdominal hysterectomy in 6,015 patients. The authors noted that white women underwent hysterectomy significantly more frequently than African American women or women of other races (Wright, Lewin, Deutsch et al., 2011). Similarly, Wright, Hershman, Burke et al. (2012) examined the effect of surgical volume on laparoscopic surgery for uterine cancer in 4,137 women using the Perspective database. Once again, the investigators reported that white women underwent hysterectomy significantly more frequently than African American women or women of other races (Wright, Hershman, Burke, et al., 2012). Still in a further analysis using the HCUP Nationwide Inpatient Sample, Wright, Lewin, Medel et al. (2011) examined morbidity and mortality in women age 65 and older with hysterectomy for uterine cancer. White women in all age

groups between 65 to greater than 85 years more frequently experienced hysterectomy than Black women or women of other races (Wright, Lewin, Medel et al., 2011).

Comorbidity and Surgical Complications

Valderas et al. (2009) indicated that comorbidity in patients requires more complex and vigilant clinical management and that patient comorbidity is often associated with poorer health outcomes. There is no universal consensus on the appropriate manner to classify and conceptualize patient comorbidity (Valderas et al., 2009). Many researchers have used the Charlson comorbidity index as a tool to quantify comorbidity and predict mortality and other adverse outcomes in patients (Quan et al., 2011; Wright, Lewin, Medel et al., 2011). With a higher Charlson score, the patient is more likely to be at risk for mortality, morbidity, and increased resource use (Quan et al., 2011). Several groups of investigators have examined comorbidity along with other clinical outcomes such as surgical complications.

Wright and his colleagues used the Charlson comorbidity index in studies examining the influence of surgeon and hospital volume on the outcome of hysterectomy performed for endometrial or uterine cancer. Wright, Lewin, Medel et al. (2011) used the Charlson index to examine the interaction between age and medical comorbidity and their association with inpatient morbidity and death in women over age 65 treated with hysterectomy for uterine cancer. They reported a statistically significant association with Charlson index scores of 1-3 and medical complications during hospitalization in women of all age groups (65-69 years, 70-74 years, 75-79 years, 80-84 years, and 85 years and older). In addition the authors reported statistically

significant associations between Charlson index scores of 1 and 2 as well as a Charlson score of 3 and perioperative complications in all age groups.

Similarly, in multivariable analysis of factors associated with perioperative morbidity in women who experienced laparoscopic hysterectomy for endometrial cancer, Wright, Hershman, Burke et al. (2012) noted increased odds of any intraoperative, perioperative, and medical complications with a Charlson comorbidity index score of 2 and greater. Wright, Hershman, Burke et al. (2012) indicated that compared to a Charlson score of 1, the odds of a woman experiencing any complication with a Charlson score of 2 were increased to 1.57 CI [1.23,2.01]; with a Charlson score greater than 2, the odds ratio for complications was 2.20 CI [1.72, 2.82]. The authors concluded that laparoscopic hysterectomy was well tolerated and was associated with an acceptable morbidity profile. However, morbidity of 12.8% in patients treated by gynecologic oncologists and 9.0% in patients treated by general gynecologists is nevertheless clinically important to note.

Complications of Care

Investigators' reports of perioperative complications, events that occurred before, during, and after surgery varied between 3% and 40%. Surgical complications were associated with patient age, comorbidities, and surgical intervention approach and technique. Surgical complications often necessitated additional treatments or interventions. For example, bleeding may require blood transfusion or return to surgery to detect the source and stem the bleeding. Still, other complications, such as infection,

may be delayed and become evident only after discharge, particularly with short length of hospital stay.

In their examination of outcomes of abdominal hysterectomy for uterine cancer Wright, Lewin, Deutsch et al. (2011) indicated that outcomes were improved in women treated by high volume surgeons, who perform more than 30 procedures a year. The most common complications identified by the authors in the 6,015 cases examined were ureteral, intestinal, and vascular injuries; wound problems; hemorrhage and transfusion; infection; and medical problems associate with the surgical injuries. Wright, Lewin, Deutsch et al. (2011) reported that perioperative surgical complications were 11.7% in patients treated by high volume surgeons compared with 15.2% in patients treated by low volume surgeons. Similarly, medical complications were 22.0% in patients treated by high volume surgeons versus 31.4% in patients treated by low volume surgeons. The investigators suggested that further research was needed to determine the long term influence of surgical volume on outcome (Wright, Lewin, Deutsch et al., 2011).

Wright, Hershman, Burke et al. (2012) noted that laparoscopic surgery has been associated with reduced morbidity when compared to abdominal laparotomy. The authors examined 4,137 cases of women with endometrial cancer who underwent either laparoscopic assisted vaginal hysterectomy or total laparoscopic hysterectomy between 2000 and 2010. Wright, Hershman, Burke et al. (2011) reported overall complication rates for low volume versus high volume surgeons of 9.8% and 10.4% respectively. Non-routine discharge−discharge with home health care or to continuing inpatient care settings−was 1.2% in low volume versus 1.7% in high surgical volume hospitals. Upon

examining multivariable analysis of factors associated with perioperative morbidity, the authors concluded neither surgeon volume nor hospital volume had substantially affected morbidity, mortality, or resource use in women with laparoscopic hysterectomy for endometrial cancer.

Further, Wright, Lewin, Medel et al. (2011) examined morbidity and mortality of surgery for endometrial cancer in the oldest old−women age 65 and over. They analyzed HCUP Nationwide Inpatient Sample databases from 1998-2007 to determine perioperative outcomes of abdominal hysterectomy for cancer of the uterus. The investigators grouped the patient age variable in five-year increments from age 65-69 years to greater than 85 years and used previously identified categories for surgical and medical morbidity. The most common complications identified by the authors in the 25,698 cases examined were ureteral, intestinal, and vascular injuries; wound problems; hemorrhage and transfusion; infection; and gastrointestinal problems. Compared to younger women, Wright, Lewin, Medel et al. (2011) noted that women over age 85 had more medical comorbidities than younger age groups. The investigators found an incremental increase in complications with advancing age. The researchers noted that when compared to women 65-69 year of age, women over age 85 had significantly increased perioperative surgical complications (12% vs.17%) and postoperative medical complications (24% vs. 34%) after abdominal hysterectomy . In addition the perioperative mortality rate was 0.4% in women age 65-69 and 1.6% in women over 85. The authors concluded that morbidity associated with abdominal hysterectomy for endometrial cancer was significantly higher in women over age 80, even when

considering higher scores on the Charlson comorbidity index (Wright, Lewin, Medel et al., 2011).

Surgical Intervention Covariates

Hysterectomy is the primary surgical intervention for treatment of premalignant, malignant and benign gynecologic conditions. Additionally, hysterectomy aids in identifying the type and stage of disease to determine which further treatment might be necessary in cases of invasive cancer (CDC, 2012). The anatomical route of access to the internal organs; and the surgical technique used in performing the procedure have been associated with patient outcomes, however not with discharge destination and early hospital readmission (Boggess et al., 2008a, 2008b; Frey et al., 2011).

Anatomic Approach and Surgical Technique

Hysterectomy may be performed through an abdominal or vaginal anatomical approach (CDC, 2011). The ACOG Committee on Gynecologic Practice reviewed currently available clinical and scientific evidence and created an opinion statement supporting vaginal hysterectomy as the safest and most cost-effective minimally invasive surgical route for hysterectomy when feasible for benign conditions (ACOG, 2009/2011). However, commentary in the ACOG Committee report indicated that from past analysis of U.S. surgical data that about 22% of all hysterectomy cases were performed vaginally, while 65% of cases were performed using an open abdominal or laparotomy incision (ACOG, 2009/2011; Whiteman et al., 2008). Laparoscopic assisted techniques, including robotic assisted laparoscopy comprised about 12% of all cases of abdominal and vaginal hysterectomy (ACOG, 2009/2011).

In recent years, laparoscopic and robotic assisted laparoscopic abdominal and vaginal hysterectomy techniques have gradually gained wider acceptance as primary routes for surgery (Boggess et al., 2008a, 2008b; Frey et al., 2011). Minimally invasive vaginal and laparoscopic techniques reduce the trauma of a large open abdominal incision through skin, muscle, and fascia; blood loss associated with laparotomy; and exposure of internal organs to infection and the potential for additional surgical injury (Boggess et al., 2008a, 2008b; Frey, et al.). Accompanying these minimally invasive benefits, Boggess et al. (2008b) noted increased risk of poor visualization and injury to surrounding tissues and structures due to operating within an enclosed cavity. In addition with some patients, laparoscopic surgery may be converted to an open abdominal incision due to peritoneal adhesions, failure to maintain the surgical space with carbon dioxide gas insuffalation, large uterine size over 250 grams, and adverse patient physiologic response to the surgical Trendelenburg head downward position (Boggess et al., 2008b). Laparoscopic and robotic assisted laparoscopic surgery incorporate complex technology requiring additional specialized surgical knowledge, training, and skill on the part of surgeons and surgical staff (Giep et al., 2010; Hollenbeck et al., 2008), as well as additional time to prepare the patient's body for introduction of the instruments (Boggess et at., 2008b). Therefore, laparoscopic and robotic assisted hysterectomy may add to the duration of the surgery and potential for perioperative complications when compared to other techniques (Boggess et al., 2008a; 2008b).

Giep et al. (2010) examined minimally invasive surgical approaches for hysterectomy performed for non-cancer indications in a cohort of 589 patients in a Southern community hospital. The investigators compared outcomes of robotic assisted laparoscopic abdominal hysterectomy, laparoscopic assisted vaginal hysterectomy, and laparoscopic supracervical abdominal hysterectomy performed by a variety of surgeons between 2006 and 2009, as robotic assisted technology was being introduced in the hospital. The mean age for women undergoing surgery for benign conditions in all three groups was less than 43 years, range 23 to 78 years (Giep et al., 2010). The authors reported low rates of intraoperative and postoperative complications within 30-days of surgery in all three groups; 3.8% for robotic assisted laparoscopic hysterectomy, 1.9% for laparoscopic assisted vaginal hysterectomy, and 2.3% for laparoscopic supracervical hysterectomy with no statistically significant difference by surgical method. The investigators concluded there were positive patient outcomes with low numbers of complications and no hospital readmissions in a selected population of younger women who had minimally invasive surgery performed by skilled laparoscopic surgeons making a transition to robotic assisted technology (Giep et al., 2010).

Boggess et al. (2008a) reported on a small case-control study examining surgical treatment of early-stage cervical cancer conducted at a Southern medical center. The investigators performed a series of robot assisted radical hysterectomy procedures on 51 consecutive patients between 2005 and 2007, and compared the patients to a historical cohort of 49 matched patients who underwent open abdominal radical hysterectomy prior to 2005. Boggess et al. reported that outcomes of robotic

assisted radical hysterectomy demonstrated reduced blood loss, decreased operative time, minimal length of stay, and increased lymph node retrieval in contrast with the open abdominal procedure (Boggess et al., 2008a). With the open procedure there were twice the number of complications (8 or 16.3%), but this was not statistically significant. The authors noted that there were important patient benefits of the robotic surgical approach, however, the mean patient was 43 years and results may have been influenced by selection bias.

In a cohort study, Boggess et al. (2008b) compared outcomes in women with robotic assisted (n = 103), laparoscopic (n = 81), and open abdominal (n = 138) hysterectomy and bilateral lymph node dissection for disease staging in uterine cancer. A total of 322 women underwent cancer staging between 2000 and 2004 and between 2005 and 2007. The authors noted statistically significant greater lymph node yield in the robotic assisted staging group, lower length of stay, and less blood loss. In addition, the investigators identified that operative time was statistically different among groups with laparoscopic surgery requiring 213.4 minutes, robotic assisted surgery 191.2 minutes, and open abdominal laparotomy 146.5 minutes. There were 5 (4.9%) postoperative complications in patients with robotic assisted surgery, 8 (9.9%) in patients with laparoscopy, and 40 (28.9%) in patients with open abdominal laparotomy. The most frequent complications with laparotomy were wound separation in 14 patients and readmission for ileus in 7 patients. The investigators concluded that endometrial cancer staging by robotic assisted surgery was feasible and preferable over laparotomy and laparoscopy techniques for lymph node yield. However, the mean age of patients in

all groups was below 65 years. In addition, the authors noted that there was selection bias and lack of randomization with the reported study.

