2017

Gender Differences in Health Service Utilization Among Veterans With Acute Kidney Injury

Freneka Fronsha Minter
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Freneka Minter

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Cynthia Newell, Committee Chairperson, Health Services Faculty
Dr. Suzanne Richins, Committee Member, Health Services Faculty
Dr. Amy Thompson, University Reviewer, Health Services Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2017

Abstract

Gender Differences in Health Service Utilization Among Veterans With Acute Kidney Injury

by

Freneka Minter

MS, Middle Tennessee State University, 2005

BS, Middle Tennessee State University, 2002

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Services

Walden University

May 2017

Abstract

The U.S. Department of Veterans Affairs (VA) studies on acute kidney injury (AKI) have focused on defined procedures and outcomes but not on gender differences. The purpose of this study was to investigate differences in health services utilization by gender and other predisposing factors (age and race) among hospitalized veterans with AKI during a 5-year period from 2008 to 2013. The study included a retrospective cohort design and the behavioral model of health services utilization as the underlying theoretical framework. Secondary data were collected from an existing VA cohort. Data from 1,636 hospitalized AKI veterans were subjected to *t* tests to assess gender differences in VA health services use and short-term outcomes. ANOVAs were conducted on data from 6,102 veterans to assess the effect of age and race on VA health services utilization. Results indicated no significant gender differences in VA health services use and short-term outcomes. However, significant differences were found in some VA health services utilization for age and race. Results may be used by VA policymakers and administrators to identify and reduce gender inequalities in VA health services use and outcomes.

Gender Differences in Health Service Utilization Among Veterans With Acute Kidney Injury

by

Freneka F. Minter

MS, Middle Tennessee State University, 2005

BS, Middle Tennessee State University, 2002

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Services

Walden University

May 2017

Dedication

This dissertation is dedicated to my family, especially my mom (Sherry Claybrooks-Clark), dad (John Minter, Jr.), step-dad (Nathaniel Clark), and grandmother (Mary Claybrooks); my long-time mentor (Dr. Judith Iriarte-Gross); and my church family, friends, colleagues, and coworkers who have provided me with endless support and encouragement. This study is also dedicated to my grandfathers, Rev. Steve Claybrooks, Sr. and Rev. John E. Minter, Sr., and my spiritual grandfather, Pastor Moses Pope, who all passed away before I was able to complete my dissertation. These strong men saw success in me and believed that I would be the first at something. They were right because I was the first in my immediate family to receive a doctorate. I am also dedicating this study to everyone who prayed, inspired, and motivated me throughout this journey. Lastly, I would like to dedicate my dissertation to the U.S. veterans and their families who made this study possible. Thank you for service!

Acknowledgments

First and foremost, I am thankful to God for giving me strength and grace throughout this educational journey. Many thanks to my committee chair, Dr. Cynthia Newell, for riding along with me on this challenging journey. Thank you for your confidence in me when I did not have confidence in myself, for your patience with me, and for your assistance throughout this process. Thank you to Dr. Suzanne Richins for agreeing to be my committee member and providing much-needed feedback to proceed through this journey. I would also like to thank Dr. Amy Thompson for serving as my university research reviewer.

I am grateful to Dr. Michael Matheny, Dr. Edward Siew, Dr. Ruth Reeves, my coworkers at Vanderbilt University Department of Biomedical Informatics' Center for Population Health Informatics, and to the staff of the Tennessee Valley Healthcare System (TVHS) Department of Veterans Affairs (VA). In particular, I would like to thank Jesse Brannen and Jason Denton for the SQL advice given to me as I was teaching myself SQL to generate my data table.

Table of Contents

List of Tables

Chapter 1: Introduction to the Study

Brody (2013) described kidney disease as an "underestimated killer" (para. 1). Kidney disease accounts for approximately 90,000 deaths of Americans each year (Brody, 2013). Kidney disease is the ninth-leading cause of death in the United States (U.S. Centers for Disease Control and Prevention [CDC], National Center for Health Statistics [NCHS], 2015). In the last 20 years, the number of deaths from kidney disease has doubled (Hoerger et al., 2015). The incidence and prevalence of kidney disease continue to rise worldwide, along with the economic burden it imposes on national health systems and society (Levey & Coresh, 2012). In 2012, approximately 3.9 million adults were diagnosed with kidney disease in the United States (Blackwell, Lucas, & Clarke, 2014). According to the CDC's National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation (2015), more than 20 million Americans are living with kidney disease at some level. Given these facts, there is a need for more research on the reduction of kidney disease deaths, incidences, and economic burden.

Kidney disease is a significant problem for U.S. veterans. Over 3,000 U.S. veterans receive a renal failure diagnosis annually (U.S. Department of Veterans Affairs, Office of Research & Development [USVARD], 2014). To maintain life, veterans with renal failure require dialysis or kidney transplant (USVARD, 2014). In 2013, approximately 14,000 veterans were on dialysis, a 13% annual increase since 2008 (USVARD, 2015). The U.S. Department of Veterans Affairs researchers have conducted extensive research to prevent kidney disease, improve kidney disease treatment, and reduce the prevalence of kidney disease-related illnesses among veterans (USVARD, 2014).

According to Hsu (2010), most kidney disease studies have focused on chronic kidney disease (CKD) and end-stage renal disease (ESRD), but not on acute kidney injury (AKI). AKI, also known as acute renal failure (ARF), is a common ailment, frequently occurring in hospitalized patients (Case, Khan, Khalid, & Khan, 2013). AKI often leads to poor patient outcomes if it is not identified early or adequately treated (Lewington, Cerdá, & Mehta, 2013). These poor patient outcomes include mortality, CKD, ESRD, and other organ failures. For this reason, more research is needed on preventing, detecting, and treating AKI. AKI occurrences in hospitalized patients have increased from 4.9% in 1983 to 20% in 2012 (Case et al., 2013). AKI is either hospital-acquired or community-acquired (Lewington et al., 2013). The incidence of AKI varies across studies because it depends on the definitions or criteria used, the setting it occurs in, and the population studied. The following definitions or criteria are used to identify AKI:

- risk, injury, and failure; and loss; and end-stage kidney disease (RIFLE);
- acute kidney injury network (AKIN); and
- kidney disease improving global outcomes (KDIGO) (Palevsky, 2012; Belcher & Parikh, 2015; Lewington, Cerdá, & Mehta, 2013).

Over 3,000 U.S. veterans receive a renal failure diagnosis annually, and over 14,000 veterans are on dialysis (USVARD, 2014). Because of these figures, VA researchers have conducted research designed to prevent kidney disease, improve treatment of kidney disease, and reduce the prevalence of chronic diseases causing kidney disease-related illnesses among veterans (USVARD, 2016). Over two thirds of all kidney disease cases in veterans are caused by chronic diseases such as diabetes and high blood pressure (USVARD, 2016). VA researchers have focused mostly on AKI procedures (e.g., lab tests and dialysis) and outcomes (e.g., development of CKD and ESRD, and nephrology referrals). Bydash and Ishani (2011) focused on long-term AKI outcomes in veterans, such as post discharge mortality and the development of CKD and ESRD. Siew et al. (2011) investigated nephrology referral rates in veterans who were AKI survivors. Schissler et al. (2013) compared community-acquired and hospital-acquired AKI prevalence, severity, and outcomes in veterans. Lafrance and Miller (2010) approximated AKI-associated mortality risk in veterans who were AKI survivors 90 days after hospital discharge. These VA researchers focused on AKI procedures (e.g., lab tests and dialysis) and outcomes (e.g., referrals, hospital complications, hospital length of stay [LOS], chronic disease, and mortality) but did not explore gender differences in these procedures and outcomes in veterans with AKI. I conducted this study to fill this research gap.

The Veterans Health Administration (VHA) is the largest health care system in the United States and strives to promote equitable, high-quality care to all veterans regardless of race, ethnicity, gender, sexual orientation, or age (USVARD, 2014). The VHA consists of 150 medical centers providing comprehensive care to more than 8.3 million U.S. veterans yearly (U.S. Department of Veterans Affairs, 2014). According to the 2013 American Community Survey, nearly 19.6 million people are U.S. veterans, and approximately 1.6 million (8.16%) veterans are female (U.S. Census Bureau, 2013). Many of these female veterans are not eligible to use VHA services. Because the VHA services are used mostly by men and tailored to them, the services must be adapted to ensure equitable, high-quality health care for women (U.S. Department of Veterans Affairs, 2012; USVARD, 2014). In the VHA, researchers have worked to identify health care disparities in the veteran population and the factors that underlie these differences (USVARD, 2014).

Women veterans (WVs) make up the fastest-growing segment of the U.S. veteran population (USVARD, 2014). Due to this growth, WVs are using VHA services more frequently that are usually used by men (USVARD, 2014). The number of women using VHA services has more than doubled in 12 years from 159,630 in 2000 to 362,014 in 2012 (Frayne et al., 2010; Frayne et al., 2014). In contrast, the number of men using VHA services has grown in 12 years from 3,225,712 in 2000 to 5,249,002 in 2012, but has not doubled (Frayne et al., 2010; Frayne et al., 2014). More studies are needed to detect gender disparities in health services use because of the increase in WVs using VHA services and the increasing demand this growth has placed on the VHA delivery systems (Frayne et al., 2014).

Gender disparities are prevalent in overall health service utilization (Vaidya, Partha, & Karmarkar, 2012). Vaidya et al. (2012) noted that women use more health care services than men overall. Borrero, Kwoh, Santorius, and Ibrahim (2006) showed that women are less likely to undergo selected medical procedures than men. The details behind the gender disparities in Borrero et al.'s (2006) study are not clear but suggest barriers to appropriate care and access, which may also lead to poor health outcomes. The current study was designed to acquire a clearer understanding of gender disparities within the U.S. veteran population by looking at differences in AKI treatments and outcomes as a function of health care use by gender.

The influx of women in the U.S. veteran population and their health services use led to more gender-related studies in the veteran population. In response to this influx, VA researchers examined gender differences in mental health and outpatient services utilization of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) veterans (Maguen, Ren, Bosch, Marmar, & Seal, 2010; Maguen et al., 2012; Wolfe, 2011). These studies were also broad in scope and not intended to reveal small aspects of a particular clinical condition such as AKI.

Studies addressing gender disparities in health care utilization or delivery in kidney disease are few. Carrero (2010) conducted a systematic review of gender differences in CKD and attributed these differences to risk and hormonal factors, prescription patterns, and responses to therapies. In another study, Khan et al. (2002) examined health care use in patients with CKD by gender. The results of these studies provided a point of comparison for studies in gender disparities in health outcomes and health care use patterns among veterans with CKD. Further distinctions are necessary for using these studies as a baseline for AKI due to the clinical differences between CKD and AKI, including differences in their prevalence, susceptibility, and outcomes.

In this chapter, I provide an overview regarding the need to examine gender differences in health service utilization among veterans with acute kidney injury. Next, I present a brief background, the problem statement, and the purpose of the study. I also describe the behavioral model of health services use as the conceptual model for this study. Additionally, I present the research questions, hypotheses, and the nature of this study. I conclude with a description of the scope, delimitations, limitations, and significance of this study, and a brief summary of the contents of each chapter.

Background

The growing female veteran population is using more VHA services, making gender-related studies a necessity in the effort to promote equitable access to care (USVARD, 2014). In the clinical realm, health care providers do not treat gender differences, but rather treat one patient at a time: male or female (Institute of Medicine (IOM), 2011). In the research realm, gender differences studies in health services utilization are needed to create health care policies and interventions to promote equitable care (Östlin, Eckermann, Mishra, Nkowane, & Wallstam, 2007). Studying gender differences can also provide “a new perspective in differential susceptibility” (IOM, 2011, p. 6). The current study was designed to give insight into how gender affects VA health care services use in veterans diagnosed with a clinical condition, such as AKI.

AKI is a preventable and treatable condition that is frequently hospital acquired (Chawla & Kimmel, 2012). AKI occurs in approximately 15% of hospitalized patients and 60% of critically ill patients; percentages vary based on the AKI definition used (Wonnacott, Meran, Amphelett, Talabani, & Phillips, 2014). AKI often results from receiving inadequate care while being hospitalized (Lewington et al., 2013). Inadequate care is usually given by untrained clinicians who fail to prevent or treat it effectively

(Lewington et al., 2013). Improper AKI treatments lead to poor patient outcomes such as mortality, CKD, ESRD, and other organ dysfunctions (Lewington et al., 2013). The most severe cases of AKI occur in the hospital (Chawla & Kimmel, 2012), so I focused on the inpatient hospital services utilization for this study. Inpatient hospital services are the services the veteran patients receive while hospitalized at the Veterans Affairs Medical Center (VAMC). No existing studies focused on AKI treatment and outcomes by gender in the veteran population, but the current study highlighted gender disparities that exist in veterans with AKI.

Problem Statement

Women are using VHA services more frequently, which have been historically used by men. Due to the growth of women in the U.S. veteran population, differences in the utilization of VHA services by gender are expected (USVARD, 2014). This increase led to research efforts addressing the use of health services in the VA to detect gender disparities. Gender-related studies on some kidney conditions (e.g., chronic kidney disease) exist. However, these studies have not addressed AKI, which is a commonly occurring kidney ailment, nor have they been conducted on the veteran population. AKI studies on the veteran population exist, yet it is currently unknown how veterans diagnosed with AKI use VHA services by gender. This study was designed to examine gender differences in utilization among hospitalized VA patients (inpatients) diagnosed with AKI.

Purpose Statement

The purpose of this study was to examine differences in health service utilization by gender for U.S. veterans diagnosed with AKI while hospitalized at VAMCs. This study was also designed to examine differences in short-term outcomes, such as length of inpatient stay and inpatient mortality by gender. I also thoroughly described the study population of hospitalized VA patients diagnosed with AKI. Existing VA data were used for this examination. A detailed description of the methodology for this study is provided in Chapter 3.

Conceptual Framework

The conceptual framework for this study was the behavioral model of health services use, also known as the behavioral model of health services utilization. Andersen (1968) developed this framework originally named “the behavioral model of families’ use of health services” to explore why families differ in the volume of medical care they use. In this framework, Andersen suggested utilization of health services consists of predisposing, enabling, and need components. The framework indicates that predisposing factors predict health care use, enabling factors hinder or impede health care use, and need-based factors indicate the need for health care (Andersen, 1995). Sociodemographic factors (e.g., gender, age, race, ethnicity, and socioeconomic status [SES]) are predisposing factors that affect health services utilization (Barton, 2010). Using this framework, I examined how the use of VA health services differed among veterans diagnosed with AKI by gender and by predisposing factors (e.g., age and race).

I chose the behavioral model of health services use as the framework for this study because this framework was used in previous studies addressing gender differences in health service utilization in the U.S. veteran population. Ouimette, Wolfe, Daley, and Gima (2003) used the framework to test the hypothesis that predisposing factors such as age, education, marital status, presence of children in the home, ethnic minority status, years of military service, and branch of service and military rank predicted VA health services use among women veterans (WV). Ouimette et al. (2003) also examined enabling factors such as insurance, income, employment, distance to the VA, and suburban/urban residence, which may hinder VA health service use in WV. Lastly, Ouimette et al. investigated need-based factors such as service-connected mental and physical disabilities indicating the need for VA health service use in WV. Ouimette et al.' (2003) used all of the framework's components but did not explore why male veterans did or did not use VA health services as a comparison to uncover disparities.

Washington, Yano, Simon, and Sun (2006) used the framework to explore the reasons WV did or did not use VA ambulatory care using a cross-sectional survey. Washington et al. examined not only VA ambulatory care utilization, but also sociodemographics (as predisposing factors) and the attitudes and barriers toward using VA ambulatory care (as enabling factors). Like Ouimette et al's study, Washington et al.'s study also did not explore why male veterans did or did not use VA ambulatory care as a comparison to uncover disparities.

Wolfe (2011) used the framework in a retrospective study on VA electronic medical records (EMR) to examine gender differences in VA health service use and physical and mental diagnoses among Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) veterans. Wolfe focused on factors that influenced VA health service use such as predisposing factors like age, sex, race, and marital status, and enabling factors such as service-connected disability. Wolfe also evaluated health status outcomes resulting from VA health service use. Wolfe' uncovered health care utilization patterns by gender in OEF and OIF veterans at one VAMC, but in this dissertation study, I addressed the effect of predisposing factors like gender, age, and race on health care utilization patterns in an inpatient veterans with AKI population sample drawn from a national cohort.

Research Questions and Hypotheses

I endeavored to answer the following research questions and evaluate the corresponding null (Ho) and research (Ha) hypotheses:

- Does gender impact VA health services utilization (e.g., the length of stay [LOS], intensive care unit [ICU] stay, and certain treatments such as dialysis) among veterans with AKI?
    - Ho_1: Gender is not associated with VA health services utilization among veterans with AKI.
    - Ha_1: Gender is positively associated with VA health services utilization among veterans with AKI.
- Do other predisposing factors (e.g., age and race) impact VA health services utilization among veterans with AKI?

  - Ho_2: Predisposing factors are not associated with VA health services utilization among veterans with AKI.
  - Ha_2: Predisposing factors are positively associated with VA health services utilization among veterans with AKI.
- Does gender impact VA short-term health outcomes (e.g., readmission and inpatient mortality) among veterans with AKI?
  - Ho_3: Gender is not associated with short-term health outcomes among veterans with AKI.
  - Ha_3: Gender is positively associated with short-term health outcomes among veterans with AKI.