Summary

Medical researchers investigating hysterectomy surgery tended to focus on outcomes of surgical interventions and techniques for treating benign and malignant gynecologic conditions such as patient morbidity and mortality, length of hospital stay, and hospital system factors, not on discharge destination and post discharge outcomes. In addition, medical researchers used a variety of quantitative methods, predominantly retrospective cohort and occasionally case-control designs to explore patient outcomes related to hysterectomy surgery. Several medical investigators noted that patient factors such as age, race, medical comorbidities, and complications, as well as surgical approach and technique, were associated to varying degrees with poor outcomes after hysterectomy surgery.

Nursing researchers examining discharge practices and patient outcomes tended to focus on the process of patient care coordiantion and care delivery within the hospital environment, at transitions in care, and across various care settings. In addition, nursing researchers used a variety of qualitative, but fewer quantitative methods for investigating barriers and outcomes to care processes. The qualitative methods used by nursing researchers included integrative reviews of literature to establish an evidence base for patient care practices and interventions; grounded dimensional analysis to simultaneously classify and analyze data for future hypothesis testing; and surveys, focus groups as well as individual interviews with patients,

informal care givers, and patient care providers to obtain information about experiences with care delivery and care processes. Fewer nursing researchers used quantitative methods, predominantly cohort designs, to examine postacute care placements.

Researcher investigating public health trends tended to provide quantitative analytic reports of incidence or prevalence of disease conditions or surgical interventions. Public policy investigators tended to provide critical analysis of health care issues at the broader multistate or nationwide level. However, with the variety of medical, nursing, and public health or policy literature, there were few studies in which hospital readmission after hysterectomy was studied, and none examining post discharge destination and early hospital readmission in elderly women. In this investigation, I focus on post hysterectomy discharge destination in elderly women, along with patient and surgical covariates, to determine the relation of these variables and 30-day hospital readmission. In Chapter 3, I elaborate on the study design and methods.

Chapter 3: Research Method

The purpose of this quantitative epidemiologic study is to investigate the association between post hysterectomy discharge destination in elderly women and early hospital readmission. The professional literature contained reports about the outcome of hysterectomy surgery, the process of patient care coordiantion, and health care trends, however, analysis of information about post hysterectomy discharge destination and 30-day hospital readmission in women age 65 and older is not readily available. In addition to examining the possible association between discharge destination after hysterectomy and early hospital readmission in elderly women, I plan to explore the possible relation between confounding patient and surgical intervention covariates and 30-day readmission.

In this chapter, I describe the research design, study methods, and data source for the study. I also include operational definitions of the study variables and a data analysis plan. Additionally, I address threats to study validity and ethical procedures to protect data confidentiality.

Research Design and Rationale

With this study I plan to employ a cohort design and use retrospective data from HCUP 2010 and 2011 California SID to examine the association between post hysterectomy discharge destination and 30-day hospital readmission in elderly women. In Chapter 2, I referred to several large studies in which medical investigators used retrospective cohort designs to examine outcomes after hysterectomy surgery. The previously described cohort studies focused on perioperative risks associated with

hysterectomy surgery, surgical techniques, and hospital or surgeon volume, not on post hysterectomy discharge destination and early hospital readmission in elderly women. It would be impractical to conduct a multisite prospective randomized clinical trial requiring extensive resources over an extended duration of time to explore the relation between post hysterectomy discharge destination and 30-day hospital readmission. A reasonable alternative option is to use existing national data resources from HCUP to explore the associations.

HCUP databases contain well documented, standardized, and reliable information (Barrett, Raetzman et al., 2012; Barrettt, Steiner et al., 2011; HCUP, 2011). The HCUP data quality control philosophy contains information indicating that the intent of HCUP is to provide a standard data format and make data usable for researchers without additional extensive editing. Through application of quality control processes, automated edit checks, and independent external quality reviews, HCUP databases contain uniform data coding and reliable statistics (HCUP, 2011). HCUP data are not imputed or changed. Invalid or inconsistent values receive specific missing value codes; the codes permit researchers to acknowledge and explore data anomalies (HCUP, 2011). With a retrospective cohort design and data from an existing and reliable source (HCUP, 2008), I plan to address the overarching research question whether post hysterectomy discharge destination is an independent predictor of 30-day hospital readmission. In addition, I plan to examine important information about patient and surgical intervention covariates that may also be associated with early hospital readmission in elderly women.

Research Methods

Elderly women discharged from California community hospitals in 2010 and 2011 will comprise the target population for this study. From HCUP online summary data for 2008 and 2009, I noted that approximately 10,000 California women age 65 and older had been discharged after undergoing abdominal and vaginal hysterectomy procedures in community hospitals (HCUPnet, 2009). I speculated that a similar number of elderly women in this large and highly populated state may also have experienced an index admission for hysterectomy surgery in 2010 and 2011.

Sampling and Sampling Procedures

I plan to draw the study sample from HCUP 2010 and 2011 California SID that includes over 3.9 million discharges per year (HCUPnet, 2012). To assemble the sample, I will use HCUP Clinical Classification Software (CCS) to identify the procedure categories, codes, and labels for abdominal and vaginal hysterectomy procedures listed in Table 2 (HCUP, 2013). Using the same codes, I will obtain information for the surgical intervention covariates anatomic approach and surgical technique.

I will compile data from women age 65 and older who underwent hysterectomy for inclusion in this study. Women under age 65 will be excluded from the study, as well as those over age 65 who died during hospitalization or were discharged with destination unknown. Additionally, women who had hysterectomy surgery in an ambulatory facility, a federal hospital, or a facility not included in the HCUP state inpatient databases will not be represented in this study (HCUP, 2009). Several types of

facilities are not part of HCUP data gathering efforts: these are Federal hospitals such as Department of Veterans Affairs, Department of Defense, and Indian Health Service hospitals; hospital units of other institutions such as prisons; long term care, rehabilitation, psychiatric, and alcoholism/chemical dependency treatment facilities.

Table 2

HCUP Clinical Classification Software Identifying Hysterectomy Procedure Categories, Codes and Labels

CCS procedure category	CCS procedure code	CCS procedure label
12.5.1	6841	Laparoscopic total abdominal hysterectomy or Total laparoscopic hysterectomy (minimally invasive)
12.5.1	6849	Total abdominal hysterectomy (open laparotomy)
12.5.1	6861	Laparoscopic radical abdominal hysterectomy or Total laparoscopic radical hysterectomy (minimally invasive)
12.5.1	6869	Radical abdominal hysterectomy (open laparotomy)
12.5.2	6851	Laparoscopic assisted vaginal hysterectomy (minimally invasive)
12.5.2	6859	Vaginal hysterectomy (minimally invasive)
12.5.2	6871	Laparoscopic radical vaginal hysterectomy (minimally invasive)
12.5.2	6879	Radical vaginal hysterectomy (minimally invasive)
12.5.3	6831	Laparoscopic supracervical hysterectomy (minimally invasive)
12.5.3	6839	Supracervical hysterectomy (open laparotomy)

Note. Adapted from "HCUP Clinical Classifications Software (CCS) for ICD-9-CM," Healthcare Cost and Utilization Project, 2014. Rockville, MD: Agency for Healthcare Research and Quality.

Power Analysis and Sample Size

To project a sample size estimate for an unmatched cohort study, with a desired two sided confidence level of 95%, and 80% power to detect a difference should one exist, I used the epidemiologic calculator from Open Source Epidemiologic Statistics for Public Health (OpenEpi) Version 2.3.1 software (Dean et al., 2011). Because previously published evidence about post hysterectomy discharge destination and early hospital readmission in women age 65 and older is unavailable, I speculated about estimates for the sample size calculation using information from HCUP online data (HCUPnet, 2009). Approximately 85% of women age 65 and older were sent home for self-care after hysterectomy in 2008 and 2009, about 8% were released home with home health care services, and about 7% were discharged to continuing inpatient care facilities (HCUPnet, 2009). Next, I projected a hypothetical estimate of hospital readmission at 8% for the group with the least frequent outcome, readmission after discharge with home health care, when compared with about 5% early hospital readmissions in the group discharged home for self-care. Women discharged with home health care are more likely to have better health status than those discharged to continuing inpatient care, therefore also likely to experience fewer readmissions (Spector et al., 2012). A total sample size of 6,635 (664 exposed and 5,971 unexposed women age 65 and older) is needed to avoid a type 1 statistical error at the 0.05 probability level, and provide adequate power at 0.80 to avoid a type 2 error (Dean et al., 2011). This projected sample size will afford the opportunity to detect differences between post hysterectomy discharge destinations home for self-care, the reference

group, and other discharge destinations from the sampling frame of approximately 10,000 California women age 65 and older (HCUPnet, 2009).

Data Source

HCUP state inpatient databases contain administrative information obtained for billing purposes from 100% of all patient medical records from participating community hospitals (HCUP, 2010). Admission and discharge information including diagnoses, procedures, and demographics comprise the core building blocks of HCUP databases (HCUP, 2010). Unlike other secondary data sources resulting from a single purpose study, HCUP databases were developed to enable research at the national, state, and local levels on a broad range of health policy, access, economic, and clinical practice issues (HCUP, 2010). Numerous investigators used HCUP state and nation wide data to explore clinical practice issues such as the quality of health care services, medical practice patterns, and outcomes of treatments (HCUP, 2010).

HCUP databases were created through the data collection efforts of multiple resources. State data organizations, hospital associations, private data organizations, and the federal government contribute to collecting and creating the HCUP databases (HCUP, 2010). Compiled yearly, HCUP databases contain information associated with individual episodes of hospital care, and comprise the largest collection of longitudinal individual patient encounter-level hospital care data in the United States (HCUP, 2009). HCUP databases include a core set of clinical and non-clinical information found in a typical hospital discharge abstract (HCUP, 2010). Because HCUP data are retrospective and devoid of patient identifiers, patient consent was not required for this study.

Access to HCUP Databases

Operating under AHRQ sponsorship, HCUP has been providing data, software, reports, tools, and other products for health care research for over 25 years (HCUP, 2010). Most HCUP products and services are accessible on-line via HCUP websites, however databases are not. HCUP databases are available for a fee through the HCUP Central Distributor (Social & Scientific Systems, Inc., Silver Springs, MD). I acquired a copy of the 2010 and 2011 California SID on compact discs through an application process (HCUP, 2013) that included a brief description of the intended use of the databases and execution of a data use agreement (DUA). The DUA contained stipulations that restricted data use for research and statistical analysis purposes only (HCUP, 2013). In the DUA, there were clear parameters for maintaining patient, physician, and hospital data confidentiality, as well as penalties in terms of fines or incarceration should violations of data use parameters occur (HCUP, 2013).

Predictor Variable: Operational Definition and Measurement

For the predictor variable, I created three nominal discharge destination categories from the 7 discharge categories in the HCUP data elements (2008) discharge disposition variable. I coded the variable as: 1-home for self-care, 2-home with home health care, and 3-continuing inpatient care (which included transfer to a skilled nursing facility, an intermediate care facility, or another type of facility such as a rehabilitation facility). I eliminated categories with a location from which readmission could not be followed−discharged against medical advice, died in hospital, discharged alive/destination unknown.

Outcome Variable: Operational Definition and Measurement

I assembled California SID variables regarding a visit link, admission date, and the number of days to the revisit or readmission event to determine 30-day hospital readmission (Barrett, Steiner, Andrews, Kassed, & Nagamine, 2012; HCUP, 2008). The visit link variable was a supplemental encrypted person identifier created by HCUP that connected the index admission and the revisit or readmission event to determine a 30-day hospital readmission (HCUP, 2008). I coded the variable as: 0-No for no readmission if there were no revisits or if the revisit event occurred after day 30, and 1-Yes for hospital readmission within day 1 to 30 of hospital discharge.