Nature of the Study

This study was quantitative in nature. I conducted a retrospective cohort study using an existing National VA database to examine differences in health service utilization by gender for U.S. veterans diagnosed with AKI while hospitalized at Veterans Affairs Medical Centers (VAMCs). I examined differences in short-term outcomes, such as length of inpatient stay and inpatient mortality, by gender. I also thoroughly described the study population of hospitalized VA patients diagnosed with AKI.

Sample

The population for this study was veterans diagnosed with AKI at a VAMC in the United States during a 5-year period between January 2008 and December 2013. The sample came from secondary data in an existing National VA Acute Kidney Injury-Chronic Kidney Disease (AKI-CKD) study cohort extracted from the VA Corporate Data

Warehouse (CDW) containing electronic medical records. The sampling strategy was used to accurately reflect the veteran population to obtain valid, usable data (see Mann, 2003).

The sampling design was a stratified random sampling intended to ensure the sample represented the female veteran population (Frankfort-Nachmias & Nachmias, 2008). Stratified random sampling is the best sampling method to use when there are small numbers of a particular group in the study population and representatives from that group may not be selected if using a simple random sample (Cottrell & McKenzie, 2005). I expected a small number of women in the sample for this study, so I chose to use stratified random sampling for this study. The study sample size, effect size, alpha, and statistical power were determined using G*Power 3.1.5 for each research question and the statistical test that corresponded to it (see Faul, Erdfelder, Buchner, & Lang, 2009). G*Power 3.1.5 is a free power analysis software used to determine statistical power and sample size to minimize error (Faul et al., 2009). I conducted an a priori power analysis using G*Power 3.1.5 to determine appropriate sample sizes for specific effect sizes, alpha levels, and power values for the statistical tests used in this study (Farrokhyar, Reddy, Poolman, & Bhandari, 2013).

Data Collection

Before data collection, I obtained institutional review board (IRB) approval from both the VA and Walden University. The VA IRB was a three-step process, requiring approval from the IRB, the research & development (R&D) committee, and the associate chief of staff of research. VA IRB approval was needed to get data use agreements approved for data collection and analysis. This study posed minimal risk because it included data from an existing cohort with no identifiers. Because this study posed minimal risk, I requested an exemption from the full IRB review and requested an expedited review instead. I also obtained IRB approval from Walden University as part of my student research requirement.

I used an existing National VA AKI-CKD study cohort extracted from the VA CDW containing electronic medical records. From this data set, I identified those in the cohort diagnosed with AKI using AKIN along with associated International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes for AKI or acute renal failure as inclusion criteria in my study population (Kidney Disease Improving Global Outcomes [KDIGO], 2012). I excluded those who did not fit the cohort criteria.

Gender was the independent variable while sociodemographic and military service variables (e.g., age, race, marital status, service branch) served as covariates. The health services used while hospitalized with AKI was the dependent variable, which I planned to identify. I determined the health services using inpatient hospital data codes or current procedural terminology (CPT) codes.

Data Analysis

Once those with AKI were identified, the subset criteria were applied to identify participants to analyze the services used during the first hospitalization. The study data covered a 5-year period, so there may have been multiple hospitalizations for the same condition. I focused on data for the first admission for this study during the study period for the analysis, but the number of readmissions due to AKI during the study period were quantified and assessed for the third research question. The study sample size, effect size, alpha, and statistical power were determined using G*Power 3.1.5 for each research question and the statistical test that corresponded to it to minimize error (see Faul et al., 2009). The Statistical Package for the Social Sciences (SPSS 21.0) was used to conduct data analysis inside of the VA Informatics and Computing Infrastructure (VINCI) workspace.

Gender was the independent variable while demographic variables (e.g., age and race) served as covariates. The health services used (e.g., intensive care unit [ICU] stay, dialysis, and length of stay [LOS]) and short-term outcomes (inpatient death and readmissions) while hospitalized with AKI were the dependent variables. I provided a descriptive analysis to describe the study population regarding demographic variables such as age, race, and gender. The descriptive statistics provided the means, standard deviations, frequencies, range of scores, and percentages (Creswell, 2009). Differences in the health services used while hospitalized and short-term health outcomes by gender were measured using independent-sample t test. The differences in the health services used while hospitalized by demographic variables, such as age and race, were measured using multivariate analysis of variance (MANOVA). The significance level was set at $p < 0.05$.

Definitions

Definitions relevant to this study include the following:

Gender differences: The differences that exist between men and women regarding VA health services use and short-term health outcomes (Bertakis, Azari, Helms, Callahan, & Robbins, 2000).

Inpatient: A patient formally admitted to a VAMC with a doctor's order (U.S. Centers for Medicare & Medicaid Services, n. d.).

Non-user: A veteran with a no inpatient admission at a VAMC (Washington, Yano, Simon, & Sun, 2006).

Retrospective cohort study: A research study, also known as a historical cohort, that includes medical records of groups of individuals who are similar but differ by a certain characteristic (for example, veterans with AKI who are male or female) and are compared to a particular outcome (such as health service use) (Song & Chung, 2010).

User: A veteran with a minimum of one inpatient admission at a VAMC (Washington, Yano, Simon, & Sun, 2006).

Utilization: The inpatient services used and treatments given during a VAMC hospitalization with an acute kidney injury diagnosis.

Veteran: A military service member who served in and was discharged from the armed forces (U.S. Department of Veterans Affairs, n. d.).

Assumptions

There were several assumptions in this study. My first assumption was that existing National VA AKI-CKD study cohort data contained accurate and reliable information based on previous studies using the same data set. This assumption was essential because retrospective cohort studies may involve selection bias and misclassification bias (Sedgwick, 2014). The use of reliable data minimizes these biases (Sedgwick, 2014). To limit misclassification bias, I examined patient cases with AKI identified as a primary or secondary procedure in VA inpatients. The National VA AKI-CKD cohort was obtained from the VA's corporate data warehouse (CDW) on VINCI that undergoes internal automated and external quality control scrutiny to make the databases as accurate as possible and useful to researchers, practitioners, and policymakers with minimal need for editing. My second assumption was that the sample obtained from an existing National VA AKI-CKD cohort was representative of the variables necessary for this study. My third assumption was that variables from the data set were valid and appropriate for measuring domains from the conceptual framework. My fourth assumption was that using the stratified random sampling procedure was accurate and truthful to eliminate any potential threats to internal and external validity.

Scope and Delimitations

To answer the research questions and address the research gap, I delimited this study to a national sample of VA inpatients diagnosed with AKI during a 5-year period from 2008 and 2013. The sample selected may not represent all patients in the national VA population, but it is representative of National VA inpatients diagnosed with AKI. Due to this delimitation, the findings of this study had limited external validity and were not be generalizable to other VA patients or veterans but were generalizable to VA AKI patients. The study sample was also delimited to the first hospitalization in the study period for the analysis, but the number of readmissions due to AKI during the study period were quantified and assessed for the third research question. The main strength of this study was the use of a National data set. This data set gave me the opportunity to use complete information regarding health services utilization and sufficient numbers of women and men in the veteran population for a meaningful analysis.

Limitations

This study had several limitations. First, the study findings could not be generalized to all veterans because I included only those with an AKI diagnosis. Furthermore, the study also included veterans who are users of VHA services, and it did not account for veterans who are non-users. Second, the small sample of women in the study was a limitation even though I was using a national dataset. To overcome the small sample limitation, I used a stratified random sampling because it is best sampling method to use when there are small numbers of a particular group in the study population (Cottrell & McKenzie, 2005). Third, the reliance of International Classification of Diseases (ICD) codes and the criteria used to identify or define AKI from the VA dataset may have been subject to misclassification, selection, and reporting bias. To overcome the limitations of administrative coding to define AKI, changes in serum creatinine (SCr) may also be used to identify AKI and staged using the AKIN criterion. Administrative codes were used as supplemental data and not for primary classification.

Significance

Recent gender differences studies in the veteran population focused on mental health and outpatient services use and on veterans who served in either OEF or OIF (Maguen et al., 2010; Maguen, Ren, Bosch, Marmar, & Seal, 2012; Wolfe, 2011). My research added to this existing literature by providing information by gender on a narrowly focused clinical case definition: inpatient services utilization and AKI using a National VA sample. My study was significant because I attempted to identify gender disparities in health services use and short-term outcomes for a particular clinical condition. Examining this gender gap in health services use and outcomes can uncover who accesses care, the type of services used, the frequency of use, and under what circumstances services are used (Barton, 2010). This study contributed to positive social change by identifying gender disparities in health services use and also in patient care and access. The findings from this study may increase VA administrators' and policymakers' knowledge of the significance of gender in VA health services use. This information may assist the VA officials and policymakers in developing and implementing policies, procedures, or universal standards of care across the VA hospitals nationally. The policies, procedures, or universal standards created may promote equal access to health care services, thereby leading to healthier outcomes and higher quality of life in VA patients.

This study focused on the veteran population, so this study's findings were not generalizable to other populations. Regarding health care delivery, there are differences between the VAMC's health care delivery system and other health care delivery systems. This study was socially significant because the methods could be a roadmap for exploring gender differences in health services utilization in other health care delivery systems. Studies on gender differences in health services utilization are needed to create policies and interventions intended to promote equitable care in health care delivery systems (Östlin et al., 2007).

Summary

Chapter 1 introduced the necessity to understand gender disparities in the veteran population in response to the influx of women using VA health services. This section also provided the significance of kidney disease in the veteran population. Gender-related studies on some kidney disease (e.g., CKD and ESRD) in veterans exist, but these studies do not include AKI (Hsu, 2010). AKI is important because it leads to poor patient outcomes if it is not identified early or adequately treated (Lewington et al., 2013). VA researchers have focused on these AKI outcomes but have not explored how health services use and outcomes differ by gender in veterans with AKI (Bydash & Ishani, 2011; Lafrance & Miller, 2010). This study was designed to focus on this research gap.

Chapter 1 included the problem statement, research questions, research hypotheses, the nature of the study, and purpose of the study. Also, Chapter 1 introduced the scientific theories used to guide the study, a definition of terms, limitations and delimitations, scope, and significance of the study. In the literature review found in Chapter 2, I addressed the scholarly literature pertinent to the conceptual framework, gender differences in health service use within the veteran population, and AKI.

Chapter 2: Literature Review

In this literature review, studies about gender and how it affects health services use in veterans with acute kidney injury (AKI) are included. The behavioral model of health services utilization (Andersen, 1968) was the theoretical framework guiding this study. The effect of this model's components (especially predisposing factors) on health services utilization among veterans with AKI was examined in this study. This literature review highlights scholarly literature pertinent to gender differences, AKI within the veteran population, health services utilization in the veteran population, and the theoretical framework.

Search Strategy

The search strategy used for this literature review involved electronic research databases such as MEDLINE, CINAHL, and PubMed. I used broad key words related to my topic and Boolean operators to find relevant literature. The key words included *gender differences*, *veterans*, *VA*, *health services*, *utilization*, *kidney*, *renal disease*, *acute kidney injury*, and *inpatient*. I used scholarly peer-reviewed journals from the last 5 years by limiting the search to publications from 2011 to 2016. I also scanned the reference lists of articles in my literature search to identify additional studies within the publication date range.

Gender Differences

Health care disparities are an important issue documented in many groups across racial/ethnic, gender, and socioeconomic strata (Ersek, Smith, Cannuscio, Richardson, & Moore, 2013). Gender differences in health care service utilization constitute an important health care disparity issue that needs to be explored in more detail to understand this gender gap (Cameron, Song, Manheim, & Dunlop, 2010; Vaidya et al., 2012). This section highlights the studies on gender disparities in health care (e.g., clinic use, diagnosis and treatment, preventive care service use, laboratory test, etc.).

Regitz-Zagrosek's review (2012) focused on articles about sex and gender differences in the most frequently used clinical units (e.g., nephrology). Regitz-Zagrosek found that sex and gender are often used interchangeably by researchers, but argued that these terms are different, with sex differences involving biological factors while gender differences involving behavior, lifestyle, and life experiences. Regitz-Zagrosek noted that gender differences studies are often used to determine differences in access to health care, use of health services, and behavior attitudes of medical personnel. Regitz-Zagrosek concluded that gender medicine and research focusing on sociological and biological aspects was needed to improve men's and women's health.

Kent, Patel, and Varela's (2012) literature review addressed studies on gender inequalities in the diagnosis and treatment of various diseases with high morbidity and mortality in women. Kent et al. found many gender differences in diagnoses and treatment of various diseases despite women using preventive care service more than men. Kent et al. proposed many reasons why these gender biases exist (e.g., the gender of treating physician, patient's SES, disease presentation by gender, and hormonal influence of illness). Kent et al. also suggested ways these gender disparities can be reduced or eliminated with an adept understanding of what was causing these gender differences in diagnoses and treatments. More research focusing on the sociological and biological aspect causing gender disparities in diagnoses and treatments can increase this understanding (Kent et al., 2012; Regitz-Zagrosek, 2012).

In a retrospective cross-sectional study, Vaidya et al. (2012) attempted to identify gender differences in preventive care services utilization using data from the Agency for Healthcare Research and Quality's 2008 Medical Expenditure Panel Survey. Out of 33,066 respondents, 30,629 met the inclusion criteria. Vaidya et al. found that women tended to use preventive care services more than men. The researchers also found that men significantly used blood pressure checks, cholesterol checks, dental examinations, and flu shots less than women. This study's results could help direct efforts to reduce or eliminate gender disparities in preventive care services utilization.

Schroeder, Bayliss, Daugherty, and Steiner (2014) used a retrospective cohort study to compare hemoglobin A1c (HbA1c), low-density lipoprotein (LDL) cholesterol, and blood pressure (BP) levels among men and women with incident diabetes. The researchers made this comparison at the time of diabetes diagnosis for a baseline and a 1-year follow-up after diagnosis. The researchers also explored the effect of age on the relationship between gender and cardiovascular risk factor control and examined disease management as a function of gender during this same period. The study cohort included 6,547 individuals with incident diabetes in an integrated care delivery system drawn from a health maintenance organization's adult diabetes registry. The researchers found at baseline women had lower HbA1c, higher LDL cholesterol, higher systolic BP, and lower diastolic BP compared with men. At follow-up, the HbA1c gender gap had closed, and the gender differences had decreased for BP and LDL cholesterol. These associations varied by age. The researchers concluded that in this cohort of individuals with incident diabetes, men and women had significant differences in risk factor control at the time of diabetes diagnosis that varied by age and decreased over time. The insight in this study's findings prompted me to consider other factors contributing to the differences by gender, such age.

Gender differences have become increasingly important for the VHA due to growth in the number of women veterans (WVs) who receive health care from the VA (Ersek et al., 2013). Differences in the utilization of VHA services by gender are expected because these services have been historically used by men (USVARD, 2014). To better understand these differences, the composition and sociodemographic factors of the veteran population by gender must be known. In the next section, I summarized the veteran population, highlighting the growth in the female segment of the veteran population.

Veteran Population

The Veterans Health Administration (VHA) is the largest U.S. health care delivery system. The VHA consists of 150 medical centers that provide care for over nine million enrolled veterans (deKleijn, Lagro-Janssen, Canelo, & Yano, 2015; U.S. Department of Veterans Affairs, 2014). VHA researchers have worked to identify health care disparities in the veteran population and the factors that underlie these differences (USVARD, 2014). Demographics and determinants of health care utilization in the veteran population are essential in planning services the VA provides to ensure an equitable distribution of VA health services (Wolfe, 2011).

The U.S. Census Bureau collects U.S. veteran data in the American Community Survey. According to the 2013 American Community Survey (U.S. Census Bureau, 2013), there were over 19.6 million U.S. veterans. Of these veterans, approximately 1.6 million (8.16%) veterans were female (U.S. Census Bureau, 2013). The VA-Profile of Veterans: 2013 confirmed these figures (U.S. VA National Center for Veteran Analysis and Statistics [NCVAS], 2015). Although all female veterans may not be eligible for VHA services, the VA must adapt to ensure that equitable, high-quality health care services are given to WVs using VHA services.

The female segment of veterans is the fastest-growing part of the veteran population (USVARD, 2014). The number of women using VHA services has more than doubled in 12 years from 159,630 in 2000 to 362,014 in 2012 (Frayne et al., 2010; Frayne et al., 2014). In contrast, the number of men using VHA services has grown in 12 years from 3,225,712 in 2000 to 5,249,002 in 2012 (Frayne et al., 2010; Frayne et al., 2014). More studies are needed to detect gender disparities in health services use due to the growth of WVs using VHA services and the increasing demand this growth has placed upon the VHA delivery systems (Frayne et al., 2014). The most current characteristics of the veteran population are summarized in Table 1.