Covariates: Operational Definition and Measurement

In this study I focused on examining post hysterectomy discharge destination in elderly women as an independent predictor of risk of 30-day hospital readmission. However, patient and surgical covariates may also be associated with the outcome variable. Therefore, it is important to examine data regarding patient and surgical covariates as well.

Patient Age on Admission

For HCUP variables, patient age for the index hysterectomy admission was calculated by HCUP from the date of birth and the admission date, and was recorded as age in years on admission in HCUP databases (HCUP, 2008). In the HCUP core file, patient age was recorded as an interval variable between 0 and 124 years. Date of birth is protected patient information and does not appear in full in HCUP databases. Because age over 65 is not normally distributed, I created a categorical age variable

using 5-year increments. The age categories were: 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, and 95-99 years.

Patient Race/Ethnicity

In the California SID, ethnicity takes precedence over race in HCUP coding (HCUP, 2008). I used the HCUP coding for the race/ethnicity nominal covariate:1-White; 2- Black; 3-Hispanic; 4-Asian/Pacific Islander; 5-Alaskan Native/Native American; and 6-Other. I recoded race/ethnicity for logistic regression analysis as: 0-non-white and 1-white.

Patient Comorbidities

I used the AHRQ patient comorbidities to examine patient preexisting medical conditions (HCUP, 2008). Comorbid conditions of interest for this study were congestive heart failure, chronic pulmonary conditions, diabetes without complications, diabetes with chronic complications, renal failure, and neurologic conditions other than vascular conditions (HCUP, 2008). These comorbid conditions were associated with adverse patient outcomes in elderly women after hysterectomy by several investigators (Judd et al., 2007; Mains et al, 2007; Wright, Hershman, Burke et al., 2012; Wright, Lewin, Deutsch et al., 2011). I coded the variable as: 0-comorbidity absent or no comorbidity and 1-comorbidity present. For logistic regression analysis, I recoded the comorbidities into one variable: 0-no comorbidity and 1-any comorbidity present.

Patient Complications

Surgical complications included any injuries or problem events associated with the surgical intervention and hospitalization. In HCUP databases, secondary diagnoses

revealed complications that arose during a hospitalization when compared with secondary diagnoses present on admission (HCUP, 2008). Surgical complications included operative injury to internal organs and structures (bladder, intestine, blood vessels, and ureters); postoperative infection (urinary, wound, pulmonary, and sepsis); hemorrhage and post hemorrhagic anemia; venous thromboembolic and precursor events; and delayed return of gastrointestinal function (Judd et al., 2007; Wright, Hershman, Burke et al., 2012; Wright, Lewin, Deutsch et al., 2011). I identified this variable as presence of any surgical complication and coded this categorical covariate variable as: 0-no surgical complication present and 1-any surgical complication present.

Surgical Covariate

Surgical covariates were determined from the CCS procedure codes used to identify patients with hysterectomy as noted in Table 2. The anatomic approach was abdominal or vaginal. I coded the anatomic approach variable as: 1-abdominal and 2-vaginal approach. The surgical technique was open abdominal laparotomy or minimally invasive laparoscopy. I coded the surgical technique variable as: 1-open abdominal laparotomy and 2-minimally invasive laparoscopy. For logistic regression analysis I recoded the nominal covariates as the following: 0-vaginal and 1-abdominal for the anatomic approach; 0-minimally invasive laparoscopy and 1-open laparotomy.

In summary, Table 3 contains the list of the QHOM constructs, study variables, variable characteristics, and coding for variable characteristics. In the table I display the conceptual progression that evolved with use of the QHOM. From the QHOM constructs, I identified study variables and variable characteristics. Then I identified

coding for the variable characteristics. The QHOM is a practical and useful framework for guiding the conceptualization and operationalization of the study.

Table 3

Linking the Quality Health Outcome Model Constructs with Coding of Study Variable Characteristics

QHOM construct	Study variable	Variable characteristics	Characteristic coding
	Predictor		
System	Discharge destination	Home for self-care Home health care Continuing inpatient care (Nominal variable)	1 2 3 Recoded 0 = no 1 = yes
	Criterion/outcome	No readmission	0 = no readmission
Outcome	30-day readmission	30-day readmission (Categorical/binary variable)	1 = readmission
	Covariates		
Client	Patient (Women ≥ 65)	Age on admission (Categorical variable)	Age in 5 year categories 0-99 years
		Race (Nominal variable)	1 = White 2 = Black 3 = Hispanic 4 = Asian/Pacific Islander 5 = Native Alaskan/ American 6 = Other Recoded 0 = non-white 1 = White
		Any medical comorbidity (Categorical variable)	0 = no comorbidity 1 = any comorbidity
		Any surgery complication (Categorical variable)	0 = no complication 1 = any complication

Note: Adapted from "HCUP Data Elements," Healthcare Cost and Utilization Project, 2008. Rockville, MD: Agency for Healthcare Research and Quality.

Data Analysis Plan

For data analyses, I planned to use SPSS version 20.0 (IBM, 2012) software. Because HCUP databases are described as well documented, standardized, and reliable through application of internal and external control measures (Barrett, Raetzman et al., 2012; HCUP, 2011), I anticipated minimal issues with data cleaning. For univariate analysis, I planned to examine frequency distributions and graphical representations to detect potential data problems prior to bivariate and multivariate analyses.

Research Questions

In this study, I examine the overarching research question whether post hysterectomy discharge destination in elderly women is an independent predictor of risk of 30-day hospital readmission. To explore this overarching research question, I formulated the following research subquestions.

Research Question 1

Is there an association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission?

Null Hypothesis 1: There is no association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Alternative Hypothesis 1: There is a significant association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Research Question 2

Is there an association between age in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 2: There is no association between age in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 2: There is a significant association between age in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 3

Is there an association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 3: There is no association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 3: There is a significant association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 4

Is there an association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 4: There is no association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 4: There is a significant association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 5

Is there an association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 5: There is no association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 5: There is a significant association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 6

Is there an association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 6: There is no association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 6: There is a significant association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 7

Is there an association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 7: There is no association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 7: There is a significant association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Data Analysis

For univariate analysis I planned to examine all variables before conducting hypothesis testing, noting frequencies and percentages of all categorical variables (Munro, 2005). The variables included:

- the nominal predictor variable post hysterectomy discharge destination: home for self-care, home with home health care, and continuing inpatient care in a post discharge facility;
- the nominal patient covariate race/ethnicity;
- the categorical covariate age on admission in 5-year increments;
- the dichotomous patient covariates presence of any comorbidity and presence of any surgical complication;
- the nominal surgical intervention covariates anatomical approach and surgical technique; and
- the dichotomous outcome variable 30-day hospital readmission or no readmission.

To explore the relation between the predictor variable post hysterectomy discharge destination and 30-day hospital readmission, I planned to use Pearson's chi-square test of independence. Further, to explore the association between each nominal and categorical patient covariate and 30-day hospital readmission, as well as between each nominal surgical intervention covariate and 30-day hospital readmission, I projected use of Pearson's chi-square test of independence. The 0.05 probability level of significance is necessary to reject the null hypotheses of independence.

I planned to perform multivariate logistic regression analysis to explore the relation between the predictor variable post hysterectomy discharge destination and the binary outcome variable 30-day hospital readmission, taking into account patient and surgical intervention covariates (Katz, 2011; Portney & Watkins, 2009). Home for self-care was the reference category for the predictor variable. All predictor variables and covariates will be entered into the model at the same time and examined through an iterative process, using maximum likelihood estimations. Only variables that fit or contribute to the model will remain while others will be eliminated, until no further improvements can be made. Regression coefficients will be interpreted in terms of odds ratios, and estimated odds of 30-day hospital readmission given the presence of a specific predictor variable or covariate. Through multivariate analysis I will identify odds ratios and the best model predicting the most significant variables associated with 30-day hospital readmission, in addition to the 95% confidence interval indicating the precision of the estimates. (Katz, 2011).

Threats to Validity

Validity refers to the ability to make inferences based on study findings (Carlson & Morrison, 2009; Portney & Watkins, 2009). The issues of interest when considering internal validity of a study focus on the appropriateness of the study design and data measurement. In planning this hypothesis testing epidemiologic study, I attempted to minimize threats to internal validity by using an appropriate study design to investigate specific research questions regarding variables which were based on constructs of an interactive conceptual framework. I determined that adequate power

and sample size were achievable by assembling two years of recent data from the California SID developed through HCUP, a reliable national resource of patient encounter level information created for health care research. I considered that selection bias may be diminished by use of the California SID which contain 100% of the data from 347 HCUP participating community hospitals in the state. The sample of women age 65 and older will be representative of those throughout the state, treated by a variety of surgeons in hospitals of varying sizes. To limit misclassification bias, I planned to examine patient cases with hysterectomy identified as a primary or a secondary procedure in women age 65 and older. Further, I planned to explore possible confounding patient and surgical intervention covariates that may also be associated with 30-day hospital readmission. I outlined a data analysis plan for univariate, bivariate, and multivariate analyses based on the interactive aspects of the QHOM and research questions.

External validity refers to the degree to which study results and conclusions could be applied or generalized to other persons, groups, or settings beyond those studied (Carlson & Morrison, 2009; Portney & Watkins, 2009). External validity is dependent on internal validity. The potential generalizability of results from this study are to women in California age 65 and older. Nevertheless, this study is an important first step in exploring post hysterectomy discharge destination and patient and surgical intervention covariates that may be associated with 30-day hospital readmission. For elderly women in California, results of this study may stimulate interest in the post

hysterectomy discharge destination outcome of early hospital readmission and interventions to decrease risk of 30-day readmission.

Ethics and Protections

To gain access to the HCUP 2010 and 2011 California SID containing de-identified patient level data, I entered into a data use agreement (DUA) with HCUP. The DUA contained parameters and prohibitions for data use, including penalties of fine or imprisonment with discovery of breach in compliance with DUA standards. The DUA instructions stipulated that I was to maintain confidentiality of all data and use data exclusively for research purposes or reporting statistical analysis, not for commercial or competitive intent. Additionally, the DUA set forth expectations; to avoid attempts to identify or link any specific patient, provider, contributor, or health system information to the database; and to avoid re-release of data to any unauthorized user.

The Walden University Institutional Review Board (IRB) reviewed and granted approval for this study (approval number 05-07-14-0112120). Because I used retrospective de-identified data in this study, not actively involved human participants, informed consent was not required. I maintained data confidentiality by storing the California SID in a password protected file on my personal computer. In addition, I stored the original data discs and any printed output in a locked file in my home office. During data analysis and modeling procedures, I installed and used the data files only on my personal home computer. I will report and disseminate only aggregated information.

Summary

For this study, I proposed a retrospective cohort design to examine whether post hysterectomy discharge destination is independently associated with 30-day hospital readmission in women age 65 and older. I planned to captured data from the HCUP 2010 and 2011 California SID about the post hysterectomy discharge destination exposure and the subsequent 30-day hospital readmission outcome, as well as the patient and surgical intervention covariates. I planned to conduct bivariate analyses to test relation between discharge destination, the predictor variable, and 30 day hospital readmission, as well as between patient and surgical intervention covariates and 30-day readmission. In addition, I planned to complete multivariate analysis to identify the best model predicting the most significant variables associated with post hysterectomy discharge destination to determine odds of 30-day hospital readmission. I planned to use post hysterectomy discharge destination home for self-care as the reference group for comparison with destinations home with home health care and continuing inpatient care. In Chapter 4, I will report results of data collection and analyses.

Chapter 4: Results

For this study, I examined the overarching research question whether post hysterectomy discharge destination in elderly women is an independent predictor of risk of 30-day hospital readmission. To explore this overarching research question, I formulated subquestions regarding the association between discharge destination, patient covariates, and surgical covariates and 30-day hospital readmission. The research question and hypotheses follow.

In this chapter, I present the results of the data collection and analysis processes. I provide descriptive statistics about the characteristics of the study sample. Further, I report results of Pearson's chi-square test of independence. I end Chapter 4 with description of multivariate analysis and odds ratios regarding the likelihood of readmission considering discharge destination as well as patient and surgical intervention covariates.

Research Question 1

Is there an association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission?

Null Hypothesis 1: There is no association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Alternative Hypothesis 1: There is a significant association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Research Question 2

Is there an association between age in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 2: There is no association between age in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 2: There is a significant association between age in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 3

Is there an association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 3: There is no association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 3: There is a significant association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 4

Is there an association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 4: There is no association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 4: There is a significant association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 5

Is there an association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 5: There is no association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 5: There is a significant association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 6

Is there an association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 6: There is no association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 6: There is a significant association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Research Question 7

Is there an association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 7: There is no association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 7: There is a significant association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Data Collection

I obtained the data source for this study, the 2010 and 2011 California SID, from the HCUP Central Distributor (Social & Scientific Systems, Inc., Silver Spring, MD). The HCUP Central Distributor provided the databases on compact discs with instructions for down loading core data files and supplemental severity or comorbidity files into data analysis software. The core SID and severity files contained discharge data from 7,906,160 hospital admissions: 3,970,921 episodes of care in 2010 and 3,933,239 in 2011. The cases represented 100% of the patients discharged from 347 eligible HCUP participating non-Federal community hospitals across California for the two years. Core and severity databases were sorted and merged using a uniformly available HCUP numeric data element; a unique 14 digit case identifier for 2010 and a 15 digit case identifier for 2011.

Hysterectomy Sample

When examining the quality of the entire merged databases, I noted considerable missing data for the variable race/ethnicity. A single notation in HCUP data elements documentation indicated that patient race/ethnicity was suppressed on some California records due to confidentiality restrictions imposed by the HCUP Central Distributor (HCUP, 2008). However, when reviewing data variables for the 89,273 cases of index admissions for abdominal and vaginal hysterectomy, over 96% of the cases contained race/ethnicity data. Therefore, the discrepancy regarding the

race/ethnicity variable in the combined database was not an issue for data analysis regarding hysterectomy cases.

Similarly, I identified copious missing data in the visit link variable in the combined databases. Visit link is an essential SID variable needed to ascertain all readmission events for a patient. The visit link variable was a formulated combination of an HCUP encrypted person number, date of birth, and gender identifier (HCUP, 2008). With any one of these components missing from data submitted to HCUP by participating hospitals, HCUP technical resources could not create the visit link variable for a given case (HCUP, 2008). Upon examination of hysterectomy cases, valid visit link values were present for 84,895 (95%) of the hysterectomy cases, again diminishing concern about excessive missing visit link data for hysterectomy cases.

Further, I observed that a discrepancy existed between age on admission recorded for the index hysterectomy surgery and age on admission recorded for the visit link revisit variable for the same year. Because 30-day readmission is a relatively short-term outcome, I anticipated that age could vary one year with a subsequent encounter that crossed a birth date. However, some of the age on readmission variables differed by two or more years. Initially, I attributed these age discrepancies to recording errors. Upon additional scrutiny of HCUP data elements documentation (2008), I discovered a brief statement that indicated age was suppressed or offset by a few years on some records in the California SID by the Central Distributor to protect patient privacy and confidentiality (HCUP, 2008). The offset age was not apparent in the index admission data, however, the offset age occurred with some regularity--about 15% of cases--in the

visit link variable. Therefore, the age on admission variable appeared to be reliable and was used for data analysis.

Of the 89,273 hysterectomy cases in the combined databases, there were 88,831 (99%) with valid age on admission. Of these cases, there were 84,895 (95%) with valid visit link data for examining revisit information. In statistical analysis, I used complete cases with valid age on admission for hysterectomy surgery and valid visit link variables.

Characteristics of the Sample

There were 88,831 hysterectomy cases with valid age data in the combined California 2010 and 2011 SID. Of these cases, 77,897 (87.7%) involved women under age 65 and 10,934 (12.3%) involved women age 65 and older. In the Figure 2 bar graph, I display age on admission in 5-year increments for all women with an index admission for abdominal or vaginal hysterectomy. There were 32 hysterectomy cases under the age of 20 years and 87cases over the age of 90 years. From this point forward, I describe the sample characteristics of women age 65 and older with valid age on admission and visit link variables present.

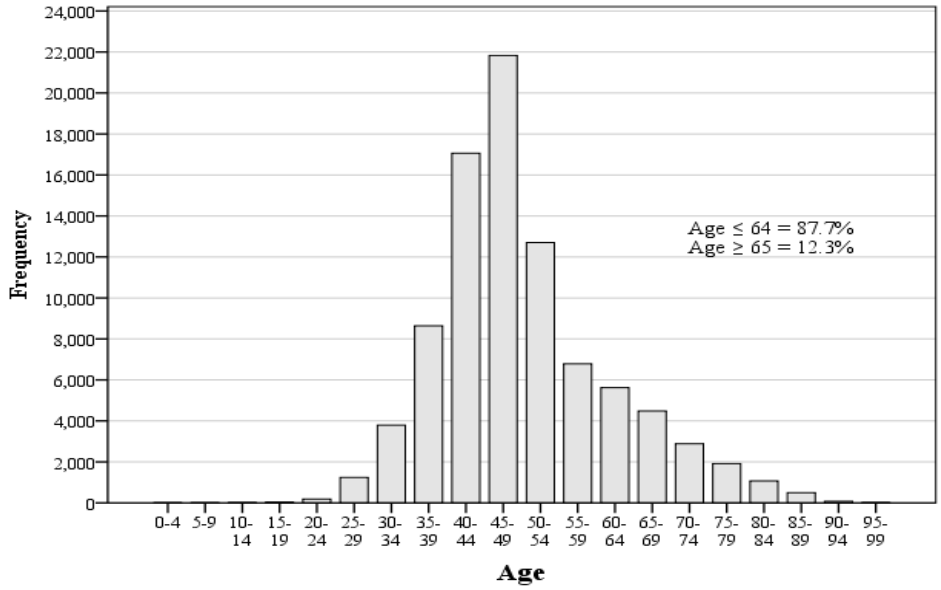

Figure 2. Bar graph displaying age on admission for all hysterectomy cases. Derived from merged HCUP 2010 and 2011 California State Inpatient Databases.

Race/Ethnicity

Of the 10,672 women age 65 and older, with valid age and visit link variables and an index admission for hysterectomy, 6,916 (64.8%) were White and 1,802 (16.9%) were Hispanic. There were 914 (8.6%) women classified as Asian/Pacific Islander, about twice the number of women (429) identified as African American (4.0%). Alaskan Native/Native American women (0.65%) were fewest in number (7). There were 240 (2.2%) women identified in the category of other race/ethnicity. In the Figure 4 bar graph, I display the values for the race/ethnicity variable in women age 65 and older admitted for hysterectomy.

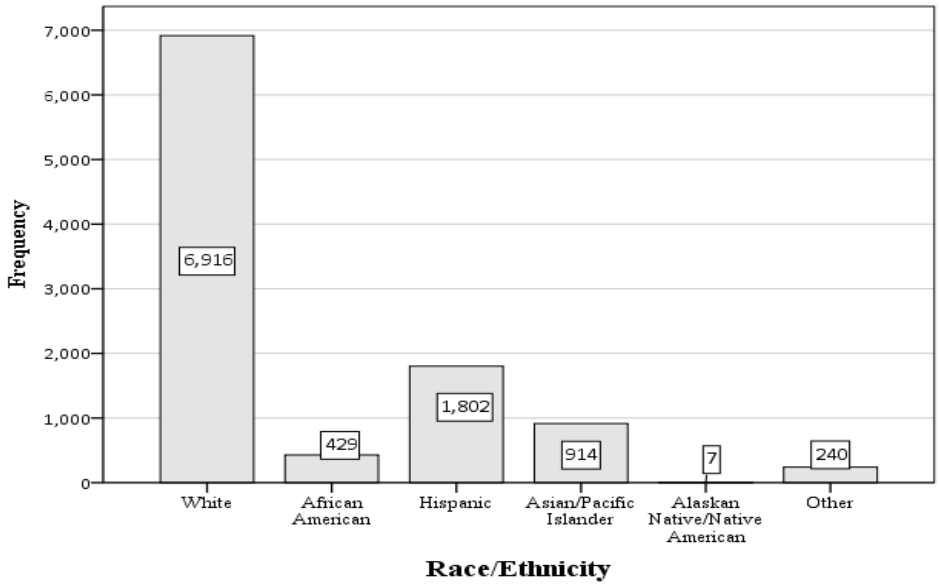

Figure 3. Bar graph displaying race/ethnicity in women age 65 and older with hysterectomy. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Discharge Destination

The majority (9,405) of the 10,672 women age 65 and older with an index admission for hysterectomy were discharged home for self-care (88.1%), whereas 655 (6.1%) were discharged with home health care, and 540 (5.1%) were discharged to continuing inpatient care in skilled nursing, rehabilitation, or long term care settings. Twenty-four women were classified as experiencing other release from the hospital, such as discharged alive but destination unknown; released against medical advice; and discharged to another short term acute care hospital. These 24 cases, as well as 48 cases of inpatient deaths were eliminated from later bivariate data analysis. In the Figure 4 bar graph, I display the values for the variable post hysterectomy discharge destination in women age 65 and older admitted for hysterectomy.

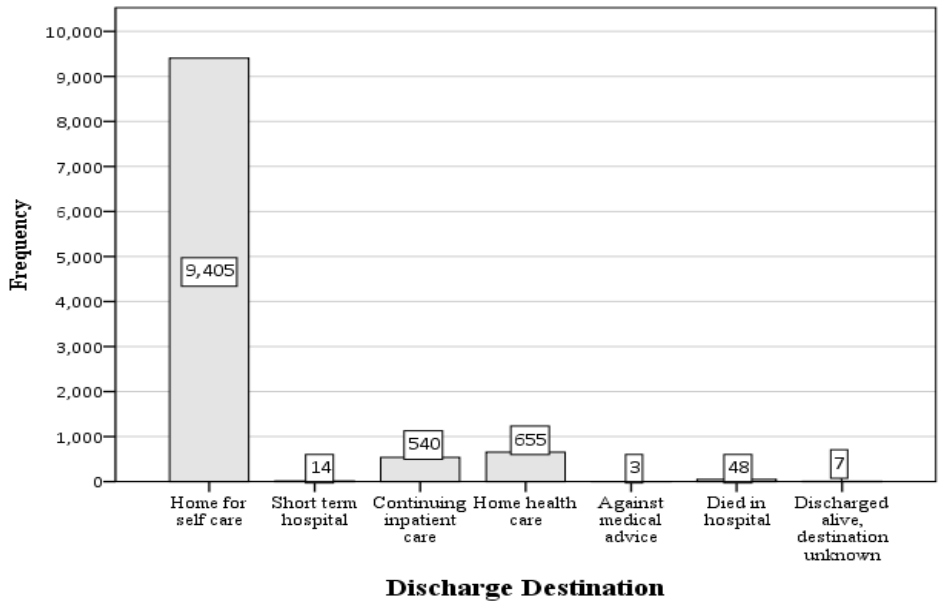

Figure 4. Bar graph displaying post hysterectomy discharge destination in women age 65 and older. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Comorbidity

Of the 10,672 women over age 65 with hysterectomy, uncomplicated diabetes was the most frequently identified comorbidity (1,809), occurring in 16.95% of cases, followed by chronic pulmonary disease in 1,167 (10.93%) cases, and renal failure in 482 (4.51%) cases. Other comorbid conditions of interest for this study were diabetes with chronic complications in 314 cases (2.94%), congestive heart failure in 307 cases (2.84%), and neurologic disorders--other than vascular disorders--in 258 cases (2.41%). In the Figure 5 bar graph, I display the values for the variable presence of medical comorbidities in women age 65 and older admitted for hysterectomy.