Table 1

Characteristics of the Veteran Population

Characteristic	Male	Female
Population numbers (19.6 million total) [a; b]	18 million (91.84%)	1.6 million (8.16%)
Median age (years) [b]	64	50
Race (percent) [b]		
White non-Hispanic	80.0%	66.2%

Characteristic	Male	Female
Nonwhite non-Hispanic	13.0%	25.7%
Hispanic	6.2%	8.2%
Marital status (percent) [b]		
Married	65.8%	49.1%
Divorced	14.6%	23.2%
Widowed or separated	10.0%	11.3%
Never married	9.6%	16.4%
Occupation (percent) [b]		
Management, professional	35.0%	47.2%
Sales, office	18.9%	28.8%
Service	16.3%	16.1%
Production, transportation	15.2%	5.9%
All other	14.6%	2.0%
Worker class (percent) [b]		
Private	65.3%	60.4%
Government	22.9%	35.0%
Self-employed	11.7%	4.6%
Health insurance coverage (percent) [b]		
Private only	28.7%	48.9%
Public only	23.2%	17.2%
Private and public	42.9%	27.2%
No coverage	5.2%	6.8%
Median earnings annually [b]	$51,924	$43,985
In poverty (percent) [b]	6.9%	10.6%
No income (percent) [b]	2.9%	7.6%
Military service period (percent)[b]		
World War II (1941 to 1946)	6.2%	3.7%
Korean War (1950 to 1955)	10.2%	3.5%
Vietnam Era (1964 to 1975)	35.4%	13.9%
Gulf War I	11.7%	23.1%
Gulf War II	12.7%	29.7%
Peacetimes	23.8%	26.2$
Education (percent) [b]		
High school graduate or less	37.6%	21.9%
Some college	36.4%	45.3%
Bachelor’s degree	15.5%	20.4%
Advanced degree	10.5%	12.4%
Has a service-connected disability	18.1%	21.0%
VA health care utilization (percent) [b]	31.0%	27.1%
Only uses VA health care (percent) [b]	9.4%	12.3%
Median age of VA users (years) [b]	64	48

Note. [a] U.S. Census Bureau. (2013). 2013 American Community Survey 1-Year Estimates. Retrieved from http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/13_1YR/B21001 [b] U.S. Department of Veterans Affairs, National Center for Veterans Analysis and Statistics. (2015). *Profile of Veterans: 2013*. Retrieved from http://www.va.gov/vetdata/docs/SpecialReports/Profile_of_Veterans_2013.pdf

Behavioral Model of Health Services Utilization

Health service utilization studies have addressed service use patterns and predictors among patients (Johnsen, 2004). The behavioral model of health services utilization (Andersen, 1968) has guided many health service use studies. This model includes factors associated with health services use and cost studies worldwide in various populations (Babitsch, Gohl, & von Lengerke, 2012; Phillips, Morrison, Andersen, & Aday, 1998; Wolfe, 2011). In this model, Andersen suggested that utilization of health services consists of predisposing, enabling, and need components. The model posited that predisposing factors predict health care use, that enabling factors hinder or impede medical use, and that need-based factors indicate the need for health care (Andersen, 1995). Sociodemographic factors (e.g., gender, age, race, and ethnicity) and socioeconomic status were some predisposing factors that affect health services utilization (Barton, 2010). This section highlights a few reviews and studies that included the model as a theoretical framework.

In a systematic review, Phillips et al. (1998) aimed to determine whether studies using the behavioral model of health services utilization included environmental and provider-related factors as contextual factors. Using the Social Science Citation Index and Science Index, Phillips et al. examined 139 medical care use studies using the model from 1975-1995 to determine whether they included methods used to analyze these factors. The researchers found environmental factors in 45% and provider-related factors in 51% of the studies. Of these studies, 14% addressed health care context by including both factors. Phillips et al. concluded that this systematic review allowed them to highlight contributions made by studies using the model to analyze environmental and provider-related factors as contextual factors.

Using PubMed, Babitsch et al. (2012) reviewed the use and implementation of Andersen's behavioral model of health services use developed in 16 out of 328 studies found between 1998 and 2011 written in English and German. Babitsch et al. discovered that researchers used the model in several health care system areas and on various diseases. Andersen's 1995 model was the version applied mostly in the studies in the systematic review. Most of the reviewed studies included demographic variables (e.g., age, marital status, gender/sex, education, and ethnicity) as predisposing factors and socioeconomic (e.g., income), health insurance, and access to health care variables as enabling factors. As need factors, most studies included health status and self-reported/perceived health on various diseases. The context of the studies and the characteristics had a substantial impact on the utilization of health services. Babitsch et al. concluded that many reviewed studies used the model as the theoretical framework, but the use of secondary data sets in most of the studies limited the variables available causing huge variations in the way these study variables were categorized. This systematic review demonstrated that the use and implementation of the model in studies were significant and should be considered in the study design.

The behavioral model of health services utilization was modified numerous times (Aday & Andersen, 1974; Andersen, 1995). Mengeling, Sadler, Tomer, and Booth (2011) used a modified version of this conceptual framework to guide their study. Mengeling et al. used the modified model to examine, define, and measure equitable access to health care by identifying veterans' preferences and perceptions as a predisposition to use health care services. The model was used in few studies addressing utilization in the veteran population.

Three studies on the U.S. veteran population included the model as a theoretical framework. In the first study, Washington et al. (2006) used the model as a theoretical framework to guide their investigation of veteran demographics, health status, and diagnoses as predictors of medical use. Ouimette et al. (2003) also used the model to describe factors associated with VA health services use. Ouimette et al. examined predisposing factors (e.g., age, education, marital status, the presence of children in the home, ethnic minority status, years of military service, and branch of service and military rank) as predictors of VA health service use. Ouimette et al. also looked at the following enabling factors that may hinder VA health service use: insurance, income, employment, distance to the VA, and suburban/urban residence. Lastly, they investigated service-connected mental and physical disabilities as need-based factors as predictors of VA health service use.

In the third study, Wolfe (2011) used the model as the theoretical framework in a retrospective study design on VA electronic medical records (EMR) to examine differences in VA health service use and physical and mental diagnoses. Wolfe (2011) focused on factors that influenced VA health service use such as predisposing factors like age, sex, race, and marital status and enabling factors such as service-connected disability. Wolfe (2011) also evaluated health status outcomes resulting from VA health service use. Wolfe (2011) indicated the categories of health service utilization as the type, size, purpose, and time interval involved. Wolfe (2011) also examined four measures of utilization: outpatient services provided, health services utilization rates, unit of analysis for the use of health services, and outcome measure of evaluated health status (e.g., health diagnoses). The use of the behavioral model of health services utilization in these studies was taken into account in the methods for this study.

Health service utilization studies examining access, quality, service patterns, and service among WVs increased with the population growth. In this section, I presented studies using the behavioral model of health services utilization (Andersen, 1968) as a theoretical framework analyzed factors (e.g. predisposing, enabling and need-based) associated with health services use. The next section focused on several studies analyzing factors related to WV use of VHA services use.

Women Veterans Research on Utilization of VA Health Services

Health care access, use, and quality of WVs have become VA priorities (Bastian, Bosworth, Washington, & Yano, 2013). These priorities resulted from the current and projected growth of WVs in the VA population. Approximately 7% of current VA users are female, but this number was expected to increase to 18% by 2040 (deKleijn, Lagro-Janssen, Canelo, & Yano, 2015; Yano, Haskell, & Hayes, 2014). Timely access to and quality of health care were also essential aspects of the VA’s commitment to ensuring the best health outcomes in WVs (Washington, Bean-Mayberry, Riopelle, & Yano, 2011).

VA's commitment to ensuring that WVs have access to care and health care needs are being met challenged the VA to deliver care in a gender-sensitive environment (deKleijn et al., 2015). WV's health care research efforts grew in response to population growth and to uphold this commitment. Despite the VA's efforts, WVs health care access and needs still lagged behind that of men because of this increasing demand also caused by population growth (deKleijn et al., 2015). Currently, WVs seek multiple visits and care outside the VA to achieve the care men receive in one visit (Yano et al., 2014). Many studies have been conducted to examine health care access and quality of care, but few studies focused on why WVs choose to and not to utilize VA health services.

Bean-Mayberry et al. (2011) conducted a systematic review of literature published from 2004 to 2008 that included 195 articles. The reviewed studies were mostly observational with a detailed analytic approach to examine the determinants of care or health (Bean-Mayberry et al., 2011). Out of the 195 articles that Bean-Mayberry et al. (2011) reviewed, 48 articles focused on access to care and services use. Twelve articles focused on determinants of access, 14 on gender-related issues in access, six on sexual trauma patients and utilization, and 11 on posttraumatic stress disorder (PTSD) or other mental health use. Five additional studies focused on access and health service use among particular cohorts of veterans related to periods of military service (e.g., OEF/OIF). Overall, the researchers found that WVs with mental health diagnoses, positive screening tests, or trauma were more likely to use more health care services than women without positive diagnoses or screenings or than male veterans.

The findings from Bean-Mayberry et al.’s (2011) systematic review were mixed, which indicate that some VA patients may underutilize health care service due to particular mental health issues. This review of 195 articles was consistent with a previous study’s findings (Goldzweig, Balekian, Rolón, Yano, & Shekelle, 2006). Goldzweig et al.’s (2006) review identified nine studies that dealt with health needs and utilization in the veteran population in general and 25 articles related to utilization and health care organization with 60% examining national samples of veterans. Both studies presented research studies emphasizing access, use, and quality of care in WVs as significant gaps in the literature (Bean-Mayberry et al., 2011).

Since utilization studies in WVs were one of the key deficiencies in the literature (Bean-Mayberry et al., 2011), I devoted the rest of this section to WV’s research focusing on utilization of VA health services. Despite the recent improvements to access to health care, WVs still underutilized VA health care compared to men (Washington, Bean-Mayberry, Riopelle, and Yano, 2011). Eliminating this disparity involves acquiring a better understanding of the WV’s health care experience, e.g., by examining the utilization patterns. The following studies present methods used to gain an understanding of WV’s utilization patterns.

In this cross-sectional study, Mengeling et al. (2011) sought to identify veterans’ health care preferences and perceptions regarding their use of VA health services. The researcher conducted computer-assisted telephone interviews on 1,002 VA-enrolled Midwestern veterans. The researchers found that single and dual users of VA care tended to serve in military combat, have PTSD diagnosis, and have worse physical health than non-VA users. They also found that both types of VA (sole and dual) users trusted that the VA provided enough privacy and safety during outpatient examinations compared with non-users. Urban WVs were more likely to advocate particular environmental care preferences (e.g., gender-specific waiting areas). Rural WVs were less liable to endorse particular care choices. Researchers concluded that veterans' medical options were similar despite VA use, but VA health care perceptions varied. The VA-only WVs users had more positive VA health care attitudes than dual users and non-VA users.

In a cross-sectional study, Washington, Bean-Mayberry, Hamilton, Cordasco, and Yano (2013) aimed to identify WVs health care use and delivery preferences by military service era for program design and patient-centeredness purposes by surveying 3,611 WVs nationally. Washington et al. (2013) found differences in health care service use by military service era. For example, WVs, who served in World War II and Korean War, used specialty care more, and those who served in the Vietnam War to present periods used more women's and mental health care. WVs who served in OEF, OIF, and Operation New Dawn (OND) had more health care visits than those who served in previous military eras. The researchers also found differences in health care delivery preferences by military service era. Location convenience was the health care delivery concern for Vietnam and earlier WVs. The cost was a health care delivery was a concern WVs who served in OEF, OIF, and OND. Gynecology and general health care services at the same location were some critical health care delivery preferences of WVs serving in all military service eras. Washington et al. (2013) concluded the study findings showed the importance taking health care preferences into account for patient-centeredness purposes to ensure efficient health care delivery and use.

Washington, Yano, Simon, and Sun (2006) sought to determine why WVs use or do not use VA health care using a cross-sectional telephone survey of 2,174 WV users and non-users throughout southern California and southern Nevada. Washington et al. (2006) found the top reasons why these WVs used the VA included affordability, women's health clinic (WHC) availability, the quality of care, and convenience. The researcher also found the top reasons why these WVs choose non-VA health care facilities included having insurance, the convenience of care, lack of knowledge of VA eligibility and services; and the belief of better quality of care. Washington et al. (2006) concluded that lack of information about VA, perceptions of VA quality of care, and inconvenience of VA care kept many WV from using VA health services.

Using 1,500 WVs from the VA National Registry of WVs (NRWV), Ouimette, Wolfe, Daley, and Gima (2003) investigated characteristics (e.g. demographics, socioeconomic status, and health status) associated with WVs use and non-use of the VA health care system. Ouimette et al. (2003) found an association between VA health service use and older age, more education, being unmarried, little insurance coverage, and poor physical and psychological health. The researchers also found that former WVs using VA health care tended to be from an ethnic minority group, have children in the home, served less military time, have better insurance coverage, and better health than current VA users. They also found an association existed between combative military experiences and former- and non-use. Ouimette et al. (2003) concluded the WVs, who are

VA users, are at greater economic, social, and health risk than non-users. This study's findings showed that WVs using VA health services are those that need it the most.

Gender Disparity Research on Health Care Utilization in the Veteran Population

Borrero, Kwoh, Santorius, and Ibrahim (2006) conducted a study investigating gender differences in utilization rates of knee/hip arthroplasty in the VA system. Borrero et al. (2006) used the fiscal year (FY) 1999 data from the VA's National Patient Care Database (NPCD) to identify veterans over 50 years old, with or without an osteoarthritis (OA) diagnosis in any joint. Within the 1,968,093 veterans (2.3% of whom were WVs) applicable to the study criteria, 329,461 (2.9% women) VA patients had an OA diagnosis. The researchers concluded that no significant gender differences existed in the VA system among veterans who had a knee/hip arthroplasty. Gender differences in knee/hip arthroplasty utilization rates were explored in differences, so gender differences in utilization may also exist for a medical condition, such as AKI.

In a retrospective cohort study, Duggal et al. (2010) examined gender differences in VA outpatient health care services utilization. The study consisted of 1,620 OEF/OIF veterans at one VA facility. Duggal et al. (2010) hypothesized that women had higher VA outpatient health services utilization rates than men among OEF/OIF veterans. The researchers found that WVs using VA outpatient health services were young, single, and non-white. Additional findings specified that after the initiation of care, gender differences in the number of outpatient visits over time did not exist. The researchers concluded that recently discharged WVs tended to seek VA health services than recently discharged men veterans, which indicates a need for more comprehensive gender-specific VA outpatient care services.

In an observation study, Haskell et al. (2010) used VA administrative and clinical databases to describe gender disparities in medical and mental health conditions and health service use in 163,812 OEF/OIF veterans using VA health services during the first year of their last deployment. Haskell et al. (2010) found that WVs using VHA services within the first year of their last deployment tended to be younger, African American, and single than male veterans. The researchers also found that WVs had more primary care and mental health visits and used care outside the VA more than their male counterparts.

In a cross-sectional study, Frayne, Yano, Nguyen, Yu, and Ananthl (2008) sought to determine if changes in gender differences in VA health care utilization and cost exist after accounting for veteran status. The study population consisted of 4,429,414 VA users in FY 2002 data from the VA NPCD outpatient and inpatient records. Frayne et al. (2008) found that over half of the non-veteran enrollees (50.7%) were women employees, and only 3.0% were men. The researchers also found that VA health care utilization and cost were lower in women than in men overall. Among VA health service users, these differences decreased for the use and cost of inpatient care and increased the utilization and cost of outpatient care. VA health care utilization rates and cost were low among women employees. The utilization rates and costs of women spouses of fully disabled veterans were similar to those of WVs. The researchers concluded that gender differences in VA health care utilization changed substantially when veteran status is taken into account. This study’s findings indicated that veteran status should be considered when using a cohort including WVs from VA databases (Frayne et al., 2008). This methodological consideration prevented underestimations of the health care needs of WVs and other women receiving VHA care and ensured the methodological rigor of the growing VA health gender equity literature (Frayne et al., 2008).

In a retrospective study, Davis, Deen, Fortney, Sullivan, and Hudson (2014) aimed to provide additional insight into potential disparities in care among this subset of VA users. Davis et al. (2014) explored ethnic and gender differences in VA primary care and mental health care services utilization among OEF/OIF veterans with depression. The study population consisted of 1,556 OEF/OIF veterans diagnosed with depression treated in medical facilities one Veteran Integrated Services Network (VISN) in the south-central region of the United States between January 2008 and March 2009. Data collection was from a network-wide VA data warehouse, drawing demographic and utilization data from the VA's EMR called the Computerized Patient Record System (CPRS). Health service use patterns were examined 90 days following the diagnosis of depression.

Davis et al. (2014) found no ethnic and gender differences in mental health treatment and services use, but WVs used primary care more male veterans. This finding dispelled historically documented VA health care use disparities in mental health and primary care treatment and services. This study was the first to examine the interaction of gender, ethnicity, and VA service utilization among OEF/OIF veterans with depression. The researchers found few differences in service use, especially in the use of VA mental health services, which are promising given the frequency of psychological disorders among returning veterans. Although progress has been made in the equity of seeking VA health care, disparities still existed. These study results confirmed that the VA is making progress toward decreasing historical differences in health care utilization.

In an observational study, Wooten et al. (2013) examined gender differences in substance use diagnosis (SUDX) and substance use treatment (SUT). The study population consisted of 152,447 (137,814 men and 14,663 women) Army service members returning from deployment in FY2010. Data collection was from the military health system data (e.g., the Defense Eligibility and Enrollment Service (DEERS) file, Contingency Tracking System (CTS), Department of Defense (DoD) Military Health System Data Repository). This study found gender differences in SUDX and SUT in the year before deployment. The underlying factor leading to this finding remained unclear. Wooten et al. (2013) concluded these disparities result from access to care gaps or a lack of gender-sensitive evaluation and treatment procedures.

In a cohort study, Chatterjee et al. (2009) compared differences in utilization of VHA outpatient and specialty mental health services between men and women in FY 1999. The researchers examined whether gender, age, and diagnostic categories contributed to differences in VHA outpatient and specialty mental health services use. The study tracked 782,789 veterans with a mental health or substance abuse (SA) diagnosis and, at least one, VHA outpatient visit in the VA’s NPCD. Chatterjee et al. (2009) found that younger WVs tended not to use any VHA mental health services compared to men and older WVs, whereas older WVs tended to use any VHA mental health services more than men veterans. The researchers also found similar findings for SA, mood, and anxiety disorders diagnoses except for PTSD, bipolar, and psychotic disorders, where WVs tended not use these services more than men. Chatterjee et al. (2009) concluded that WVs tended to underutilize VA mental health services compared to men, but this utilization varied when taking age and diagnosis into account. Chatterjee et al. (2009) stressed that is important that many factors need to be considered when examining differences to provide an adequate picture of WVs' health service needs.