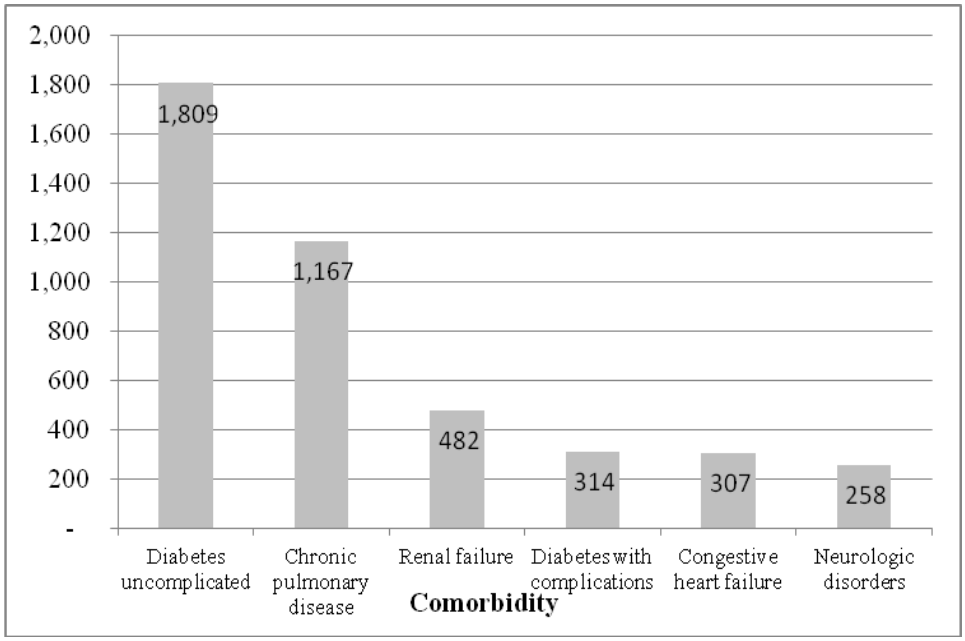

Figure 5. Bar graph displaying presence of medical comorbidity in women age 65 and older with hysterectomy. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Complications

In HCUP databases, secondary diagnoses revealed complications that arose during a hospitalization when examined and compared with secondary diagnoses present on admission (HCUP, 2008). In women age 65 and older with hysterectomy, complications were infrequent and occurred in 3.24% of cases over the 2-year period. There were 189 (1.77%) complications related to injury or problem events associated with the hysterectomy surgical intervention and medical care. Hemorrhage or post hemorrhagic anemia occurred in 68 cases (0.63%), infection in 64 cases (0.59%); delayed return of gastrointestinal function in 18 cases (0.17%); and venous thromboembolic or precursor events such as phlebitis occurred in 7 cases (0.06%). There were 10,326 cases without complications. In the Figure 6 bar graph, I display the

values for the variable presence of complications in women age 65 and older admitted for hysterectomy.

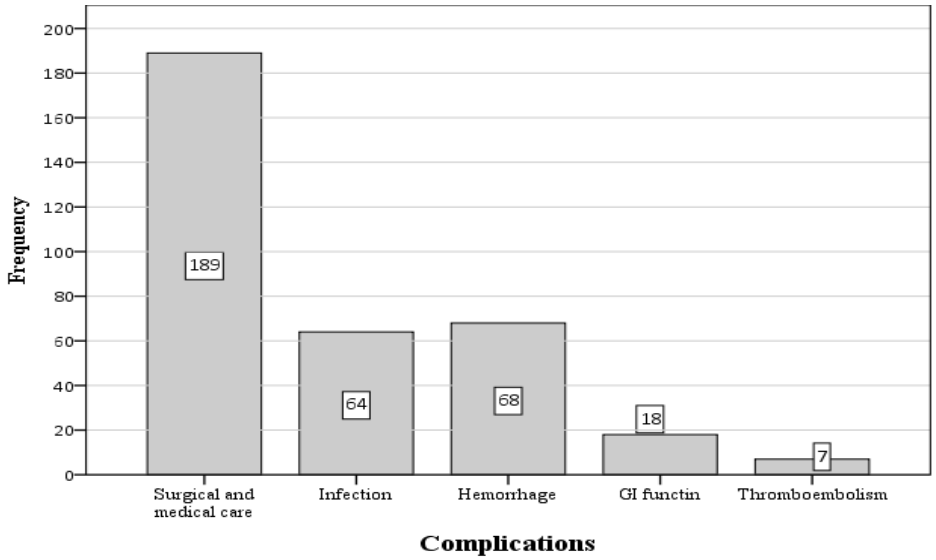

Figure 6. Bar graph displaying presence of complications in women age 65 and older with hysterectomy. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Anatomic Approach

In 5,983 (56.1%) patients age 65 and older, surgeons used the abdominal anatomic approach for the hysterectomy procedure. Over 43% (4,679) of women age 65 and older experienced the vaginal approach. In the Figure 7 bar graph, I display values for the variable anatomic approach used in performing the surgical intervention in women age 65 and older during the index admission.

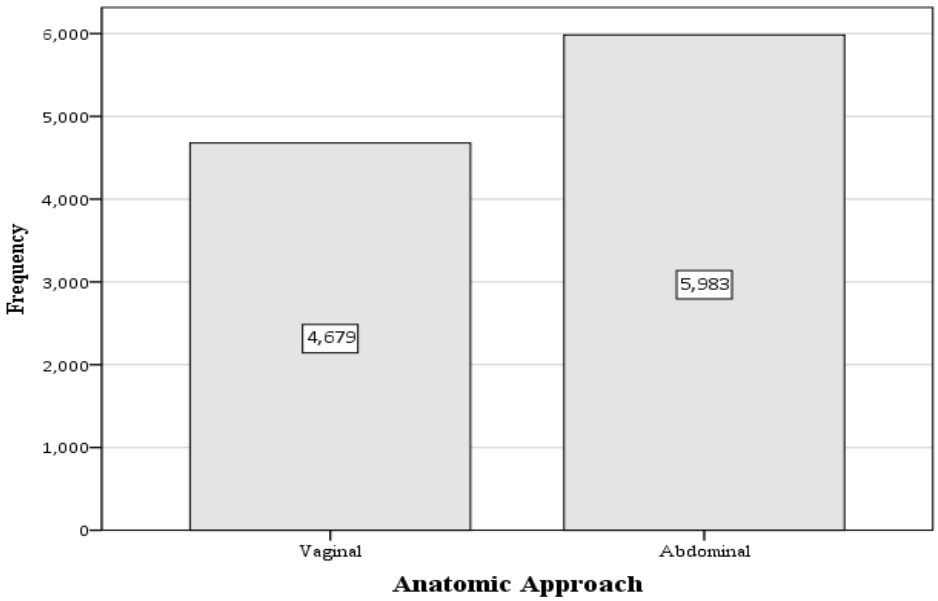

Figure 7. Bar graph displaying the anatomic approach for hysterectomy in women age 65 and older. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Surgical Technique

Surgeons used minimally invasive laparoscopic and vaginal techniques in 6,355 (59.5%) cases of hysterectomy in women age 65 and older. For 4,317 (40.5%) cases, surgeons used the open abdominal laparotomy technique. In the Figure 8 bar graph, I display values for the variable surgical technique used in performing the surgical intervention in women age 65 and older during the index admission.

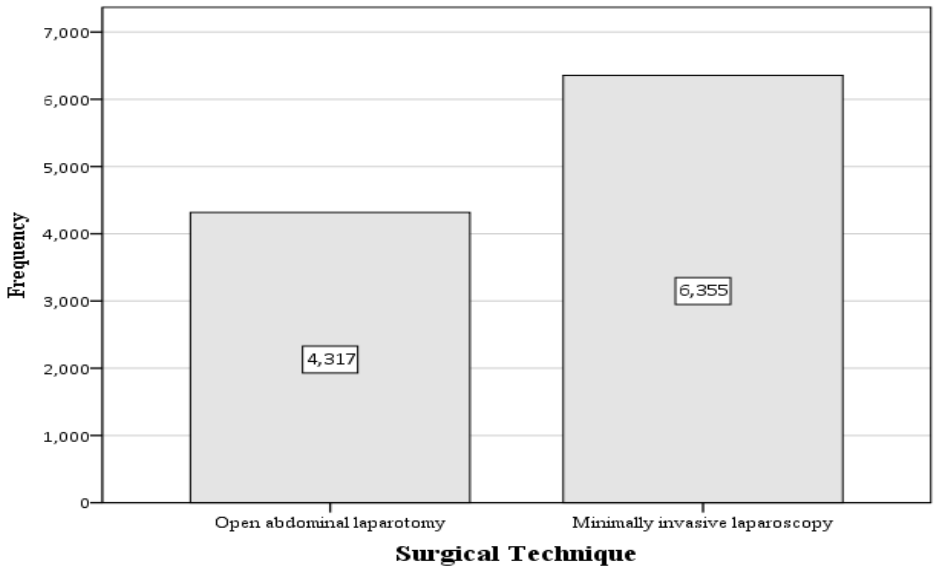

Figure 8. Bar graph displaying the surgical technique for hysterectomy in women age 65 and older. Derived from data in the merged HCUP 2010 and 2011 California State Inpatient Databases.

Bivariate Analysis

To conduct bivariate analysis more efficiently, a smaller data set was derived from the fully merged California 2010 and 2011 SID that contained over 7.9 million records. Cases of women age 65 and older with an index admission for hysterectomy and valid visit link data were extracted and merged with the records of women readmitted within 30 days to formulate a post hysterectomy discharge destination data set. During creation of this data set, additional deviations in data became evident. Three cases with negative time to readmission and one case with missing days to event for calculating hospital readmission were excluded from the data set resulting in 10,598 cases for bivariate analysis. The entire post hysterectomy discharge destination data set was used in statistical analysis to assure examination of all valid data.

Research Question 1

Is there an association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission?

Null Hypothesis 1: There is no association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

Alternative Hypothesis 1: There is a significant association between post hysterectomy discharge destination in elderly women and 30-day hospital readmission.

There were 10,598 women age 65 and older discharged after hysterectomy; 757 (7.1%) were readmitted within 30 days and 9,841 (92.9%) were not. Of 9,404 women age 65 and older discharged home for self-care, 478 (5.1%) were readmitted in 30 days or less and 8,926 (94.9%) were not. There were 654 women discharged with home health care; 113 (17.3%) were readmitted and 541 (82.7%) were not. Of 540 women discharged to continuing inpatient care, 166 (30.7%) were readmitted within 30 days and 374 (69.3%) were not. In the Figure 9 bar graph, I display the values for the variables post hysterectomy discharge destinations and 30-day hospital readmission in the sample of women age 65 and older admitted for hysterectomy.

I used a chi-square test of independence to examine the relation between post hysterectomy discharge destination and 30-day hospital readmission. The relation between these variables was significant, χ^2 (2, N = 10,598), = 614.82, p <.001, and supported rejection of the null hypothesis. Elderly women discharged home with home care and to continuing inpatient care are more likely to be readmitted within 30 days of discharge than those discharged home for self care.

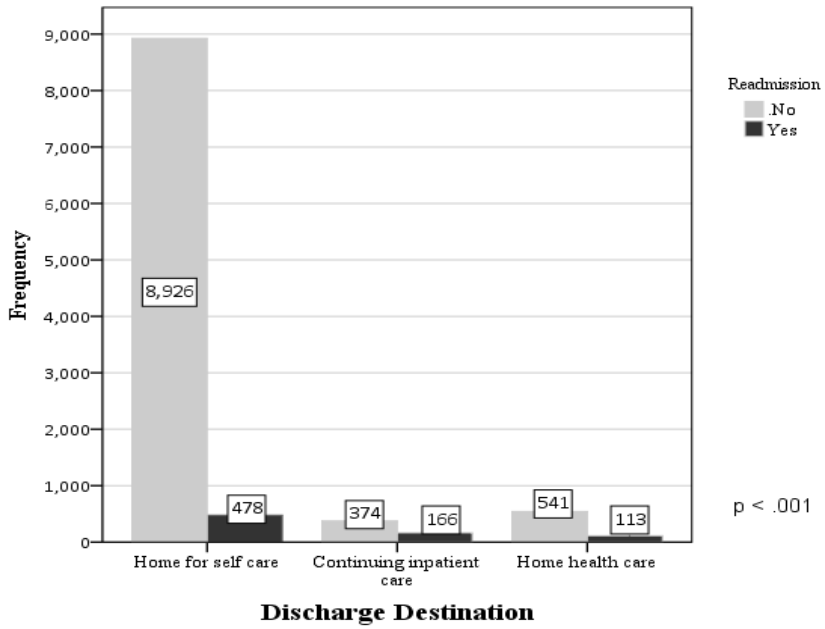

Figure 9. Bar graph displaying post hysterectomy discharge destinations and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from the merged HCUP 2010 and 2011 California State Inpatient Databases.

Research Question 2

Is there an association between age in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 2: There is no association between age in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 2: There is a significant association between age in elderly women with hysterectomy and 30-day hospital readmission.

Because age on admission in elderly women is not normally distributed, I formulated a categorical variable for age in 5-year increments. In the Figure 10 bar graph, I display values for the variables age on admission and 30-day hospital

readmission in the sample of women age 65 and older admitted for hysterectomy. Although infrequent, surgeons performed hysterectomy in women up to 99 years of age. Likewise, post hysterectomy hospital readmission occurred throughout all 5-year age categories between 65 and 99 years.

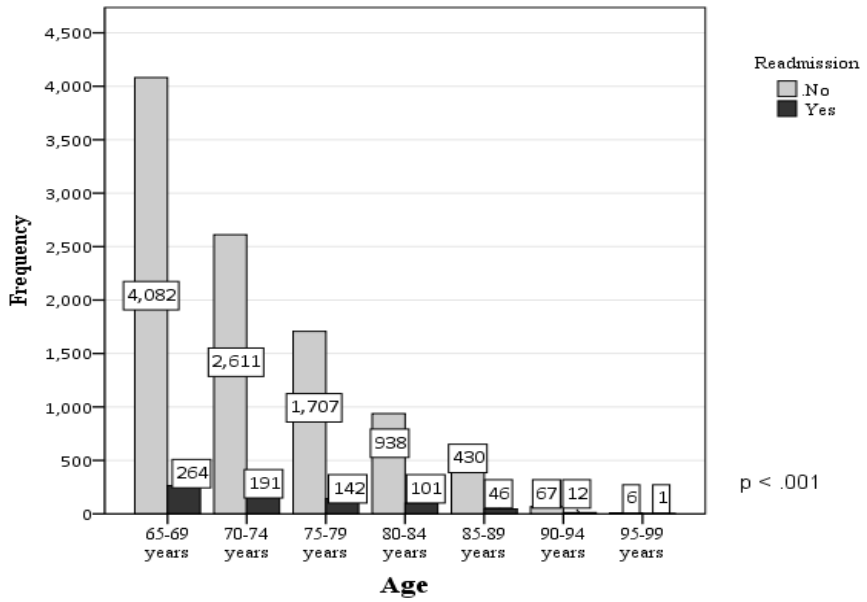

Figure 10. Bar graph displaying age on admission and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from the merged HCUP 2010 and 2011 California State Inpatient Databases.

There were 757 women readmitted within 30 days of discharge. Approximately 79% (597) of post hysterectomy 30-day readmissions occurred between the ages of 65 and 79 years, with greatest frequency (264) or approximately 34.8% occurring in the age category 65-69. I used a chi-square test of independence to examine the relation between age in elderly women with hysterectomy and 30-day hospital readmission. The relation between these variables was significant, χ^2 (6, N = 10,598), = 31.95, p <.001,

and supported rejection of the null hypothesis. Elderly women with hysterectomy are more likely to be readmitted within 30 days of discharge as age increases.

Research Question 3

Is there an association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 3: There is no association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 3: There is a significant association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

There were 10,236 valid comparisons made between race/ethnicity categories in women age 65 and older with hysterectomy and 30-day hospital readmission. The missing data in 362 cases may be explained by the action of the HCUP Central Distributor--to suppress race/ethnicity in some patient records in order to protect patient confidentiality (HCUP, 2008). In the Figure 11 bar graph, I display values for the variables race/ethnicity and 30-day hospital readmission in the sample of women age 65 and older admitted for hysterectomy. Thirty-day hospital readmissions occurred in 492 (66.3%) White women followed by 131 (17.7%) readmissions in Hispanic women. Sixty-four (8.6%) Asian/Pacific Islanders experienced 30-day hospital readmissions compared to 42 (5.7%) African American women. There were 13 hospital readmissions in the category of Other and no readmissions in the Alaskan Native/Native American category.

I used a chi-square test of independence to examine the relation between race/ethnicity and 30-day hospital readmission. The relation between these variables was not significant, χ^2 (5, N = 10,236), = 6.08, p <.289, and supported the null hypothesis. There was no association between race/ethnicity in elderly women with hysterectomy and 30-day hospital readmission.

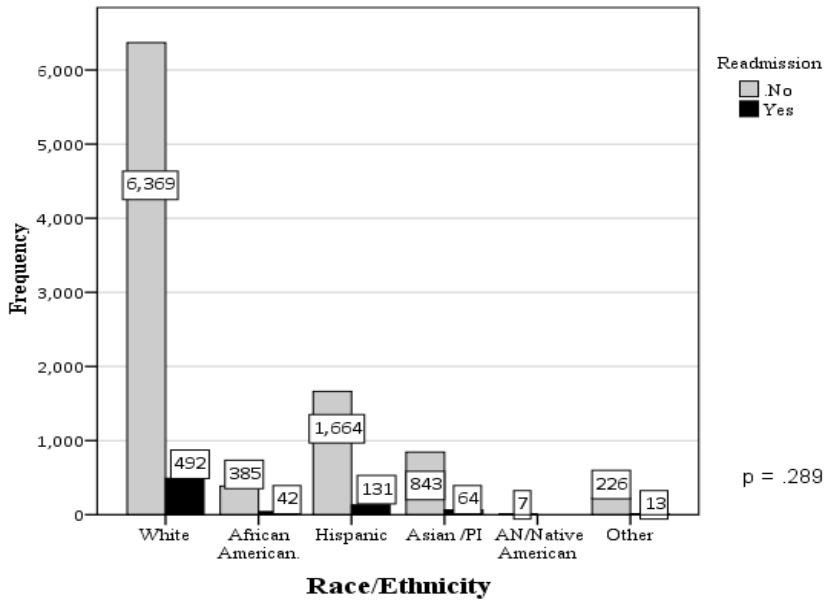

Figure 11. Bar graph displaying race/ethnicity and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from HCUP 2010 and 2011 California State Inpatient Databases.

Research Question 4

Is there an association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 4: There is no association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 4: There is a significant association between presence of any medical comorbidity in elderly women with hysterectomy and 30-day hospital readmission.

Presence of any one of six comorbid conditions previously noted by researchers to be associated with adverse outcomes after hysterectomy surgery were examined: congestive heart failure, chronic pulmonary conditions, uncomplicated diabetes, diabetes with chronic complications, neurological disorders, and renal failure. Based on the individual chi-square results of comparisons of each comorbidity and 30-day hospital readmission, a recoded binary variable for any comorbidity was created using five comorbidities identified as having a statistically significant association with 30-day post hysterectomy hospital readmission. Uncomplicated diabetes was excluded from the recoded comorbidity variable due to lack of statistical significance in women age 65 and older with hysterectomy in the post hysterectomy discharge destination data set.

In the Figure 12 bar graph, I display the values for the variables presence of any comobidity and 30-day hospital readmission in the sample of women age 65 and older admitted for hysterectomy. There were 315 (9.0%) cases of post hysterectomy readmission in women 65 and older with any comorbidity out of 3,492 women with comorbidities. There were 442 (6.2%) post hysterectomy readmissions out of 7,106 women with none of the five comorbidities present.

I used a chi-square test of independence to examine the relation between presence of any medical comorbidity and 30-day hospital readmission. The relation between these variables was significant, χ^2 (1, N = 10,598), = 27.69, p <.001 and

supported rejection of the null hypothesis. Elderly women with presence of any medical comorbidity were more likely to be readmitted within 30 days of discharge than those without any medical comorbidity.

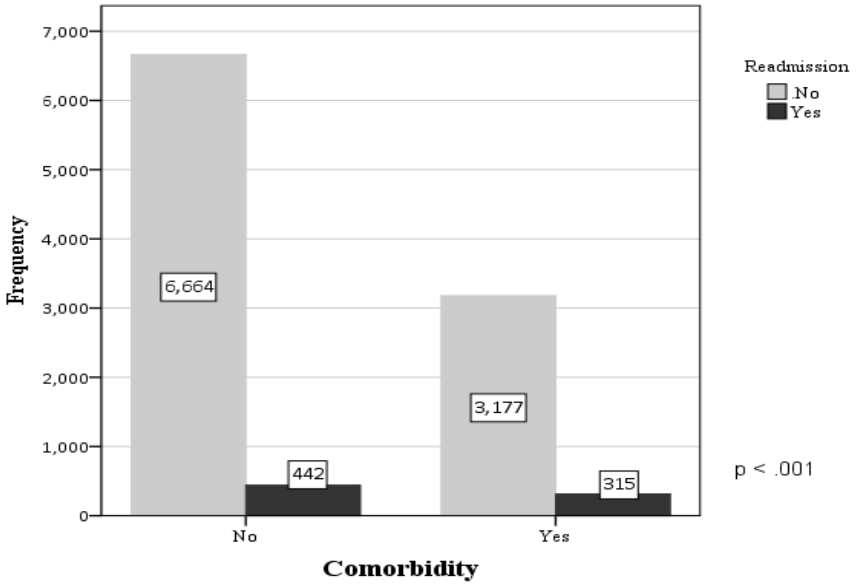

Figure 12. Bar graph displaying presence of any comobidity and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from HCUP 2010 and 2011 California State Inpatient Databases.

Research Question 5

Is there an association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 5: There is no association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 5: There is a significant association between presence of any surgical complication in elderly women with hysterectomy and 30-day hospital readmission.

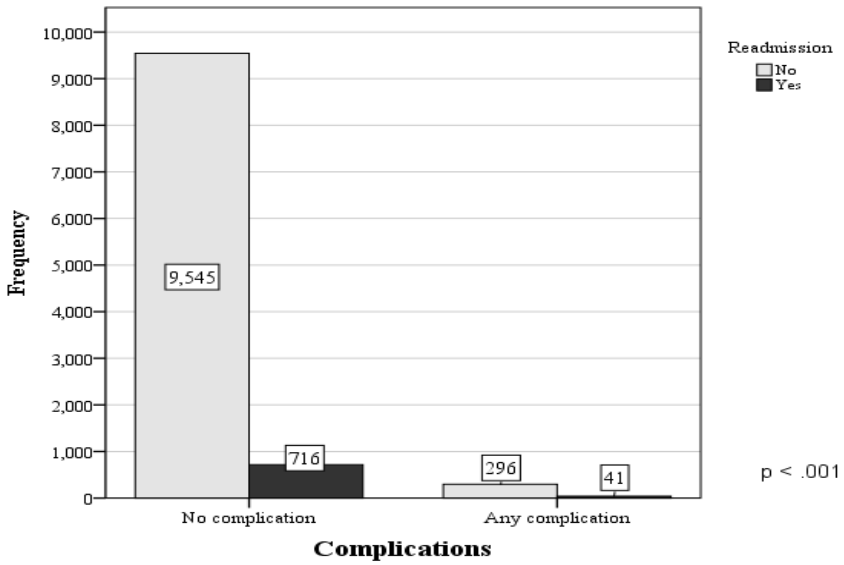

Figure 13. Bar graph displaying presence of any complication and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from HCUP 2010 and 2011 California State Inpatient Databases.