In a cohort study of veterans at high cardiovascular disease (CVD) risk, Goldstein et al. (2014) examined differences in CVD risk factor control by gender and race. After inclusion and exclusion criteria, the study consisted of 24,965 (23,955 men and 1,010 women) veterans. Goldstein et al. (2014) ran an analysis of variance (ANOVA) to examine differences by gender and by race on three CVD risk factors values, such as LDL (low-density lipoprotein), blood pressures (BPs), and hemoglobin A1c (hA1c) levels. Goldstein et al. (2014) found that WVs had higher LDL values than men veterans. African-American veterans had higher BP values than White WVs. BP and LDL values and hA1c levels were worse in African-American veterans than White veterans, with significant differences in men. Gender and racial disparity studies, such as this one, raised awareness of factors that contribute to disparities and help in intervention development.

In a retrospective cohort study using national VA Clinical Assessment, Reporting, and Tracking (CART) Program data, Davis et al. (2015) evaluated sex differences among veterans undergoing an initial diagnostic catheterization. The study found some sex differences existed among undergoing catheterization. After inclusion and exclusion criteria, the study consisted of 85,936 veterans (3,181 WVs) who underwent an initial diagnostic catheterization between October 2007 and September 2012 at any of the 77

VA catheterization laboratories. The researchers ran statistical analyses to determine sex differences in demographics, clinical characteristics, comorbidities, coronary anatomy, cardiac treatments, procedural complications and long-term outcomes after the diagnostic catheterization. They found WVs to be younger with fewer CVD risk factors than men, but with more obesity, depression, and PTSD. WVs also had lower rates of obstructive coronary artery disease than men. Rates of procedural complications and long-term outcomes were similar in both genders. The study findings displayed some sex differences existed among veterans undergoing catheterization providing insight into some clinical implications for practitioners.

In a retrospective study, Maguen et al. (2012) examined mental health service use by gender for outpatient, inpatient, primary, and emergency care in 159,705 OEF/OIF veterans diagnosed with PTSD. The researchers also investigated service use rates among these veterans, who also had depression and alcohol use disorders (AUD), by gender. Using VA OEF/OIF roster data, Maguen et al. (2012) identified OEF/OIF veterans diagnosed with PTSD with at least one VA clinical visit between October 7, 2001, and December 31, 2010. Maguen et al. (2012) found women veterans (WVs) with PTSD tended to be single, Black and had higher mental health service use in primary and emergency care than men veterans with PTSD. The researchers also found that male veterans had higher inpatient mental health use than WVs. The researchers also noticed that veterans having comorbid PTSD with either depression or AUD used all four care types compared to those with just PTSD only. They also observed WVs, who had comorbid PTSD and depression, had greater inpatient hospitalizations for mental health care than WVs without depression and men veterans who had comorbid PTSD and depression (Maguen et al., 2012). Maguen et al. (2012) concluded that more research is needed to increase knowledge in gender disparities in health service use.

In a retrospective, cross-sectional study, Haskell et al. (2010) investigated EMRs to see if there were gender differences in stress-related conditions and pain scores exist. The EMRs consisted of 1,129 OEF/OIF veterans (1,032 men, 197 women) using primary care or women's clinic services in a VA Healthcare System in Connecticut between 2001 and 2006. The researchers used text-processing techniques to retrieve VA clinical reminder screening data to evaluate these OEF/OIF veterans. This procedure was done to reveal the degree of positive screens for stress-related conditions and pain in OEF/OIF WVs. Haskell et al. (2010) found that WVs tended to test positive for stress-related conditions (e.g., military sexual trauma (MST) and depression) but not for PTSD. The researchers found no significant differences in pain scores by gender. Male veterans had a body mass index (BMI) compared to WVs. The researchers concluded that gender disparities existed in positive screening occurrences for stress-related conditions (e.g., MST, depression, obesity, and PTSD), which was necessary information for providing gender-specific care.

In this retrospective, cross-sectional study, Maguen, Ren, Bosch, Marmar, and Seal (2010) examined gender differences in socio-demographic and military-related characteristics of veterans with depression and PTSD. This investigation using VA administrative data consisted of 329,049 OEF/OIF veterans diagnosed with depression and PTSD visiting a VA facility between April 1, 2002, and March 31, 2008. Maguen et al. (2010) found that WVs tended to be young, Black and diagnosed with depression more than male veterans. They also found that male veterans tended to have PTSD and AUD diagnosis more than WVs. An association existed between older age and a higher PTSD and depression diagnoses occurrences among WVs. Maguen et al.'s (2010) findings highlighted the importance of including young and diverse WVs in all OEF/OIF veterans' studies to adequately identify the needs and barriers affecting prevention and treatment services in this group.

In a cross-sectional study, Vimalananda, Miller, Palnati, Christiansen, and Fincke (2011) compared lipid-lowering therapy in veterans with diabetes and hyperlipidemia. This gender comparison was made among these veterans using VHA services in 2006. Vimalananda et al. (2011) found that WVs had greater LDL levels and tended not to receive or initiate lipid-lowering therapy than men veterans. This difference was significant for receiving or initiating lipid-lowering therapy in the young WVs less than 45 years old (Vimalananda et al., 2011). Vimalananda et al. (2011) concluded that WVs with diabetes and hyperlipidemia received invasive lipid-lowering therapy less than men. This difference was important because early interventions to control diabetes and hyperlipidemia can reduce the burden of cardiovascular disease (CVD) in WVs later (Vimalananda et al., 2011).

In a cross-sectional analysis, Sambamoorthi, Mitra, Findley, and Pogach (2012) measured the extent to which gender differences in poor lipid control among 527,568 veterans (516,986 men, 10,582 women) veterans using VHA facilities individuals at risk for CVD using patient-level characteristics. Sambamoorthi et al. (2012) used merged

VHA and Medicare claims data for the FY 2002 and 2003. Sambamoorthi et al. (2012) found that WVs tended to have poor lipid control than men, which was mostly explained by age, ill health, medications use, and depression. Some characteristics were modifiable, so individual characteristics contributed little to these gender differences. Sambamoorthi et al. (2012) also found that increasing lipid-lowering drugs prescriptions and treating depression among WVs can partially reduce gender disparities in lipid control. Sambamoorthi et al. (2012) concluded the largest part of the gender gaps in lipid control is unknown due to additional risks factors that have not been identified.

Using a mixed retrospective chart review and survey study design, Ersek, Smith, Cannuscio, Richardson, and Moore (2013) evaluated differences in end-of-life (EOL) care quality by gender for 36,618 VAMC patients nationwide who died in VAMCs nationwide between July 2008 and June 2011. Ersek et al. (2013) found that receiving the best EOL care (e.g., treatment goal discussions, palliative and bereavement consults, and chaplain contact) did not differ significantly by gender. The researchers also found that family members of WVs reported the overall care provided as *excellent* more than the family of men veterans. Ersek et al. (2013) concluded that WVs received equal and in some areas better EOL care quality than male veterans.

Using a retrospective study design, Wolfe (2011) examined gender disparities in outpatient health service use and physical and mental diagnoses among 4,080 OEF/OIF veterans enrolled at a central Mississippi VAMC. The researcher found that most OEF and OIF veterans did not use VHA services and that gender does not influence outpatient service use. Among those that did use VA health services, WVs tended to use them more than men veterans. These WVs tended to be young, Black, and unmarried compared to men veterans. OEF and OIF veterans with a service-connected disability used VHA services more, regardless of gender. Wolfe (2011) focused on differences in outpatient health service use by sex among veterans from the OEF and OIF military service eras, so the study findings could not be generalized to the entire veteran population. This study provided a detailed view of health care utilization patterns in a particular group of veterans at one VAMC.

In a secondary analysis, Montgomery and Byrne (2014) compared veterans' VA health and behavioral health services use by gender following a homeless episode and assessed the relationship between veterans' use of ordinary versus VA homeless programs. Montgomery and Byrne (2014) performed statistical analyses on administrative data from various sources, finding that veterans used both mainstream and VA homeless services equally by gender. Montgomery and Byrne (2014) also found little gender differences in inpatient services use after a homeless period. Male veterans used substance abuse, outpatient treatment, and emergency services more than WVs. Veterans, who sought non-VA homeless services, tended to access emergency services but not outpatient treatment. Montgomery and Byrne (2014) concluded that homeless veterans who were not using VA programs did not use preventive or behavioral VA health care, so measure must be taken to educate them about such care. Montgomery and Byrne (2014) also concluded that more research is needed on veterans, who are homeless, not identified as such by VA, particularly women.

Gender Disparity Research on Kidney-Related Conditions

Gender influences the incidence, prevalence, and progression of kidney disease (Silbiger and Neugarten, 2008; Silbiger, 2011). Carrero's (2010) systematic review discussed gender and sex disparities in CKD, which is an AKI risk factor and outcome. These variations included differences in risk and hormonal factors, medications, and therapy responses, which all potentially influence the predisposition, progression, biological, chemical, and psychological aspects of CKD (Carrero, 2010).

Silbiger and Neugarten's (2008) review examined relevant studies on both animals and humans assessing gender's role play in kidney disease progression to uncover the underlying the effect of gender. Silbiger and Neugarten (2008) found that in several renal diseases, such as polycystic kidney disease, a few neuropathy conditions, and chronic renal disease of unknown cause, the advancement to end-stage renal failure was faster in men than women. Silbiger and Neugarten (2008) indicated diet, kidney size, and sex hormones as factors leading to diabetes and kidney disease disparities. In some of the animal-related studies involving renal disease, estrogens slowed the renal disease progression rate. Silbiger and Neugarten (2008) identified several studies that evaluated the influence of estrogen on human renal function but concluded that further studies assessing the effects hormonal factors have on the gender disparities in kidney disease progression are needed.

Silbiger's review (2011) also examined both animal and human studies focusing on the effect gender had on the progression of renal disease. Silbiger (2011) found that females exhibit simpler development of kidney disease than males. Silbiger (2011) noted that sex hormones (e.g., estrogens and testosterone) are culprits this gender disparity. The researcher mentioned a study exploring the direct effects of sex hormones on a kidney cell's life in the estrogen receptor knockout (ERKO) mouse (Silbiger, 2011). Silbiger (2011) stated that in that study, testosterone induced and estradiol hindered kidney cell damage. Silbiger (2011) emphasized the need for more studies examining the effects of sex hormones on renal disease progression.

In a prospective, observational cohort study, Yu, Katon, and Young (2015) evaluated relationships between sex and CKD in 1,464 diabetic patients with a normal renal function using primary care clinics. Yu et al. (2015) found that CKD incidence rates were higher for women than men. Yu et al. (2015) also found that women had a greater incident CKD risk than men after adjusting for demographics, baseline estimated Glomerular Filtration Rate (eGFR), and diabetes duration. This risk continued after additional adjustments. Yu et al. (2015) also found sex disparities in incident CKD were constant across age groups and caused by variations in low eGFR development.

In a special editorial, Norris and Nissenson (2008) indicated CKD as a national public health problem that is affected by many factors (e.g., gender, race or ethnicity, and socioeconomic status) causing inequities in incidence, prevalence, and complications. The existence of these health inequities provided opportunities to gain an understanding of factors cause them to improve clinical outcomes (Norris & Nissenson, 2008). The researchers presented recent studies documenting efficient health care systems that have reduced many CKD-related disparities and improved patient outcomes (Norris & Nissenson, 2008). Norris and Nissenson (2008) concluded that the health care systems could become global leaders in medical technology, health promotion, and prevention of CKD.

In a random effects meta-analysis, Nitsch et al. (2013) assessed the associations of eGFR and albumin-creatinine ratio (ACR) levels by gender for mortality, in general, cardiovascular (CV)-related mortality, and ESRD. The study consisted of 2,051,158 participants in cohorts from five continents divided into three groups: general population, high-risk, and CKD. Nitsch et al. (2013) found that men had greater all-cause and CV mortality risks at all eGFR and ACR levels. In both sexes, lower eGFR and higher ACR were linked to an increased risk. The researchers found no sex differences linked to eGFR and urinary ACR with ESRD risk (Nitsch et al., 2013). Nitsch et al. (2013) concluded that both genders faced increased all-cause mortality, CV mortality, and ESRD risks with lower eGFR and higher ACR levels.

Acute Kidney Injury

Acute kidney injury (AKI), also known as acute renal failure (ARF), is defined as a sudden decrease in kidney function (Palevsky, 2012; Belcher & Parikh, 2015). The sudden decrease in kidney function was denoted by a decline in glomerular filtration rate (GFR) causing urea and other chemicals to accumulate in the blood (Kellum, Unruh, Murugan, 2011). The associations AKI has with morbidity, mortality, and health care costs are significant (Belcher & Parikh, 2015). Since there is no standardized definition of AKI, the AKI incidence rate depends on the definitions or criteria used. The estimated AKI incidence rate for hospitalized patients is 5-10% depending on the definitions or criteria used (Palevsky, 2012). AKI is becoming more common, increasing almost 20-

times over the past quarter century (Palevsky, 2012). In an editorial, James and Wald (2014) indicated the AKI population-based incidence in the U.S. grew from 3000 to 5000 occurrences per million person-years during the past two decades. The mortality rate increases with the decline of kidney function because the kidneys are the functional organ responsible for maintaining many different homeostatic conditions (Murugan & Kellum, 2011). Approximately two million people worldwide die yearly because of AKI (Murugan & Kellum, 2011). Ronco and Chawla (2013) mentioned that the absolute number of AKI-associated deaths in the U.S. more than doubled in a decade (2000-2009) from 18,000 to approximately 39,000.

With the dramatic increase in AKI incidence in the past twenty years, Siew and Davenport's review (2015) explored this growth, along with its potential contributors, in North America and Western Europe. The researchers concluded that growth in AKI incidence increased workload-related patient outcomes and health care costs, which remains a challenge for the medical community. They also mentioned several ways to reduce the AKI burden, including identifying ways to prevent, treat, and reduce the impact of this condition. Belayev and Palevsky's review (2014) scanned study over the past five years demonstrating a link between AKI and CKD. Out of all the studies scanned, the causality of developing of CKD after AKI could not be established because AKI risk factors are independent of the risk for developing of CKD.

AKI Definitions/Criteria

There are three criteria used to define AKI severity:

- Risk, Injury, Failure, Loss, and End-stage (RIFLE),

- Acute Kidney Injury Network (AKIN), and
- Kidney Disease: Improving Global Outcomes (KDIGO) (Palevsky, 2012; Belcher & Parikh, 2015; Lewington, Cerdá, & Mehta, 2013).

The RIFLE criterion groups AKI into three severity stages (Risk, Injury, Failure) and two outcome stages (Loss and End-stage) (Palevsky, 2012). The RIFLE stages depend on the change in SCr, duration in the reduction of urine volume (oliguria or little urine), and length of kidney failure (Palevsky, 2012). The AKIN criterion revised RIFLE by defining AKI as a 50% escalation in SCr within 48 hours. In AKIN, the Risk, Injury, and Failure stages of RIFLE become stage 1, 2, 3. The AKIN criterion also drops the two outcome stages (Loss and End-stage) (Palevsky, 2012; Belcher & Parikh, 2015; Thomas et al., 2015). The KDIGO criterion is a combination of RIFLE and AKIN. The KDIGO criterion modifies stage 3 AKI to include any rise in creatinine (Thomas et al., 2015). Thomas et al. (2015) concluded that these AKI definitions/criteria did not function differently but were used differently in practice.

With the emergence of the AKI definitions and criteria, such as RIFLE, AKIN, KDIGO, Ostermann and Chang (2011) compared the performance of these AKI definitions and criteria by applying them to 41,972 ICU patients. They found that AKI incidence and outcomes varied depending on the definitions and criteria used. RIFLE and AKIN yielded similar total AKI occurrences but different AKI rates and outcomes for the individual AKI stages. They also found mortality rates among these various AKI stages differed depending on the definitions and criteria used and an independent association with mortality using multivariate analyses. The researchers concluded that the AKI definitions and criteria correlated concerning AKI severity and outcome. The AKI definitions and criteria have limitations and the potential to miss positive AKI patients, which need to be considered when determining which AKI definitions and criteria to use in clinical practice.

Reviews on AKI

This section presents several recent reports about AKI. In the first review, Srisawat and Kellum (2011) examined current information about the definition, classification, and epidemiology of AKI. The researchers highlighted the recent AKI epidemiological advances in and outside the ICU. They also suggested future directions for AKI prevention and management.

Rewa and Bagshaw's review (2014) also provided an overview of the evolution of AKI epidemiology, outcomes, and economic implications, along with reiterating the AKI definitions. Rewa and Bagshaw (2014) concluded that the increasing AKI incidence is due in large part to a higher prevalence of liabilities and exposures to modifiable risks during hospitalization. Rewa and Bagshaw (2014) found a linkage between AKI and an increased adverse outcomes risk. These adverse outcomes include mortality, CKD, ESRD, reduced health-related quality of life (HRQL), and an overconsumption of health care resources, which leads to a negative economic impact. Additional research is needed to improve these outcomes.