Presence of any surgical complication included injuries or problem events associated with the hysterectomy surgical intervention and medical care, such as injury to other tissues and organs and side effects from treatments. Other complications of surgery included infection; hemorrhage; slow return of gastrointestinal function exhibited by nausea and vomiting; and venous thromboembolic events or precursors. In the Figure 13 bar graph, I display the values for the variables presence of any surgical complication and 30-day hospital readmission in the sample of women age 65 and older admitted for hysterectomy. There were 41 (12.2%) cases of post hysterectomy readmission in women age 65 and older with any surgical complication out of 337 women with any surgical complication (296 not readmitted). Out of 10,261 cases with

no surgical complications present, 716 (6.97%) cases experienced post hysterectomy readmission and 9,545 did not.

I used a chi-square test of independence to examine the relation between presence of any surgical complication and 30-day hospital readmission. The relation between these variables was significant, χ^2 (1, N = 10,598), = 13.24, p <.001 and supported rejection of the null hypothesis. Elderly women with the presence of any surgical complication are more likely to be readmitted within 30 days of discharge than those without any complication.

Research Question 6

Is there an association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 6: There is no association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 6: There is a significant association between surgical anatomic approach in elderly women with hysterectomy and 30-day hospital readmission.

The anatomic approach for hysterectomy surgery may be vaginal or abdominal. There were 10,588 cases in women age 65 and older with valid anatomic approach data for hysterectomy surgery; 4,674 (44.1%) with vaginal and 5,914 (55.9%) with abdominal approach. Of the 755 women readmitted within 30 days of post hysterectomy discharge, 164 (21.7%) women underwent vaginal approach and 591(78.3%) abdominal approach. Cases not readmitted within 30-days of discharge

included 4,510 (45.9%) with vaginal approach and 5,323 (54.1%) with abdominal approach. In the Figure 14 bar graph, I display the values for the variables surgical anatomic approach and and 30-day hospital readmission in the sample of women age 65 and older admitted for hysterectomy.

I used a chi-square test of independence to examine the relation between anatomic approach for hysterectomy and 30-day hospital readmission. The relation between these variables was significant, χ^2 (1, N = 10,588), = 165.77, p <.001 and supported rejection of the null hypothesis. Elderly women with abdominal anatomic approach for hysterectomy are more likely to be readmitted within 30 days of discharge than those with vaginal anatomic approach.

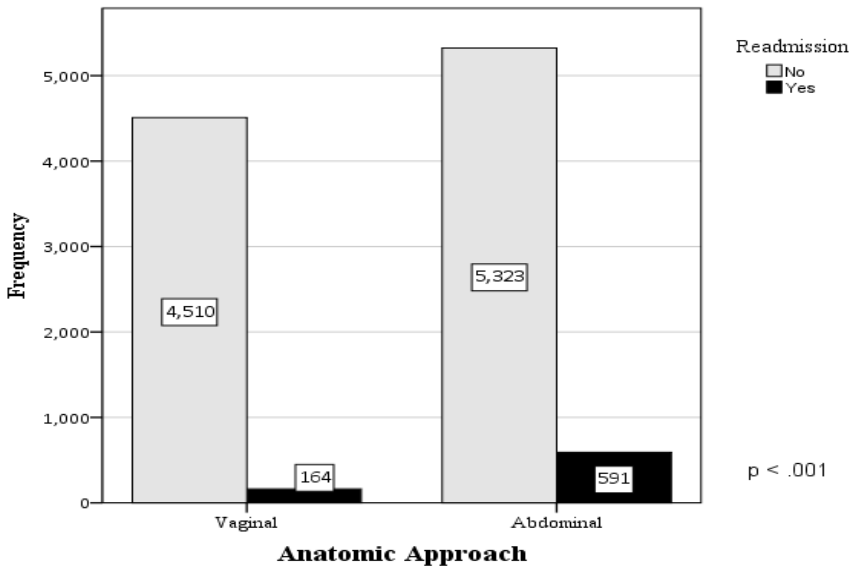

Figure 14. Bar graph displaying surgical approach and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from HCUP 2010 and 2011 California State Inpatient Databases.

Research Question 7

Is there an association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission?

Null Hypothesis 7: There is no association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Alternative Hypothesis 7: There is a significant association between surgical technique in elderly women with hysterectomy and 30-day hospital readmission.

Hysterectomy surgical techniques included open abdominal laparotomy and minimally invasive laparoscopic and vaginal techniques. There were 10,588 cases in women age 65 and older with valid data regarding surgical technique for hysterectomy; 4,241 (40.1%) with open abdominal laparotomy and 6,347(59.9%) with minimally invasive techniques. Of the 755 women readmitted within 30 days of post hysterectomy discharge, 506 (67.0%) women underwent open laparotomy and 249 (33.0%) minimally invasive techniques. Cases not readmitted within 30-days of discharge included 3,735 (38.0%) with open laparotomy and 6,098 (62.0%) with minimally invasive techniques. In the Figure 15 bar graph, I display surgical techniques and post hysterectomy 30-day hospital readmission in elderly women.

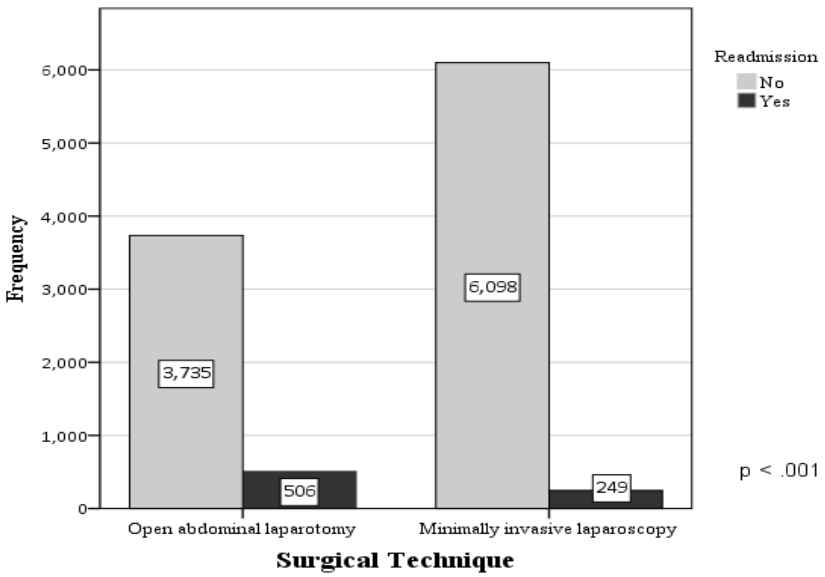

Figure 15. Bar graph displaying surgical technique and 30-day hospital readmission. Derived from the post hysterectomy discharge destination data set compiled from HCUP 2010 and 2011 California State Inpatient Databases.

I used a chi-square test of independence to examine the relation between surgical technique and 30-day hospital readmission. The relation between these variables was significant, χ^2 (1, N = 10,588), = 246.19, p <.001 and supported rejection of the null hypothesis. Elderly women with open abdominal laparotomy for hysterectomy surgery are more likely to be readmitted within 30 days of discharge than those with minimally invasive techniques for hysterectomy.

Logistic regression

I used logistic regression modeling to examine the overarching research question whether post hysterectomy discharge destination in women age 65 and older was an independent predictor of 30-day hospital readmission. The predictor variable was post hysterectomy discharge destination: home for self-care, home health care, and

continuing inpatient care. I used home for self-care was the reference group. The outcome variable was 30-day hospital readmission. Patient covariates included age on admission, race/ethnicity, presence of any medical comorbidity, and presence of any complication of surgical care. Surgical intervention covariates were anatomic approach and surgical technique. All variables were entered in a single step.

Covariates were grouped by patient age, race, comorbidity, and complication. Surgical intervention covariates were grouped by anatomic approach and surgical technique. This allowed the statistical significance of sets of covariates to be assessed. Demographics included age which was categorized in 5 year increments from 65 through 99 years and race as a binary variable identified as white and all others. Comorbidities included presence of any one of five comorbidities including congestive heart failure, chronic pulmonary conditions, diabetes with chronic complications, neurologic conditions, and renal failure. Complications included presence of any one of the following: surgical care problems; infection; hemorrhage; impeded gastrointestinal function; and venous thromboembolic problems. Surgical intervention covariates were vaginal and abdominal anatomic approach, and surgical open abdominal laparotomy and minimally invasive laparoscopy techniques. The covariates were analyzed sequentially in five blocks. In Table 4, I included the odds ratios and 95% confidence intervals from the logistic regression analysis.

Table 4

Logistic Regression Model

Variables	Odds ratio Exp(β)	95% CI for Exp(β) Lower	upper	Significance
Home for self-care				
Home health care	2.898	2.290	3.668	.000**
Continuing inpatient care	5.898	4.684	7.427	.000**
Age 65-69				
Age 70-74	1.046	0.857	1.275	.661
Age 75-79	1.036	0.830	1.293	.755
Age 80-84	1.065	0.822	1.380	.636
Age 85-89	0.787	0.551	1.124	.188
Age 90-94	0.979	0.498	1.923	.951
Age 95-99	1.081	0.115	10.139	.945
Race/ethnicity	1.042	0.885	1.226	.662
Any comorbidity	1.121	0.955	1.316	.163
Any complication	1.100	0.770	1.570	.601
Anatomic approach	1.391	1.061	1.824	.017*
Surgical technique	0.540	0.423	0.690	.000**

Note: *$p < .05$. ** $p < .001$.

Interpretation of the model

There were statistically significant differences in discharge destination to home health care and continuing inpatient care in the model. Women discharged with home health care had 2.99, $p < .001$, 95% CI [2.29, 3.67] greater odds of being readmitted within 30 days after discharge for hysterectomy surgery than women discharged home for self-care. Women discharged to continuing inpatient care had 5.99, $p < .001$, CI [4.68, 7.43] greater odds, of 30-day hospital readmission than women discharged home for self-care. There were no statistically significant differences with patient covariates

in the model. Surgical covariates, anatomic approach and surgical technique were statistically significant. Women with an abdominal anatomic approach to hysterectomy surgery were at 1.39, $p = .017$, 95% CI [1.06, 1.82] increased odds of readmission. Women who experienced minimally invasive surgical techniques were at 0.54, $p < .001$, 95% CI [0.42, 0.69] reduced odd of readmission after hysterectomy surgery.

Summary

The projected purpose of this study was to identify whether post hysterectomy discharge destination is an independent predictor of risk of 30-day hospital readmission in elderly women.Through bivariate analysis I found that there was a statistically significant association between post hysterectomy discharge destination in women age 65 and older and 30-day hospital readmission. In addition, from results of bivariate analyses, in which I examined the association between patient factors and post hysterectomy hospital readmission, I noted statistically significant differences between age on admission, any patient comorbidity, and any surgical complication, and 30-day hospital readmission. There was no association between race/ethnicity and 30-day hospital readmission. However, there was a statistically significant association between surgical anatomic approach and 30-day hospital readmission, as well as between surgical technique and 30-day hospital readmission in elderly women after hysterectomy. Further from results of logistic regression analysis I noted that there was a statistically significant difference in 30-day hospital readmission when comparing home for self-care with the destinations home with home health care and continuing inpatient care. Patients with post hysterectomy discharge for home health care had odds

of readmission 2.99 times greater than those discharged home for self-care. Patients age 65 and older discharged to continuing inpatient care after hysterectomy had odds of readmission 5.99 times greater than those discharged home for self-care. In Chapter 5, I discuss the implications of these results as well as study limitations. I offer recommendations for further exploration of post hysterectomy discharge destination outcomes. I end Chapter 5 with a description of the potential impact of this study for positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative epidemiologic study was to explore the association between post hysterectomy discharge destination in elderly women and early hospital readmission within 30-days of discharge. I conducted this study using a cohort design and data from the HCUP 2010 and 2011 California SID because there was a lack of information about the adverse outcome of hospital readmission after a fairly common gynecologic surgery in elderly women. I also examined confounding covariates of patient age, race, comorbidity, and surgical complication, as well as surgical intervention of covariates anatomic approach and surgical technique in relation to early hospital readmission.