Murugan and Kellum's review (2011) discussed AKI epidemiology, pathogenesis, treatment, and prognosis and described the role of biomarkers in AKI diagnosis and management. To accurately diagnose AKI, a standardized set of criteria was determined to measure glomerular function as a result of urine production and SCr level changes, and together they formed the RIFLE criterion (Murugan & Kellum, 2011). The development of the RIFLE criterion was instrumental in providing a consistent standard for measuring the degree of AKI. It was further modified by the AKIN in 2005 to include a significant patient subset that had decreased renal function more pronounced than substantial variation but not enough to meet RIFLE criterion as a result of early or mild AKI (Murugan & Kellum, 2011). Despite research efforts in detection, diagnosis, and treatment, AKI survivors acquired long-term risks for developing CKD and ESRD, and no effective cure existed (Murugan & Kellum, 2011).

Since AKI is a serious global health problem (Kam Tao Li et al., 2013), Grams et al. (2015a) conducted a collaborative meta-analysis to quantify AKI risk associated with variables, such as eGFR, ACR, and demographics (e.g., age, sex, and race). This study consisted of thirteen study cohorts from eight different counties yielding 1,364,568 participants. Grams et al. found that 16,480 (1.3%) general population and 2,087 (2.6%) CKD cohort participants had AKI after a one-year. Grams et al. also found low eGFR and high ACR values were linked to AKI. The researchers also found a linkage between old age and high AKI risk. Grams et al. also observed that males and African Americans had a higher AKI risk. The AKI linkages with demographics variables were reduced by low eGFR and high ACR values. The researchers concluded that low eGFR and high ACR values are active AKI risk factors that weaken the AKI linkage with age, sex, and race.

AKI Awareness and Prevention

AKI leads to poor patient outcomes if it is not identified early or adequately treated. By writing an article, Lexington, Cerdá, and Mehta (2013) wanted to change this by provided a rationale and proposal for an approach to raising awareness of AKI incidence and consequences. Their goal with this article was to improve timely detection, treatment, and management of AKI and to emphasize the need for collaboration among those involved in the care of AKI patients. The researchers mentioned that fractured, unsuccessful approaches hinder efforts addressing AKI and offered recommendations for adaptable efforts to address AKI at both practical and policy levels (Lexington, Cerdá, & Mehta, 2013).

Ronco and Chawla's article (2013) expressed ways to increase AKI awareness and prevent it. The researcher mentioned several factors must be accounted for in preventing AKI, which include population demographics (e.g., age, race, and gender), comorbidities, and the use of cardiac catheterization and mechanical ventilation. AKI is due to both modifiable and non-modifiable and no validated treatments for it. AKI can be managed using dialysis and other therapies if given in a prompt manner. These treatments do not repair any organ damage caused by AKI. Therefore, prevention of and early intervention for AKI are critical. Ronco and Chawla (2013) pushed for an AKI public awareness campaign to bring attention AKI's impact on the mortality and morbidity of hospitalized patients.

Since AKI occurs more frequently in hospitalized patients, Hoste and Schurgens (2008) provided a literature review on AKI epidemiology in hospitalized patients, emphasizing intensive care unit (ICU) patients. Hoste and Schurgens (2008) mentioned that the lack of standard AKI definitions/criteria hindered valid AKI epidemiological comparisons and evaluations. With RIFLE, the population incidence of AKI and ARF has been captured, along with the impact of those needing renal replacement therapy (RRT) treatments (Hoste & Schurgens, 2008). Hoste and Schurgens (2008) also indicated that the effects of AKI and ARF on outcomes, such as length of stay (LOS), mortality, and ESRD, have also been captured. AKI occurs more frequently in Intensive Care Unit (ICU) patients. Rising AKI and RRT rates led to worse patient outcomes. These patient outcomes included an extended LOS, which is an important economic outcome, and mortality. Hoste and Schurgens (2008) concluded that an association exists between increasing AKI severity and in-hospital death, with 50-60% of deaths associated with RRT treatments.

Disparities in Those With Acute Kidney Injury

The worldwide AKI incidence is unknown because of underreporting, disparities, and various definitions and criteria (Cerdá et al., 2008). Knowledge of AKI incidence, risk factors, and disparities is essential in planning and developing efforts to detect and treat it effectively (Cerdá et al., 2008). The studies presented in this section focused disparities in those with acute kidney injury. One centered on the health care delivery and outcomes, and the other one focused on racial disparities.

Abraham, Thompson, Bodger, and Pearson (2012) used all of England's hospital information to identify emergency patients, where AKI contributed to their hospital stay to examine inequalities in workload and outcomes of care. Abraham et al. (2012) utilized

International Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) codes to capture admission diagnosis and applied a set of rules to identify AKI in emergency admissions over two years. Then, Abraham et al. (2012) compared patient outcomes (e.g., 30-day mortality) with the level of kidney specialist care offered at each hospital. Abraham et al. (2012) found 1.34% of all emergency admissions had AKI, and 30-day mortality was 30.0%. The researchers also found that over half of the hospitals did not offer any kidney specialists care, and the AKI mortality rates at those hospitals were considerably greater than those that provided that care. Due to this study finding, Abraham et al. (2012) concluded that AKI patients were not receiving the best care and measures must be taken to treat AKI as an emergency at all hospitals.

Since African-Americans face a higher risk of AKI than Caucasians, Grams et al. (2014) conducted a study to explain these racial differences in risk by examining clinical, socioeconomic, and genetic risk factors. This study consisted of 10,588 middle-aged adult participants. The researchers tracked these individuals from their baseline study visit to their first AKI hospitalization, ESRD, death, or the end of the study. As a result, Grams et al. found several racial disparities, such as higher baseline eGFR values, lower SES, education level, and health insurance rates, and higher AKI incidence in African Americans than Caucasians. Grams et al. also found that these disparities remained after adjusting for multiple variables (e.g., demographics, CV risk factors, and the number of hospitalizations). These racial differences were reduced with higher income and insurance rates. These study findings led Grams et al. (2014) to conclude that the high AKI risk among African Americans correlates to disparities in SES.

Acute Kidney Injury in the Veteran Population

In a retrospective cohort study, Siew et al. (2011) investigated trends in nephrology referral rates among AKI survivors at risk for kidney dysfunction later using a VA database. This study consisted of 3,929 VISN-9 VA inpatients with AKI in a five-year period. Siew et al. (2011) examined time to referral, taking kidney function improvements, the start of dialysis, and death as competing risks over a year into account. The researchers conducted the following statistical analyses: descriptive statistics for patient characteristics, competing risk for referrals, treatments, and outcomes, and two sensitivity analyses. As a result, Siew et al. (2011) found the median age was 73 years, the frequency of readmissions due to kidney dysfunction was 60%, and the overall mortality was 22%. Siew et al. (2011) also found the nephrology referral incidence before kidney function improvements, the start of dialysis, and death was 8.5%. Siew et al. (2011) concluded that AKI severity has no effect on referral rates and that only a few at-risk survivors received a referral after an AKI episode. Siew et al.'s (2011) study provided a way to identify AKI survivors at risk for kidney dysfunction later, which could aid in early nephrology interventions, but it did not address gender differences in nephrology referrals.

In a retrospective cohort study, Schissler et al. (2013) compared community-acquired AKI (CA-AKI) and hospital-acquired AKI (HA-AKI) regarding prevalence, severity, and outcomes. The study consisted of 422 patients admitted to a single Veterans Affairs Medical Center (VAMC). Schissler et al. (2013) identified AKI patients using ICD-9 code between September 1999 and May 2007 and confirmed them using the

RIFLE criterion. Schissler et al. (2013) determined the patient has CA-AKI if the SCr level was sufficiently elevated to meet RIFLE criterion at admission and HA-AKI if there is an increase in SCr 24 hours or longer after admission. Schissler et al. (2013) found that 335 patients had CA-AKI and that volume depletion was the culprit. Schissler et al. (2013) also found that CA-AKI patients had fewer chronic illnesses, fewer hospital problems, shorter LOS, and reduced mortality than those with HA-AKI. The researchers concluded that CA-AKI occurs more frequently than HA-AKI and that HA-AKI is more severe than CA-AKI. This study did not address gender differences in CA-AKI and HA-AKI.

Lafrance and Miller (2010) conducted a retrospective study on a large cohort of AKI-surviving U.S. veterans to approximate AKI-associated mortality risk 90-days post-hospital discharge. Lafrance and Miller (2010) used linked EMR data sets, comprised of patient demographics, diagnostic and procedural codes, medications, and lab results. The study cohort consisted of 82,711 hospitalized AKI patients with at least one VA hospitalization in a five-year period (Lafrance & Miller, 2010). Lafrance and Miller (2010) determined the first hospitalization as the index admission and followed up 90-days post-hospital discharge of index admission. Lafrance and Miller (2010) identified AKI in patients using the AKIN criterion. LaFrance and Miller (2010) found that 17.4% patients that survived at least 90 days after discharge died during follow-up. LaFrance and Miller (2010) also found the adjusted AKI mortality risk increased with the escalation of AKI stage escalated. LaFrance and Miller (2010) concluded that an association existed with AKI not requiring dialysis and increased long-term AKI mortality risk for survivors and that long-term AKI mortality risk was greatest in the worst cases. This study included gender in the analyses but did not focus on the differences in long-term AKI mortality risk by gender.

In a retrospective cohort study, Matheny et al. (2014) aimed to determine laboratory surveillance frequency among AKI survivors to improve post-AKI outcomes. Matheny et al. (2014) pooled study cohort from EMR clinical data from five VAMCs in VISN 9 identifying 10,955 AKI patient admissions between January 2002 and December 2009. Matheny et al. (2014) tracked these patients for a year, capturing death, palliative care enrollment, or renal function improvements. Matheny et al. (2014) assessed the delivery and timing of outpatient lab testing for SCr concentrations, quantitative proteinuria, phosphorus, and parathyroid hormone (PTH). For outpatient follow-up at 90 days and a year respectively, Matheny et al. (2014) found that SCr measures on 69% and 85% of patients, quantitative proteinuria measures on 6% and 12% of patients, and PTH or phosphorus measures on 10% and 15% of patients. The researchers concluded that SCr was a standard testing all patients after AKI. Quantitative proteinuria, PTH, or phosphorus measures were not frequently monitored in AKI patients. The gender variable was collected with the demographic information in this study; gender differences in laboratory test surveillance in VA AKI patients were not examined.

In a retrospective study, Chawla et al. (2014) aimed to see if hospitalized veterans with myocardial infarction (MI), AKI, or both have higher major adverse cardiac events (MACE) and major adverse kidney events (MAKE) risk or a combination of both, called major renocardiovascular events (MARCE). This study consisted of 36,980 patients in the VA database with ICD-9 codes for AKI or MI and admitted in the VA for six years, from October 1999 to December 2005 (Chawla et al., 2014). Chawla et al. (2014) found that most deaths among veterans with both MI and AKI and the fewest deaths occurred among veterans with MI only. Compared to MI patients, Chawla et al. (2014) also found that AKI patients and patients with both MI and AKI developed severe MARCE outcomes. The researchers concluded that compared with the VA patients with only AKI or MI veterans with both MI and AKI had poorer long-term outcomes than those. Although this study focused on veterans, it did not report the outcomes by gender.

In a retrospective observational cohort study, Grams et al. (2015b) aimed to determine AKI frequency, risk factors, and outcomes of multiple types of major surgery to inform clinical trials and identify high AKI risk patients relating to major surgery. The study consisted of 3.6 million U.S. veterans who received major surgery from 2004 to 2011 in the VA Corporate Data Warehouse (CDW). Surgery type was determined from ICD-9 procedure codes. After the researchers had applied the inclusion and exclusion criteria, postoperative AKI was defined and staged using KDIGO criterion, LOS, ESRD, and mortality. Gram et al. (2015b) found that postoperative AKI occurred in 11.8% of the 161,185 major surgery hospitalizations, with cardiac surgery having the highest risk. Postoperative AKI risk factors include old age, African-American race, hypertension, diabetes mellitus, and low eGFR. Postoperative AKI patients had longer lengths of stay and higher 30-day readmission, 1-year ESRD, and mortality rates. The researchers concluded that postoperative AKI was common and has similar risk factors and outcomes of surgery type. The study findings can inform postoperative AKI in clinical trials. This cohort included mostly men, so gender differences in AKI frequency, risk factors, and outcomes after multiple types of major surgery were not reported.

Summary

This literature review demonstrated studies about gender and how it affects health services use in veterans with acute kidney injury (AKI). The studies in this literature review resulted from keyword searches related to gender differences, veterans, VA, health service utilization, kidney or renal disease, and acute kidney injury from 2011-2016. The reference lists of the literature found were also scanned for additional relevant research. This literature review highlighted scholarly literature pertinent to gender differences, AKI within the veteran population, health services utilization in the veteran population, and the theoretical framework.

Gender differences in health care service utilization is an important health care disparity issue that needs to be explored in greater detail (Cameron, Song, Manheim, & Dunlop, 2010; Vaidya, Partha, & Karmakar, 2012). Regitz-Zagrosek (2012) noted that gender differences studies determined differences in access to health care, use of health services, and behavior attitudes of medical personnel. This literature review contained a section, which highlighted studies on gender disparities in health care (e.g., clinic use, diagnosis and treatment, preventive care service use, laboratory test, etc.). Gender differences have become increasingly important for the VHA due to growth in the number of women veterans (WVs) who receive health care from the VA (Ersek et al., 2013). WVs are using VHA services more frequently, which have been historically used by men, so differences in the utilization of these VHA services by gender are expected

(USVARD, 2014). To better understand these differences, the composition and other socio-demographic factors of the veteran population by gender must be known.

Health service utilization studies have examined service use patterns and predictors among patients (Johnsen, 2004). The behavioral model of health services utilization (Andersen, 1968) was the theoretical framework that has guided many health service use studies and guided this study as well. The effect of this model's components (predisposing, enabling, and need factors) has on health services utilization among veteran with AKI was examined in this study.

Due to the demand that the growth of the WVs population has placed on the VHA, the amount of research on WVs' use of VA health services has increased. Most VA research studies focused on health care access, use, and quality of WVs, which have become VA priorities (Bastian, Bosworth, Washington, & Yano, 2013). These research studies were descriptive in nature and focused mostly on mental health conditions. Much of this research targeted WVs from a single military era or a single facility, limiting the ability of VA researchers to investigate age differences and military service difference in those WVs using VA health services. Many of these studies could not be generalized to all WVs because they are not all enrolled in the VA. This study focused on a national cohort of those using VA health services but does not take into account those not using VA health services.

Gender influenced the incidence, prevalence, and progression of kidney disease as determined by studies conducted on animals and humans (Silbiger and Neugarten, 2008; Silbiger, 2011). Gender-related studies on some kidney disease (e.g., CKD and ESRD) in veterans also existed, but these studies did not include AKI (Hsu, 2010). AKI is important because it leads to poor patient outcomes if it is not identified early or adequately treated (Lewington, Cerdá, & Mehta, 2013). VA researchers have focused on these AKI procedures (e.g., lab test) and outcomes (e.g., referrals, hospital complications, LOS, chronic disease, and mortality) associated with it but have not explored how health service use differs by gender in veterans with AKI (Bydash & Ishani, 2011; Lafrance & Miller, 2010). This study was designed to focus on this research gap.

Chapter 3: Research Method

The purpose of this study was to investigate differences in health services utilization by gender among hospitalized Veterans Affairs Medical Center (VAMC) acute kidney injury (AKI) patients. I also examined differences in short-term outcomes such as length of inpatient stay and inpatient mortality by gender. In this chapter, I describe the study design, methods, setting, and sample for this investigation. I also address ethical considerations to protect data confidentiality and threats to validity.

Study Design, Approach, and Rationale

This study was a retrospective cohort study to examine disparities in access, delivery, and use of health care services (see Carlson & Morrison, 2009). I used retrospective data from a 5-year period from January 1, 2008 to December 31, 2013, to examine differences in health services utilization by gender among Department of Veteran Affairs (VA) AKI patients. The retrospective data study design was useful to determine whether health service use and other short-term outcomes differed by gender (see Carlson & Morrison, 2009). Strengths of retrospective cohort studies include maintaining a sequence of events and exploring several outcomes.

Retrospective/Archival Data

I used secondary data from an existing National VA Acute Kidney Injury-Chronic Kidney Disease (AKI-CKD) study cohort extracted from three VA data sources. Secondary data are data that have been collected for another purpose (e.g., electronic medical records) and are used by researchers to answer research questions (Carlson & Morrison, 2009). Several advantages and disadvantages need to be taken into consideration when using secondary data (Carlson & Morrison, 2009). The advantages of secondary data use include being quick and efficient and tending to yield large sample sizes that cover large geographical areas allowing the researcher to assess national trends (Andersen, Prause, & Silver, 2011; Carlson & Morrison, 2009). Disadvantages of secondary data use include all of the variables of interest might not be included, and it may be difficult to understand how and why data were collected (Carlson & Morrison, 2009). Andersen et al. (2011) noted secondary data analysis is a unique method to answer research questions by making use of existing data about the population of interest. I had access to a large VA sample that had been examined using validated data collection and assessment strategies (see Andersen et al., 2011).

Setting, Data Source, and Sample

Setting

The study population was veterans diagnosed with AKI at a VAMC in the United States during a 5-year period from January 2008 to December 2013. The study sample came from secondary data in an existing National VA Acute Kidney Injury-Chronic Kidney Disease (AKI-CKD) study cohort extracted from three VA data sources. Inclusion and exclusion criteria, G*Power analysis, and the stratified sampling method were applied to this study cohort to collect data to answer each research question.

Data Sources

The National AKI-CKD study cohort consisted of three data sources. The first data source was VA Informatics and Computing Infrastructure (VINCI), which is a national electronic data warehouse pooling data from all VA hospitals and a suite of tools designed to let researchers access the data remotely. VINCI has a corporate data warehouse (CDW) and four regional data warehouses and includes patient demographic information, logs of inpatient and outpatient computerized physician order entry (CPOE), pharmacy, laboratory, coded diagnoses, specialty consultation records, prosthetics medical product data, surgical data, emergency department integration software (EDIS), echocardiography data, radiology data, care assessment need (CAN) risk prediction scoring, pathology data, and fee-based medical treatments.

The second data source was VA Information Resource Center (VIReC), which provides Center for Medicare & Medicaid Services (CMS) data interconnected with the electronic medical records of veterans. The Medicare data present in VIReC were linked to VINCI observations to ensure the complete capture of the outcome of ESRD using United States Renal Data System (USRDS) data. Medicare data also included data on dialysis and transplant services for all ESRD patients who were veterans and on veterans seeking nephrology care outside the VA setting. Veterans included in the data source were distributed from VIReC with all historical data for those veterans.

The third data source was the VA National Patient Care Database (NPCD), which provided access to data sets from Medical SAS (MedSAS) inpatient and outpatient files, the InPatient Evaluation Center (IPEC), and the NPPD (National Patient Prosthetics Database), which were all housed in the NPCD. MedSAS inpatient and outpatient files consisted of VHA data from VHA inpatient and outpatient encounters. IPEC is a national program created to measure and report risk-adjusted outcomes for all hospitalized patients excluding transplantation, nursing home, psychiatry, rehab, hospice, and admissions < 24 hours. IPEC includes available inpatient data from the VHA's EHR to calculate risk-adjusted outcomes such as standardized mortality ratios (SMR) for hospitalization and 30-day mortality (30-day SMR). IPEC also reports risk prediction models. The NPPD contains prosthetics and medical product (devices) data from the Veterans Health Information Systems and Technology Architecture (VistA) and CDW for procurement and implantation.

Sampling

The sampling strategy was chosen to reflect the veteran population to attain valid, usable data (see Mann, 2003). The sampling design was a stratified random sampling design to ensure the sample represented the female veteran population (Frankfort-Nachmias & Nachmias, 2008). Stratified random sampling is the best sampling method to use when there are small numbers of a particular group in the study population and representatives from that group may not be selected if using a simple random sample (Cottrell & McKenzie, 2005). I expected that there would be a small number of women in this study sample for this study, so I chose to use the stratified random sampling for this study.

Sample Size Determination and Power Analysis

An inadequate sample size causes type I (α) and type II (β) errors which involve either rejecting the null hypothesis when it is true or confirming the null hypothesis when it is false (Das, Mitra, & Mandal, 2016). Determining an adequate sample size for a study reduces these errors, reduces costs, and helps ensure the fidelity and validly of the study (Das et al., 2016; Kim & Seo, 2013). I used G*Power 3.1.5, a power analysis program, to determine an adequate sample size for each research question and the statistical test that corresponded to it (see Faul et al., 2009).

For the first and third research questions, I used an independent-sample *t* test to determine gender differences in health service use measures (e.g., dialysis and length of stay) and short-term outcomes (e.g., mortality and readmission) while hospitalized. Assuming a normal distribution of means for gender, I used G*Power 3.1.5 to conduct an a priori power analysis to calculate the sample size for the *t*-test analysis to determine differences between two independent means (women and men) two-tailed with an effect size of 0.5, alpha (α) error probability level of 0.05, power (1-β) error probability of 0.95, and allocation ratio (women *N*/men *N*) of .028. The output of the a priori power analysis yielded a total sample size of 1,636, with the sample size for men as 1,591 and the sample size of women as 45.

For the second research question, I used a multivariate analysis of variance (MANOVA) to determine age and race differences in health service use measures (e.g., dialysis and length of stay). I used G*Power 3.1.5 to conduct an a priori power analysis to calculate the sample size for *f* tests two-tailed with a ratio var 1/ var 0 of 1.5, alpha (α) error probability of 0.05, power (1-β) error probability of 0.95, and allocation ratio (women *N*/men *N*) of .028. The output of the a priori power analysis yielded a total sample size of 6,102, with the sample size for men as 5,936 and the sample size of women as 166.

Ethical Considerations

Before data collection, I obtained IRB approval from both the VA and Walden University. The VA IRB was a three-step process, requiring approval from the IRB, the research & development (R&D) committee, and the associate chief of staff of research. VA IRB approval was needed to get data use agreements executed and approved for data release for collection and analysis purposes. This study posed minimal risk because I used existing data from an existing cohort with no identifiers. Because the study posed minimal risk, I requested an exemption from the full IRB review and requested an expedited review instead. I also obtained IRB approval from Walden University as part of my study requirement. Once IRB approval was obtained, I requested access to data through the VA's Data Access Request Tracker (DART) request.

Data Collection

Using an existing National VA AKI-CKD study cohort extracted from the VA CDW containing electronic medical records, I identified those in the cohort diagnosed with AKI using definitions specified by the Acute Kidney Injury Network (AKIN) along with associated International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes for AKI or acute renal failure as inclusion criteria in my study population (Kidney Disease Improving Global Outcomes (KDIGO), 2012). Hospitalized AKI patients were identified by the ICD-9-CM code 584.x (USRDS, 2014). I excluded those who did not fit the set cohort criteria. Table 2 presents relevant ICD-9 codes associated with AKI that were used in the study cohort (CMS, n. d.).

Table 2

Relevant ICD-9 Codes Associated With AKI [a]

ICD-9 Code	Diagnostic Description
584.5	Acute kidney failure with lesions of tubular necrosis
584.6	Acute kidney failure with lesions of renal cortical necrosis
584.7	Acute kidney failure with lesions of renal medullary (papillary) necrosis
584.8	Acute kidney failure with other specified pathological lesion in kidney
584.9	Acute kidney failure, unspecified

Note. [a] Center for Medicare & Medicaid Services. (n. d.). *ICD-9 Codes included in Range 584.5 - 584.9*. Retrieved from https://www.cms.gov/medicare-coverage-database/staticpages/icd9-code-range.aspx?DocType=LCD&DocID=29217&Group=1&RangeStart=584.5&RangeEnd=584.9

All data collection occurred within the VINCI environment. This data included general demographics, inpatient and outpatient procedure and diagnosis codes using both CPT and ICD-9 coding, laboratory data, and CPOE records.

Variables

Gender was the independent variable while demographic variables (e.g., age and race) served as covariates. The health services used while hospitalized with AKI (e.g., dialysis and length of stay [LOS]) were the dependent variables. These services were identified using inpatient hospital data codes (e.g., ICD-9) or current procedural terminology (CPT) codes. Table 3 presents relevant ICD-9 and CPT codes associated with AKI patients needing dialysis that were used in the study cohort (USRDS, 2014).

Table 3

Relevant ICD-9 and CPT Codes Associated With AKI Patients Needing Dialysis

Code Type (e.g. ICD-9 procedure or diagnosis codes or CPT code)	Code
ICD-9 procedure	39.95
ICD-9 procedure	54.98
ICD-9 diagnosis	v45.1
ICD-9 diagnosis	v56.0
ICD-9 diagnosis	v56.1
CPT	90935
CPT	90937
CPT	90945
CPT	90947

Note. [a] U.S. Renal Data System. (2014). Methods: Chronic Kidney Disease. [In USRDS 2013 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States], *American Journal of Kidney Diseases, 63*(1 Suppl), e137-e150. doi:10.1053/j.ajkd.2013.10.024

Research Questions and Hypotheses

I endeavored to answer the following research questions and evaluate the corresponding null (Ho) and research (Ha) hypotheses related to veterans with AKI:

- Does gender impact VA health services utilization (e.g., length of stay (LOS), intensive care unit [ICU] care, and certain treatments such as dialysis) among veterans with AKI?
  - Ho_1: Gender is not associated with VA health services utilization among veterans with AKI.
  - Ha_1: Gender is positively associated with VA health services utilization among veterans with AKI.
- Do other predisposing factors (e.g., age and race) impact VA health services utilization among veterans with AKI?

- Ho_2: Predisposing factors are not associated with VA health services utilization among veterans with AKI.
- Ha_2: Predisposing factors are positively associated with VA health services utilization among veterans with AKI

- Does gender impact VA short-term health outcomes (e.g., readmission and inpatient mortality) among veterans with AKI?
  - Ho_3: Gender is not associated with short-term health outcomes among veterans with AKI.
  - Ha_3: Gender is positively associated with short-term health outcomes among veterans with AKI.

Data Analysis Plan

Once those with AKI were determined, the subset criteria were defined to identify variables to analyze the services used during the first hospitalization. This study data covered a five-year period, so there were multiple hospitalizations for the same condition, so I only focused the study data on the first hospitalization for the analysis but quantified and assessed the number of readmission due to AKI during the study period for the third research question. The Statistical Standard Grad Pack Software (SPSS 21.0) (IBM, 2012) was used to conduct data analysis inside the VINCI workspace. I provided a descriptive analysis to describe the study population regarding socio-demographic variables and military characteristic variables, such as age, race, gender, marital status, and branch of service. The descriptive statistics provided the means, standard deviations, frequencies, a range of scores, and percentages (Creswell, 2009). Differences in the health services used while hospitalized and short-term health outcomes by gender were determined using independent samples *t* test. The differences in the health services used while hospitalized by demographic variables, such as age and race, were determined using multivariate analysis of variance (MANOVA). The significance level was set at $p < 0.05$.

Retrospective cohort studies are at risk of confounding. Additional statistical analyses (e.g., propensity score and multiple regression) could be used to combat confounding risk. Propensity scores could be used to determine the chance the AKI patient would use VA health services. Both, propensity score and multiple regression methods, were used to address confounding. The only limitation to these methods was that they do not consider unmeasured confounders. (Ho, Peterson, & Masoudi, 2008)

Threats to Validity

Validity means the ability to make inferences from study findings (Carlson & Morrison, 2009). Validity is a challenge for studies like this one (Carlson & Morrison, 2009). Two types of validity exist internal and external validity (Carlson & Morrison, 2009; Creswell, 2009). Both validity types are essential when determining the worth of an experiment (Carlson & Morrison, 2009). Internal validity indicates the strength of study conclusions (Carlson & Morrison, 2009). Retrospective cohort studies, such as this one, have low internal validity meaning that methodical study error could cause differences because of no control group (Carlson & Morrison, 2009). 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). External validity is dependent on internal validity (Carlson & Morrison, 2009). This study is a retrospective cohort design, so confounding is an internal threat to validity (Ho, Peterson, & Masoudi, 2008). To mitigate confounding, multiple regression analysis could be used as an additional statistical method (Ho, Peterson, & Masoudi, 2008). Other threats to validity can arise as a result of bias including history, selection bias, maturation, and testing bias (Creswell, 2009; Mann, 2003).

Summary

This study was designed to examine gender differences in health service utilization among hospitalized veteran with AKI using a retrospective cohort study design during a five-year period from January 2008 and December 2013. The sample came from secondary data in an existing National VA AKI-CKD study cohort extracted from three VA data sources: VINCI, VIReC, and NPCD. Descriptive analysis was performed to describe the study population and to provide the means, standard deviations, frequencies, a range of scores, and percentages (Creswell, 2009). Differences in the health services used while hospitalized and short-term health outcomes by gender were determined using independent samples *t* test. The differences in the health services used while hospitalized by demographic variables, such as age and race, were determined using multivariate analysis of variance (MANOVA). The significance level was set at $p < 0.05$. Statistical analyses, (e.g., multiple regression and propensity scores) could be used to combat confounding risk. The only limitation to these statistical methods is that they do not consider unmeasured confounders. (Ho, Peterson, & Masoudi, 2008)

This quantitative secondary analysis promoted social change because it was a step in identifying and reducing gender inequalities in the use VA health services among those hospitalized with AKI. These methods may lead to findings that can increase VA administrators and policymakers' knowledge of the significance of gender in VA health services use. Then, study finding can result in the development and implementation policies, procedures, or universal standards of care across the VA hospitals nationally to reducing gender inequalities in the use VA health services thus leading to healthier outcomes and overall quality of life in VA patients. These methods can also be used as a roadmap for exploring gender differences in health services utilization in other health care delivery systems. Using the methods in this chapter, I reported results from the data collection and analyses in chapter 4.

Chapter 4: Results

The purpose of this retrospective cohort study was to investigate differences in health services utilization by gender among hospitalized Veterans Affairs Medical Center (VAMC) acute kidney injury (AKI) patients. I also examined differences in short-term outcomes such as length of inpatient stay and inpatient mortality by gender. The theoretical basis for this study was the behavioral model of health services use developed by Andersen (1968) to identify predisposing factors that predict health care use, such as gender, age, and race. In this study, I endeavored to answer the following research questions and test the following null (Ho) and research (Ha) hypotheses:

- Does gender impact VA health services utilization (e.g., length of stay (LOS), intensive care unit [ICU] care, and certain treatments such as dialysis) among veterans with AKI?
  - Ho_1: Gender is not associated with VA health services utilization among veterans with AKI.
  - Ha_1: Gender is positively associated with VA health services utilization among veterans with AKI.
- Do other predisposing factors (e.g., age and race) impact VA health services utilization among veterans with AKI?
  - Ho_2: Predisposing factors are not associated with VA health services utilization among veterans with AKI.
  - Ha_2: Predisposing factors are positively associated with VA health services utilization among veterans with AKI.

- Does gender impact VA short-term health outcomes (e.g., readmission and inpatient mortality) among veterans with AKI?
  - Ho_3: Gender is not associated with short-term health outcomes among veterans with AKI.
  - Ha_3: Gender is positively associated with short-term health outcomes among veterans with AKI.

In this chapter, I describe the data collection process to identify data meeting the study's criteria. I also provide a comprehensive summary of the results to answer the research question.

Data Collection

The National VA Acute Kidney Injury-Chronic Kidney Disease (AKI-CKD) study cohort was extracted from the VA corporate data warehouse (CDW) containing VA electronic medical records housed on VA Informatics and Computing Infrastructure (VINCI). The relational database housing the cohort was in Structured Query Language (SQL) format. I used SQL Server Management Studios (SSMS) software to obtain the cohort file. Once I got into the cohort file on VINCI using SSMS, I noticed the associated ICD-9-CM diagnostic codes for AKI or acute renal failure were not included but were used to identify the patients intially, so the hospitalized AKI patients were identified using the AKIN stage. I excluded those who did not fit the cohort criteria, such as those under 18 years of age, those with without an AKIN stage, and any admission after the first hospitalization within the study period. Erroneous values for variables were also excluded. In my data collection process, I also noticed variables that I was interested in that were in the original data dictionary for the study cohort were not included in the actual data set. However, I was able to capture gender as my independent variable and age at admission and race as my covariates. For my dependent variables, I was able to capture the following dependent variables as utilization measures: intensive care unit (ICU) stay, length of stay (LOS), and inpatient dialysis. I also captured the following dependent variables as outcome measures: inpatient death and number of admissions. After identifying the needed variables, I wrote an SQL query to generate the data table, which was imported into Excel to undergo sampling and analysis. All data collection and analyses occurred within the VINCI environment, which was necessary to conduct the study and keep the data protected.

Of the 223,800 total hospitalizations in the National VA AKI-CKD study cohort from January 1, 2008 to December 31, 2013, 169,271 unique hospitalized patients in the National VA AKI-CKD study cohort met the study's inclusion criteria. After the population had been defined, I divided the data table into strata for stratified random sampling purposes. Because this study focused on gender differences in health services utilization and outcomes in AKI inpatients at the VA, I wanted to ensure that a proportional number of female and male veterans were represented, so I divided the population into two strata: men and women. In the sample who met the inclusion criteria, 4,560 were female veterans, and 164,710 were male veterans. Because of the small number of female veterans in the study population, I applied stratified random sampling to capture representatives from the female veteran group, which may not have been selected if random sampling had been used. A random sample from each stratum was taken proportionate to the stratum's size in the study population and corresponding to the a priori power analysis generated by G*Power for each research question and corresponding statistical test. For the first and third research questions, I generated a subset sample of 1,636 hospitalized VA patients with AKI (1,591 men and 45 women) as the final study sample for data analysis. For the second research question, I generated a subset sample of 6,102 (5,936 men and 166 women) as the final study sample for data analysis.

Results

Descriptives

The study sample for Research Questions 1 and 3 consisted of 1,636 hospitalized AKI patients from the National VA AKI-CKD study cohort; 2.8% were women (*n* = 45) while the rest were men (97.2%, *n* = 1591). In the sample, 72.1% of the patients were White, 22.7% were Black, 1.3% were Asian-Hawaiian-Pacific Islander, 0.7% were Native American-Alaskan Native, and 3.3% were unknown. Table 4 presents the study sample's demographics, including frequencies, percentages, means, and standard deviations. Table 5 presents the descriptive statistics of VA health service utilization measures by gender in the study sample.