Through bivariate and logistic regression analysis, I found statistically significant associations between post hysterectomy discharge destination and 30-day hospital readmission, as well as between surgical intervention covariates and 30-day hospital readmission in California women age 65 and older. In bivariate analysis, there were statistically significant association between patient covariates—age on admission for hysterectomy, presence of any medical comorbidity, presence of any surgical complication and 30 day readmission. There was no association between race/ethnicity and hospital readmission.

Interpretation of Findings

The association between post hysterectomy discharge destination and early hospital readmission previously had not been documented in women age 65 and older nor had these findings been reported in medical, nursing, and public health literature.

The majority of medical research reports associated with hysterectomy contained information about patient outcomes related to the surgical procedure or technique, perioperative complications, other inpatient complications associated with patient comorbidity, length of hospital stay, and inpatient mortality, not discharge destination or hospital readmission. Similarly in the nursing literature, there was a scarcity of information about the outcome of post hysterectomy discharge destination in relation to early hospital readmission. Several reports of nursing studies addressed general issues regarding planning, coordination, and communication associated with patient release or transfer from the hospital setting. Additionally, the public health literature contained reports of incidence or prevalence of disease conditions or surgical interventions related to hysterectomy, but scant information about post hospital outcomes associated with post hysterectomy discharge destination. This investigation was a novel approach to exploring early hospital readmission with a focus on hysterectomy, a fairly common surgical intervention in elderly women.

Patient covariates of age on admission, presence of a medical comorbidity, and presence of a surgical complication were independently associated with 30-day readmission in bivariate analysis, but not in multivariate analysis. In the medical literature, these patient covariates also have been reported to have varying associations with adverse outcomes such as inpatient mortality, perioperative morbidity, and extended length of hospital stay. However, advancing age and comorbid conditions are associated with individuals who have compromised health status and decreased

functional ability, suggesting that these patient covariates may be reflected in discharge destination decisions by care providers.

Further in this study, results indicated that the abdominal surgical approach was associated with a slight increase in odds of early hospital readmission and that minimally invasive techniques were associated with a moderate reduction of odds of 30-day hospital readmission. These findings were consistent with guidelines promulgated by ACOG, the professional medical practice organization recommending less traumatic anatomic exposure and minimally invasive techniques for hysterectomy when medically appropriate (ACOG, 2011). In addition, the study findings coincided with findings of several investigators indicating the value of minimally invasive techniques. Verifying the association between surgical intervention approach and technique and 30-day hospital readmissions reinforced the importance of surgical expertise in the team members and surgeons involved in performing hysterectomy.

Findings from the study verified that complex interactions existed among discharge destination, patient, and surgical intervention variables and the outcome 30-day hospital readmission. However, study findings diverged somewhat from the constructs depicted in the QHOM (see Appendix B) that indicated there was no direct interaction between the surgical intervention and the outcome. The results of this analysis suggested that the intervention may have a direct effect on the outcome.

Limitations of the study

Because I used California 2010 and 2011 SID, the study results may not represent nationwide patterns in post hysterectomy discharge destination and 30-day

hospital readmission. The study findings can be generalized only to the elderly women in California who underwent hysterectomy. Although the study findings indicate that an important association exists between post hysterectomy discharge destination and early hospital readmission, the association does not imply a causal relation. Selection bias may have been a factor in regard to the anatomic approach and surgical technique employed for the hysterectomy intervention. Clinical indications and surgeon preference may have influenced decisions about the surgical intervention in unforeseen ways. Similarly, clinical factors, patient and family preference, and insurer benefits may have influenced decisions about discharge destination. Elderly women discharged home for self-care may have been somewhat healthier and initially less compromised that than their counterparts discharged with home health care or to continuing inpatient care settings. Additionally, healthier patients may have more clinical options open to them for the surgical intervention. This information was not available in an administrative data base and may merit additional investigation.

The research questions posed in this study focused on the outcome of 30-day hospital readmission in elderly women in relation to post hysterectomy discharge destination. Associations between patient and surgical covariates and discharge destination were not addressed in this study, nor were questions about the purpose or reason for the hysterectomy surgical intervention and discharge destination. Examination of these associations in future investigations may provide further insights into discharge destination and early hospital readmission.

As previously noted, patient age and race/ethnicity in the California SID were manipulated by the HCUP Central Distributor to protect patient confidentiality. Suppressed race/ethnicity information may have contributed to missing data in this variable traditionally examined as a confounder in research studies. The HCUP Central Distributor manipulation of the race/ethnicity variable begs the question of how the perturbations may have contributed to study results.

Recommendations

Research about post hysterectomy discharge destination and risk of 30-day hospital readmission may benefit from examination of additional variables, such as diagnostic reason for the surgery to clarify whether benign or malignant conditions contribute to post hysterectomy discharge destination and 30-day hospital readmission. In a future study, new insights may be gained by improving the precision of variable measurement such as the age, comorbidity, and complications variables.

In situations where there are complex interactions among predictor variables and covariates, some researchers have suggested use of path analysis or structural equation modeling to examine the complexities of interactions. These advanced statistical methods were not proposed for this initial exploratory study. However, path analysis or structural equation modeling may be helpful in future studies examining the discharge destination and hospital readmission, particularly studies that employ the QHOM as a conceptual framework.

Implications

The implications for positive social change that arise from this study are related to verifying that an association exists between post hysterectomy discharge destination in elderly California women and 30-day hospital readmission, information previously not documented in this manner. Additionally, identifying that increased odds of readmission with discharge home with home health care are almost 3 times greater than discharge home for self-care and almost 6 times greater with discharge to a continuing inpatient care setting is important information to share with health care providers, administrators, and policy makers interested in preventing early hospital readmission and aligning patient care services with patient care needs. In addition, this important information can be used by health care providers to call attention to the need for improved pre and post discharge interventions focused on transitions in care settings for elderly women who may undergo hysterectomy for gynecologic conditions. Reducing 30-day hospital readmissions could contribute to the physical, emotional, and social well being of patients and their family members and to reduced health care expenditures.

Conclusions

In this study, post hysterectomy discharge from the hospital with home health care was associated with almost 3 times greater odds of early hospital readmission than discharge home for self-care. Similarly, post hysterectomy discharge from the hospital to a continuing inpatient care setting such as a skilled nursing facility or a rehabilitation facility was associated with almost 6 times greater odds of hospital readmission within

30 days than discharge home for self-care. These findings indicate that post hysterectomy discharge home with home health care and to a continuing care facility require intensive intervention to avoid early hospital readmissions.

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Appendix A: States and State Data Organizations Participating in HCUP

The following states and state data organizations participate in providing information for the Healthcare Cost and Utilization Project State Inpatient Databases. An asterisk indicates that de-identified readmission information is available in the State Inpatient Databases.

Alaska* State Hospital and Nursing Home Association
Arizona Department of Health Services
Arkansas* Department of Health
California* Office of Statewide Health Planning and Development
Colorado Hospital Association
Connecticut Hospital Association
Florida* Agency for Health Care Administration
Georgia* Hospital Association
Hawaii* Health Information Corporation
Illinois Department of Public Health
Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Louisiana* Department of Health and Hospitals
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts* Center for Health Information and Analysis
Michigan Health & Hospital Association
Minnesota Hospital Association
Mississippi* Department of Health
Missouri*Hospital Industry Data Institute
Montana MHA - An Association of Montana Health Care Providers
Nebraska* Hospital Association
Nevada Department of Health and Human Services
New Hampshire Department of Health & Human Services
New Jersey Department of Health
New Mexico* Department of Health
New York* State Department of Health
North Carolina Department of Health and Human Services
North Dakota (data provided by the Minnesota Hospital Association)
Ohio Hospital Association
Oklahoma State Department of Health

Oregon Association of Hospitals and Health Systems; Health Policy and Research
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina* Budget & Control Board
South Dakota Association of Healthcare Organizations
Tennessee* Hospital Association
Texas Department of State Health Services
Utah* Department of Health
Vermont Association of Hospitals and Health Systems
Virginia* Health Information
Washington* State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

Appendix B: Quality Health Outcomes Model Constructs and Study Variables

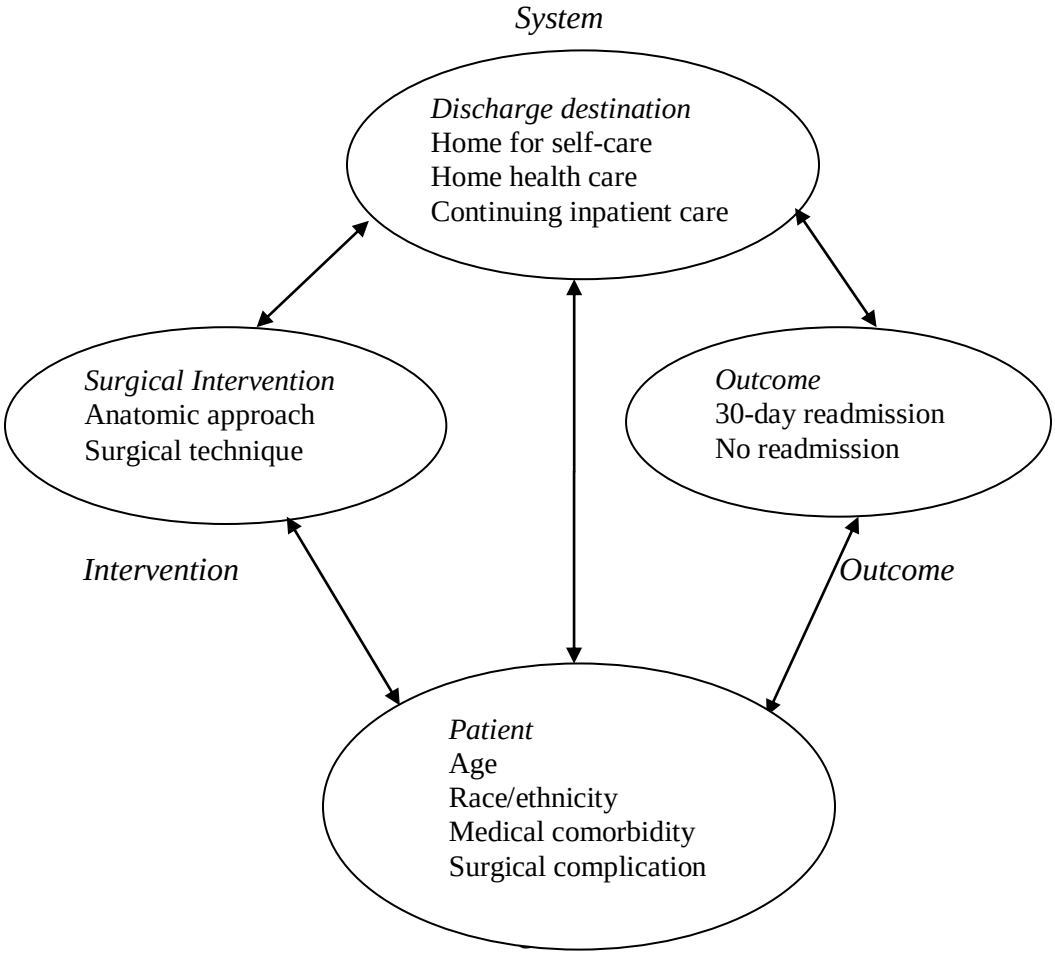

Figure 3. Relation among the constructs of the quality health outcomes model (QHOM) and study variables. The QHOM constructs are listed in italics above and below the ovals. The study variables that correspond to the model constructs are listed in the ovals. The predictor variable is discharge destination; the outcome variable is 30-day readmission. Patient and surgical intervention factors interact with the system variable to influence the outcome. The arrows indicate the direction of interaction among the constructs and variables. Adapted from "Quality Health Outcomes Model" by P. H. Mitchell, S. Ferketich et al., 1998, *Journal of Nursing Scholarship, 30,* p. 43. Copyright 1998 by John Wiley & Son Inc.

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