Table 4

Demographic Characteristics of Study Sample for Research Questions 1 and 3 (n=1,636)

Demographic Characteristic		*n*	%
Gender	Male	1591	97.2
	Female	45	2.8
Age at Admission	M = 69.04 SD = 11.67		

Demographic Characteristic		*n*	%
	18-30	3	.2
	31-40	10	.6
	41-50	63	3.9
	51-60	298	18.2
	61-69	532	32.5
	≥70	730	44.6
Race	White	1179	72.1
	Black	371	22.7
	Asian-Hawaiian-Pacific Islander	21	1.3
	Native American -Alaskan Native	11	0.7
	Unknown	54	3.3
AKIN Stage	1	1248	75.8
	2	246	14.5
	3	162	9.6
Total Study Sample (N)		1636	

Table 5

Descriptive Statistics of VA Health Service Utilization Measures by Gender (n=1,636)

VA Health Services Utilization Measures		*N*	%	Male *n*	%	Female *n*	%
ICU Stay	Yes	420	25.7	408	25.0	12	0.7
	No	1216	74.3	1183	72.3	33	2.0
Inpatient Dialysis	Yes	53	3.2	51	3.12	2	0.12
	No	1583	96.8	1540	94.13	43	2.63
LOS (Days)	2-5 days	427	26.1	407	24.9	20	1.2
	6-10 days	542	33.1	534	32.6	8	0.5
	11-15 days	257	15.7	253	15.5	4	0.2
	16-20 days	134	8.2	132	8.1	2	0.1
	21-25 days	90	5.5	86	5.3	4	0.2
	26-30 days	52	3.2	49	3.0	3	0.2
	≥31 days	134	8.2	130	7.9	4	0.2
Total Study Sample (N)		1636					

VA Health Services Utilization Measures	Gender	*n*	Mean	Std. Deviation	Std. Error Mean
LOS (Days)	Male	1591	14.026	19.9342	.4998
	Female	45	16.778	28.1642	4.1985
ICU Stay	Male	1591	.256	.4368	.0110
	Female	45	.267	.4472	.0667
Inpatient Dialysis	Male	1591	.032	.1762	.0044
	Female	45	.044	.2084	.0311
Total Study Sample (N)		1636			

The study sample for Research Question 2 consisted of 6,102 hospitalized AKI patients from the National VA AKI-CKD study cohort; 2.7% were women (*n* = 166) while the rest were men (97.3%, *n* = 5,936). In the sample, 71.0% of the patients were White, 22.9% were Black, 1.3% were Asian-Hawaiian-Pacific Islander, 0.9% were Native American-Alaskan Native, and 3.8% were unknown. Table 6 presents the study sample's demographics, including frequencies, percentages, means, and standard deviations. Table 7 presents the overall descriptive statistics of the study sample's VA health service utilization measures.

Table 6

Demographic Characteristics of Study Sample for Research Question 2 (n=6,102)

Demographic Characteristic		*n*	%
Gender	Male	5936	97.3
	Female	166	2.7
Age at Admission	M = 69.06 SD = 11.960		
	18-30	16	0.3
	31-40	36	0.6
	41-50	238	3.9
	51-60	1126	18.5
	61-69	1975	32.4
	≥70	2711	44.4
Race	White	4335	71.0
	Black	1399	22.9
	Asian-Hawaiian-Pacific Islander	81	1.3
	Native American -Alaskan Native	57	0.9
	Unknown	230	3.8
AKIN Stage	1	4636	76.0
	2	830	13.6
	3	636	10.4
Total Study Sample (N)		6102	

Table 7

Descriptive Statistics of VA Health Service Utilization Measures for Research Question 2 Study Sample by Gender

VA Health Services Utilization Measures		*N*	%	Male (*n* =5936)		Female (*n*=166)	
				n	%	*n*	%
ICU Stay	Yes	1605	26.3	1559	25.5	46	0.8
	No	4497	73.7	4377	71.7	120	2.0
Inpatient Dialysis	Yes	216	3.5	212	3.5	4	0.1
	No	5886	96.5	5724	93.8	162	2.7
LOS (Days)	2-5 days	1648	27.0	1587	26.0	61	1.0
	6-10 days	2044	33.5	2003	32.8	41	0.7
	11-15 days	989	16.2	965	15.8	24	0.4
	16-20 days	477	7.8	467	7.7	10	0.2
	21-25 days	291	4.8	284	4.7	7	0.1
	26-30 days	177	2.9	169	2.8	8	0.1
	≥31 days	476	7.8	461	7.6	15	0.2
Total Study Sample (N)		6102					

Research Question 1 and Hypotheses

Research Question 1: Does gender impact VA health services utilization (e.g., ICU stay, LOS, and inpatient dialysis) among veterans with AKI?

Ho_1: Gender is not associated with VA health services utilization among veterans with AKI.

Ha_1: Gender is positively associated with VA health services utilization among veterans with AKI.

I conducted an independent samples *t* test to answer Research Question 1and test the hypotheses regarding differences in VA health service utilization measures, such as ICU stay, inpatient dialysis, and LOS, by gender. The *t*-test results indicated no significant differences between male and female veterans in ICU stay ($t(1634) = -155$, *p*=.877), inpatient dialysis (*t*(1634)= -.463, *p*=.644), and LOS (*t*(1634)= -.901, *p*=.368). These results supported the null hypothesis that gender was not associated with VA health services utilization measures (e.g., ICU stay, LOS, and inpatient dialysis) among veterans with AKI. Table 8 presents the results of the independent sample *t*-test analyses.

Table 8

T-Test Results for VA Health Service Utilization Measures by Gender

VA Health Services Utilization Measure		Levene's Test for Equality of Variances		*t* test for Equality of Means						
		F	Sig.	*t*	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LOS	Equal variances assumed	4.109	.043	-.901	1634	.368	-2.7520	3.0535	-8.7412	3.2372
	Equal variances not assumed			-.651	45.25	.518	-2.7520	4.2281	-11.2665	5.7625
ICU Stay	Equal variances assumed	.092	.762	-.155	1634	.877	-.0102	.0661	-.1398	.1194
	Equal variances not assumed			-.151	46.41	.880	-.0102	.0676	-.1462	.1257
Inpatient Dialysis	Equal variances assumed	.835	.361	-.463	1634	.644	-.0124	.0268	-.0649	.0401
	Equal variances not assumed			-.395	45.79	.695	-.0124	.0314	-.0756	.0508

Research Question 2 and Hypotheses

Research Question 2: Do other predisposing factors (e.g., age and race) impact VA health services utilization among veterans with AKI?

Ho_2: Predisposing factors are not associated with VA health services utilization among veterans with AKI.

Ha_2: Predisposing factors are positively associated with VA health services utilization among veterans with AKI.

The behavioral model of health services cited that predisposing factors predict health care use. In this study, I sought to see if predisposing factors (e.g., age and race) had an effect on VA health service utilization measures.

A one-way multivariate analysis of variance (MANOVA) was conducted to determine the effect of two predisposing factors (age and race) on the dependent variables, which were VA health services utilization measures, such as ICU stay, inpatient dialysis, and LOS. For the first MANOVA I conducted, the independent variable, age, included six age ranges: 18-30, 31-40, 41-50, 51-60, 61-69, and ≥70. The dependent variables were the VA health service utilization measures, such as LOS, ICU stay, and inpatient dialysis. Significant differences were found among the age ranges on the dependent measures, Wilks's Lambda (Λ) = .99, $F(15, 16823.25) = 2.44$, $p<.01$. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. The results of this MANOVA were reported in Table 9. Analyses of Variance (ANOVA) on the dependent variables were conducted as a follow-up test to the MANOVA. The ANOVA on LOS was significant, $F(5, 6096) = 4.05$, $p < .01$, $\eta^2 = .003$, while the ANOVA test on ICU Stay

($F(5, 6096) = 1.96$, $p = .082$, $\eta^2 = .002$) and Inpatient Dialysis ($F(5, 6096) = 1.77$, $p =.115$, $\eta^2 = .001$) were nonsignificant. The results of the ANOVA were reported in Table 10. These findings the support the research hypothesis showing age, as a predisposing factor, was associated with LOS among veterans with AKI but supports the null hypothesis showing age, as a predisposing factor, was not associated with ICU stay and inpatient dialysis among veterans with AKI.

Table 9

MANOVA Results for Age and VA Health Service Utilization Measures

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.056	119.558	3.000	6094.000	.000	.056
	Wilks' Lambda	.944	119.558	3.000	6094.000	.000	.056
	Hotelling's Trace	.059	119.558	3.000	6094.000	.000	.056
	Roy's Largest Root	.059	119.558	3.000	6094.000	.000	.056
Age	Pillai's Trace	.006	2.440	15.000	18288.000	.001	.002
	Wilks' Lambda	.994	2.441	15.000	16823.252	.001	.002
	Hotelling's Trace	.006	2.442	15.000	18278.000	.001	.002
	Roy's Largest Root	.004	4.336	5.000	6096.000	.001	.004

Table 10

ANOVA Results for Age and VA Health Service Utilization Measures

Source	Dependent Variables (VA Health Service Utilization Measures)	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	LOS (Days)	8055.935[a]	5	1611.187	4.051	.001[a]	.003
	ICU Stay	1.897[b]	5	.379	1.958	.082[b]	.002
	Inpatient Dialysis	.303[c]	5	.061	1.773	.115[c]	.001
Intercept	LOS (Days)	105474.629	1	105474.629	265.175	.000	.042
	ICU Stay	21.425	1	21.425	110.595	.000	.018
	Inpatient Dialysis	.406	1	.406	11.894	.001	.002
Age	LOS (Days)	8055.935	5	1611.187	4.051	.001	.003
	ICU Stay	1.897	5	.379	1.958	.082	.002
	Inpatient Dialysis	.303	5	.061	1.773	.115	.001
Error	LOS (Days)	2424709.210	6096	397.754			
	ICU Stay	1180.942	6096	.194			
	Inpatient Dialysis	208.051	6096	.034			
Total	LOS (Days)	3557608.000	6102				
	ICU Stay	1605.000	6102				
	Inpatient Dialysis	216.000	6102				
Corrected Total	LOS (Days)	2432765.145	6101				
	ICU Stay	1182.839	6101				
	Inpatient Dialysis	208.354	6101				

R Squared = .003 (Adjusted R Squared = .002); b. R Squared = .002 (Adjusted R Squared = .001); c. R Squared = .001 (Adjusted R Squared = .001)

For the second MANOVA I conducted, the independent variable, race, included five categories: White, Black, Asian-Hawaiian-Pacific Islander, Native American - Alaskan Native, and Unknown. The dependent variables were the VA health service utilization measures, such as LOS, ICU stay, and inpatient dialysis. Significant differences were found among race on the dependent measures, Wilks's $\Lambda = .99$, F(12, 16126.15) = 2.57, $p<.01$. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. The results of this MANOVA were reported in Table 11. Analyses of Variance (ANOVA) on the dependent variables were conducted as a follow-up test to the MANOVA. The ANOVA on LOS (F(4, 6097) = 4.15, $p < .01$, $\eta^2 = .003$) and Inpatient Dialysis were significant (F(4, 6097) = 3.99, $p < .01$, $\eta^2 = .003$), while the ANOVA test on ICU Stay (F(4, 6097) = 0.33, $p = .856$, $\eta^2 = .000$) was nonsignificant. The results of the ANOVA were reported in Table 12. These findings the support the research hypothesis showing race, as a predisposing factor, was associated with LOS and inpatient dialysis among veterans with AKI but supports the null hypothesis showing race, as a predisposing factor, was not associated with ICU stay among veterans with AKI.

Table 11

MANOVA Results for Race and VA Health Service Utilization Measures

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.085	188.154[b]	3.000	6095.000	.000	.085
	Wilks' Lambda	.915	188.154[b]	3.000	6095.000	.000	.085
	Hotelling's Trace	.093	188.154[b]	3.000	6095.000	.000	.085
	Roy's Largest Root	.093	188.154[b]	3.000	6095.000	.000	.085
Race	Pillai's Trace	.005	2.571	12.000	18291.000	.002	.002
	Wilks' Lambda	.995	2.574	12.000	16126.146	.002	.002
	Hotelling's Trace	.005	2.576	12.000	18281.000	.002	.002
	Roy's Largest Root	.004	6.708[c]	4.000	6097.000	.000	.004

a. Design: Intercept + Race

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha = .05

Table 12

Results of ANOVA for Race and VA Health Service Utilization Measures

Tests of Between-Subjects Effects

Source	Dependent Variables (VA Health Service Utilization Measures)	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	LOS (Days)	6600.537[a]	4	1650.134	4.147	.002a	.003
	ICU Stay	.258[b]	4	.064	.333	.856b	.000
	Inpatient Dialysis	.544[c]	4	.136	3.989	.003c	.003
Intercept	LOS (Days)	137360.094	1	137360.094	345.189	.000	.054
	ICU Stay	47.766	1	47.766	246.267	.000	.039
	Inpatient Dialysis	1.013	1	1.013	29.734	.000	.005
Race	LOS (Days)	6600.537	4	1650.134	4.147	.002	.003
	ICU Stay	.258	4	.064	.333	.856	.000
	Inpatient Dialysis	.544	4	.136	3.989	.003	.003
Error	LOS (Days)	2426164.607	6097	397.928			
	ICU Stay	1182.581	6097	.194			
	Inpatient Dialysis	207.810	6097	.034			
Total	LOS (Days)	3557608.000	6102				
	ICU Stay	1605.000	6102				
	Inpatient Dialysis	216.000	6102				
Corrected Total	LOS (Days)	2432765.145	6101				
	ICU Stay	1182.839	6101				
	Inpatient Dialysis	208.354	6101				

Research Question 3 and Hypotheses

Research Question 3: Does gender impact VA short-term health outcomes (e.g., readmission and inpatient mortality) among veterans with AKI?

Ho_3: Gender is not associated with short-term outcomes among veterans with AKI.

Ha_3: Gender is positively associated with short-term health outcomes among veterans with AKI.

In Table 13 the overall descriptive statistics VA health service outcome measures in the study sample were presented in frequencies, percentages, means and standard deviations.

Table 13

Descriptive Statistics for VA Health Service Outcomes Study Sample by Gender (n=1,636)

VA Health Service Outcomes Measures		*n*	%	Male *n*	Male %	Female *n*	Female %
Inpatient Deaths	Yes	165	10.1	161	9.8	4	0.2
	No	1471	89.9	1430	87.4	41	2.5
Number of Readmission	0	1	0.1	1	0.1	0	0.0
	1	1273	77.8	1233	75.4	40	2.4
	2	230	14.1	226	13.8	4	0.2
	3	74	4.5	73	4.5	1	0.1
	4	39	2.4	39	2.4	0	0.0
	5	7	0.4	7	0.4	0	0.0
	6	9	0.3	9	0.6	0	0.0
	7	1	0.1	1	0.1	0	0.0
	8	2	0.1	2	0.1	0	0.0
Total Study Sample (N)		1,636					

VA Health Service Outcomes Measures	Gender	*n*	Mean	Std. Deviation	Std. Error Mean
Inpatient Death	Male	1591	.101	.3017	.0076
	Female	45	.089	.2878	.0429
Number of Readmissions	Male	1591	1.365	.8426	.0211
	Female	45	1.133	.4045	.0603

An independent samples *t* test was conducted to answer this research question and test these hypotheses and to look at differences in VA health service short-term outcome measures, such as inpatient death and the number of readmissions, by gender. The *t*-test results indicated there was not a significant difference in males and females in inpatient death ($t(1634) = -.270$, p=.787 and number of readmission ($t(1634)= 1.84$, p=..066).

These results supported the null hypothesis that gender was not associated with VA short-term health outcome measures, such as inpatient death and the number of readmissions, among veterans with AKI. In Table 14, the results of the independent samples *t*-test analyses were displayed.

Table 14

T-Test Results for VA Short-Term Outcomes by Gender (n=1,636)

Short-Term Outcome		Levene's Test for Equality of Variances		*t* test for Equality of Means						
		F	Sig	*t*	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Inpatient Death	Equal variances assumed	.301	.584	.270	1634	.787	.0123	.0455	-.0770	.1016
	Equal variances not assumed			.282	46.78	.779	.0123	.0436	-.0753	.1000
Number of Readmissions	Equal variances assumed	12.59	.000	1.839	1634	.066	.2318	.1260	-.0154	.4791
	Equal variances not assumed			3.629	55.44	.001	.2318	.0639	.1038	.3599

Summary

The purpose of this retrospective cohort study was to investigate differences in health services utilization by gender among hospitalized VA AKI patients. Also, this study aimed to examine differences in short-term outcomes, such as length of inpatient stay and inpatient mortality by gender. After applying inclusion and exclusion criteria and the stratified sampling method to an existing National VA AKI-CKD study cohort extracted from the VA CDW containing electronic medical records, a subset sample of 1,636 unique hospitalized AKI patients with was generated as the final study sample used for data analysis purposes for research questions 1.

The first analysis I conducted were descriptive statistics to describe the study samples for each research question. For research questions one and three, the study sample consisted of 1,636 hospitalized AKI patients from the National VA AKI-CKD study cohort, approximately 2.8% were women (*N* = 45), while the rest were men (97.2%, *N* = 1591). About 72.1% of the patients were White, 22.7% of the patients were Black, 1.3% of the patients were Asian-Hawaiian-Pacific Islander, 0.7% of the patients were Native American – Alaskan Native and 3.3% of the patients were Unknown. Tables 4 and 5 reported the overall descriptive statistics and the study sample's demographics, regarding frequencies, percentages, and selected means and standard deviations. For research question two, the study sample consisted of 6,102 hospitalized AKI patients from the National VA AKI-CKD study cohort. Approximately 2.7% were women (N = 166), while the rest were men (97.3%, N = 5,936). About 71.0% of the patients were White, 22.9% of the patients were Black, 1.3% of the patients were Asian-Hawaiian-Pacific Islander, 0.9% of the patients were Native American – Alaskan Native and 3.8% of the patients were Unknown. Tabled 6 and 7 reported the study sample's demographics and overall descriptive statistics, regarding frequencies, percentages, means and standard.

Additional analyses were conducted to answer the three research questions and test the research and null hypotheses associated with them. To answer research question 1 and test the hypotheses associated with it, independent samples *t* tests were conducted to look at differences in VA health service utilization measures, such as ICU stay, inpatient dialysis, and LOS, by gender. The *t*-test results indicate there was not a significant difference in males and females in ICU stay ($t(1634) = -155$, $p=.877$), inpatient dialysis ($t(1634)= -.463$, $p=.644$), and LOS ($t(1634)= -.901$, $p=.368$). These results supported the null hypothesis that gender was associated with VA health services utilization measures (e.g., ICU stay, LOS, and inpatient dialysis) among veterans with AKI. In Table 8, the results of the independent samples *t*-test analyses were displayed.

In regards to answering research question 2 and testing the hypotheses associated with it, I conducted a one-way multivariate analysis of variance (MANOVA) to determine the effect of two predisposing factors (age and race) on the dependent variables, which were VA health services utilization measures, such as ICU stay, inpatient dialysis, and LOS. For the first MANOVA I conducted, significant differences were found among the age ranges on the dependent measures, Wilks's Lambda (Λ) = .99, $F(15, 16823.25) = 2.44$, $p<.01$. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. Analyses of Variance (ANOVA) on the dependent variables were conducted as a follow-up test to the MANOVA. The ANOVA on LOS was significant, $F(5, 6096) = 4.05$, $p < .01$, $\eta^2 = .003$, while the ANOVA test on ICU Stay ($F(5, 6096) = 1.96$, $p = .082$, $\eta^2 = .002$) and Inpatient Dialysis ($F(5, 6096) = 1.77$, $p =.115$, $\eta^2 = .001$) were nonsignificant. The results of this MANOVA were reported in Table 9, and the results of the ANOVA were reported in Table 10. These findings the support the research hypothesis showing age, as a predisposing factor, was associated with LOS among veterans with AKI but supports the null hypothesis showing age, as a predisposing factor, was not associated with ICU stay and inpatient dialysis among veterans with AKI. For the second MANOVA I conducted, significant differences were found among race on the dependent measures, Wilks's Λ = .99, F(12, 16126.15) = 2.57, p<.01. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. Analyses of Variance (ANOVA) on the dependent variables were conducted as a follow-up test to the MANOVA. The ANOVA on LOS (F(4, 6097) = 4.15, $p < .01$, $\eta^{2 =}$ .003) and Inpatient Dialysis were significant (F(4, 6097) = 3.99, $p < .01$, $\eta^{2 =}$ .003), while the ANOVA test on ICU Stay (F(4, 6097) = 0.33, $p = .856$, $\eta^{2 =}$ .000) was nonsignificant. The results of this MANOVA were reported in Table 11, and the results of the ANOVA were reported in Table 12. These findings the support the research hypothesis showing race, as a predisposing factor, was associated with LOS and inpatient dialysis among veterans with AKI but supports the null hypothesis showing race, as a predisposing factor, was not associated with ICU stay among veterans with AKI.

For research question 3 and test the hypotheses associated with it, independent sample *t* tests were conducted to look at differences in VA health service short-term outcome measures, such as inpatient death and readmission, by gender. The *t*-test results indicated there was not a significant difference in males and females in inpatient death (*t*(1634) = -.270, *p*=.787 and number of readmission (*t*(1634)= 1.84, *p*=..066). These results supported the null hypothesis that gender was not associated with VA short-term health outcome measures, such as inpatient death and the number of readmissions among veterans with AKI. In Table 14, the results of the independent samples *t*-test analyses were displayed.

This chapter began with an introduction of the study, the data collection procedures to get the study sample, and descriptive statistics results. The analyses involved to test each hypothesis, along with the results, were presented after that. A brief summary of findings ended this chapter. The next chapter provides an explanation of the findings based on previous studies, limitations, conclusions, and recommendations.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this retrospective cohort study was to investigate gender differences in health services utilization among hospitalized Veterans Affairs Medical Center (VAMC) patients with acute kidney injury (AKI). I also examined gender differences in short-term outcomes among hospitalized VAMC patients with AKI. I conducted this study using an existing National Department of Veteran Affairs (VA) Acute Kidney Injury- Chronic Kidney Disease (AKI-CKD) study cohort extracted from the VA corporate data warehouse (CDW) because there was a lack of studies addressing gender differences using inpatient cases. After applying inclusion and exclusion criteria and the stratified sampling method for the existing AKI-CKD study cohort, I identified a subset sample of 1,692 hospitalized patients with AKI as the final study sample for data analysis. I conducted descriptive statistics to describe the study sample. Approximately 3% of VA AKI patients in were women (n = 46), and the rest were men (n = 1646). About 72% of the VA AKI patients were White, 23% were Black, 1.2% were Asian-Hawaiian-Pacific Islander, 0.6% were Native American-Alaskan Native, and 3.2% were unknown. I conducted additional analyses to answer three research questions and test the hypotheses associated with them.

Review of Major Findings

To answer Research Question 1 and test hypotheses associated with it, I conducted independent samples t tests to look at differences in VA health service utilization measures such as intensive care unit (ICU) stay, inpatient dialysis, and length of stay (LOS) by gender. The t-test results indicated no significant differences between male and female veterans in ICU stay ($t(1634) = -155$, $p=.877$), inpatient dialysis ($t(1634)= -.463$, $p=.644$), and LOS ($t(1634)= -.901$, $p=.368$). These results supported the null hypothesis that gender was not associated with VA health services utilization measures (e.g., ICU stay, LOS, and inpatient dialysis) among veterans with AKI.

To answer Research Question 2 and test the hypotheses associated with it, I conducted a one-way multivariate analysis of variance (MANOVA) to determine the effect of two predisposing factors (age and race) on the dependent variables, which were VA health services utilization measures such as ICU stay, inpatient dialysis, and LOS. For the first MANOVA, I found significant differences among the age ranges on the dependent measures, Wilks's Lambda (Λ) = .99, $F(15, 16823.25) = 2.44$, $p<.01$. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. I conducted analyses of variance (ANOVAs) on the dependent variables as a follow-up test to the MANOVA. The ANOVA on LOS was significant, $F(5, 6096) = 4.05$, $p < .01$, $\eta^{2\,=}$ .003, while the ANOVA test on ICU stay ($F[5, 6096] = 1.96$, $p = .082$, $\eta^{2\,=}$ .002) and inpatient dialysis ($F[5, 6096] = 1.77$, $p =.115$, $\eta^{2\,=}$ .001) were nonsignificant. These findings supported the research hypothesis indicating age, as a predisposing factor, was associated with LOS among veterans with AKI, and supported the null hypothesis indicating age, as a predisposing factor, was not associated with ICU stay and inpatient dialysis among veterans with AKI. For the second MANOVA, I found significant differences among race on the dependent measures, Wilks's Λ = .99, $F(12, 16126.15) = 2.57$, $p<.01$. The multivariate Eta Squared (η^2) based on Wilks's Λ was .002. I conducted ANOVAs on the dependent variables as a follow-up test to the MANOVA. The ANOVA results on LOS

($F[4, 6097] = 4.15$, $p < .01$, $\eta^2 = .003$) and inpatient dialysis were significant ($F[4, 6097] = 3.99$, $p < .01$, $\eta^2 = .003$), while the ANOVA results on ICU stay ($F[4, 6097] = 0.33$, $p = .856$, $\eta^2 = .000$) were nonsignificant. These findings supported the research hypothesis indicating race, as a predisposing factor, was associated with LOS and inpatient dialysis among veterans with AKI, and supported the null hypothesis indicating race, as a predisposing factor, was not associated with ICU stay among veterans with AKI.

To answer Research Question 3 and test the hypotheses associated with it, I conducted independent samples *t* tests to look at differences in VA health service short-term outcome measures such as inpatient death and readmission by gender. The *t*-test results indicated no significant differences between male and female veterans in inpatient death ($t[1634] = -.270$, $p=.787$ and number of readmission ($t[1634]= 1.84$, $p=.066$). These results supported the null hypothesis that gender was not associated with VA short-term health outcome measures, such as inpatient death and the number of readmissions among veterans with AKI.

Interpretation of Study Findings

Studies focusing on gender differences have become increasingly important for the VHA due to growth in the WV population receiving VA health care services (Ersek et al., 2013). Gender differences in VA health care services were expected because these services have been traditionally used by men (USVARD, 2014). The behavioral model of health services utilization (Andersen, 1968) was the underlying framework for this study. One component of this model is predisposing factors that predict health care use. Sociodemographic factors (e.g., gender, age, race, and ethnicity) and socioeconomic status are some predisposing factors that affect health services utilization (Barton, 2010). I found that for predisposing factors such as gender, age, and race, there were no significant differences in VA health services utilization measures such as ICU stay, inpatient dialysis, and LOS. I also found that there were no significant gender differences in short-term outcomes such as readmissions and inpatient death among veterans with AKI.

Research Question 1

Research Question 1 and the research and null hypotheses associated with it focused on VA health service utilization measures (e.g., ICU stay, inpatient dialysis, and LOS) by gender. This study’s findings were consistent with the results of several studies mentioned in the literature review, which indicated no significant differences in VA health service utilization measures by gender. Borrero et al. (2006) found that utilization rates of knee/hip arthroplasty in the VA system did not differ by gender. Duggal et al. (2010) found that VA outpatient services utilization did not differ by gender. Davis et al. (2014) also found no significant differences in VA mental health treatment and services use by ethnicity and gender, but did find differences in primary care use by gender. These study findings did not support historically documented VA health care use disparities related to gender, and these studies focused on outpatient health care services and mental health treatment and services in the VA rather than inpatient health care services.

The current study’s findings differed from several studies’ findings that indicated gender differences in utilization. Haskell et al. (2010) found gender differences in VA primary care and mental health visits. Frayne et al. (2008) found gender differences in

VA health care utilization and cost, especially when the veteran status was considered. Wooten et al. (2013) found differences in SUDX and SUT in the year before deployment by gender. Chatterjee et al. (2009) found differences in VHA outpatient and specialty mental health services by gender, but this finding also varied when age and diagnosis were considered. Davis et al. (2015) found some gender differences among veterans experiencing their first diagnostic catheterization. Maguen et al. (2012) found gender differences in mental health service use in primary and emergency care and inpatient mental health use among veterans with PTSD. Haskell et al. (2010) investigated EMRs and found gender differences in stress-related conditions but no significant gender differences in pain scores. Vimalananda et al. (2011) found gender differences in veterans with diabetes and hyperlipidemia receiving invasive lipid-lowering therapy. Maguen et al. (2010) found gender differences in PTSD and AUD diagnosis among veterans.

Research Question 2

Research Question 2 and the research and null hypotheses associated with it focused on VA health service utilization measures (e.g., ICU stay, inpatient dialysis, and LOS) by age and race. Age and race served as the predisposing factors that predict health care use as cited in the behavioral model of health services utilization (Andersen, 1968; Barton, 2010). The findings in this study were split. There were no significant differences in any of the VA health service utilization measures by age, but race significantly affected the LOS and inpatient dialysis. AKI is a serious health problem associated with demographics such as age, sex, and race (Kam Tao Li et al., 2013). Grams et al. (2015a) conducted a collaborative meta-analysis to quantify AKI risk factor variables (e.g., eGFR and ACR values) with demographic variables (e.g., age, sex, and race). The researchers found that low eGFR and high ACR values were active AKI risk factors that weakened the AKI linkage with age, sex, and race (Grams et al., 2015a). In another study, Grams et al. (2015b) found that some postoperative AKI risk factors included old age and African-American race, and postoperative AKI outcomes included longer lengths of stay and higher 30-day readmission, 1-year ESRD, and mortality rates. Given findings from the current study that race, as a predisposing factor, was associated with LOS and inpatient dialysis among veterans with AKI, and Grams et al. (2015b) findings that African Americans had longer lengths of stay, higher admission, and mortality rates, further study is needed to compare utilization and outcomes by race in the AKI population.

Several studies indicated differences in utilization by age or race. Ouimette et al.'s (2003) examination of predisposing factors as predictors of VA health services use revealed an association between VA health services use and older age, and former WVs using VA health care were likely to be from an ethnic minority group. Chatterjee et al. (2009) found differences in VHA outpatient and specialty mental health services use by gender, age, and diagnostic categories for PTSD and depression among veterans. Maguen et al. (2010) also found gender, age, and racial differences among veterans diagnosed with PTSD and depression. Goldstein et al. (2014) found gender and ethnic disparities in CVD risk factor control, such as BP values, LDL values, and hA1c levels. Gender and racial disparity findings raise awareness of factors that contribute to disparities and help in intervention development. Wolfe (2011) found that WVs who tended to use more VA health services were younger, Black, and never married. Knowing the predisposing factors of VA health care is important in planning an equitable distribution of VA health services (Wolfe, 2011).

Some researchers examined racial differences in AKI that warrant discussion. Grams et al. (2014) examined racial disparity by looking at clinical, socioeconomic, and genetic risk factors by race in 10,588 middle-aged participants. The researchers found several racial differences in risk factors, such as higher baseline eGFR values, lower SES, education level, and health insurance rates, and a higher AKI incidence in African Americans than Caucasians. Grams et al. (2014) also found that these disparities remained after adjusting for multiple variables (e.g., demographics, CV risk factors, and the number of hospitalizations). Racial differences were reduced with higher income and insurance rates (Grams et al., 2014). These findings led Grams et al. (2014) to conclude that the high AKI risk among African Americans correlates to disparities in SES. Gram et al. (2014) found racial disparities in a non-VA AKI population, and the current study's results indicated significant differences in race and health services use measures in a VA AKI inpatient population.

Mathioudakis et al. (2016) analyzed National Hospital Discharge Survey data for hospitalized adults with diabetes to explore racial disparities in chances of getting AKI. The researchers found that Black diabetic patients had higher odds of attaining AKI and AKI-related risk factors than White diabetic patients. In contrast to the current study's findings, Mathioudakis et al. found no racial differences in length of stay.

Research Question 3

The associations AKI has with morbidity, mortality, and health care costs are significant (Belcher & Parikh, 2015). Abraham et al. (2012) examined inequalities in workload and AKI outcomes of care using all of England's hospital information to compare patient outcomes (e.g., AKI and 30-day mortality) in emergency patients with the level of kidney specialist care offered. Abraham et al. found that 1.34% of all emergency admissions had AKI, and 30-day mortality was 30.0%. The researchers also found that over half of the hospitals did not offer any kidney specialists care, and the AKI mortality rates at those hospitals were considerably higher than those that provided that care. Abraham et al. concluded that AKI patients were not receiving the best care, and measures needed to be taken to treat AKI as an emergency at all hospitals.

Research Question 3 and the hypotheses associated with it focused on VA health short-term outcome measures (e.g., inpatient death and the number of readmissions) by gender. I found no significance gender differences in short-term outcome measures such as inpatient death and number of readmissions. These results were not consistent with many previous studies of the veteran population, which focused on short-term AKI outcomes after patient discharge and did not explore gender differences in these outcomes in veterans with AKI. To my knowledge, this study is the first to address this research gap.

Limitations of Study

This study had several limitations. First, the study's finding could not be generalizable to all veterans since I only included those with an AKI diagnosis.

Furthermore, the study also included veterans who are users of VHA services, and it does not account for veterans who are non-users. Second, the potential small sample size of women was a limitation in the study, even though I used a National dataset. To overcome the small sample size limitation, I used a stratified random sampling because it was the best sampling method to use when there is a lesser number in a particular group of the study population (Cottrell & McKenzie, 2005). Small sample size for the gender strata was randomly selected from an existing AKI-CKD VA cohort, which could have affected the statistical study results. Third, ICD codes were not available in the existing cohort, so the reliance of ICD codes to identify did not pose as a limitation. The AKIN stage was used to identify those with AKI in the VA dataset. An assumption was made that is a subject had an AKIN stage of 1-3 that they had AKI while hospitalized. The AKIN criterion, alone, had the limitations and the potential to miss positive AKI patients, which needs to be considered when identifying study subjects. Classifying subjects in this manner could lead to subject misclassification, selection, and reporting bias. Lastly, some of the variables of interest in this study were not included in the dataset because it was a secondary data source.

This study also had some strengths. First, retrospective cohort studies are useful in exploring and understanding disparities, such as the gender differences in health service use and outcome that this study is attempting to uncover (Carlson & Morrison, 2009). Other strengths of retrospective cohort studies include that it maintains a sequence of events and several outcomes can be studied at once. Lastly, the use of a National dataset, which had been examined using validated data collection and analysis strategies in previous studies, providing the opportunity to use a complete of information regarding health services utilization and sufficient numbers of women and men in the veteran population for a meaningful analysis. These limitations and strengths yield some recommendations for further research and action.

Recommendations

Given the limitations and strengths of this study, additional research is needed using the National AKI-CKD cohort to find out more about AKI and gender differences in veterans in an inpatient setting. To make it generalizable, capture more variables of interest, and obtain more veterans in population, linking the National AKI-CKD cohort to other data sources (e.g., Medicare data and university hospitals affiliated with the VA) could enhance this study's findings. This National AKI-CKD cohort had been examined using validated data collection and analysis strategies in previous studies, so this should allow for oversampling in women veterans in an unbiased manner. Classifying AKI subjects in multiple ways, such as a combination of ICDs and administrative coding to define AKI and AKI criteria and definitions, could mitigate subject misclassification, selection, and reporting bias.

Andersen's (1968) the behavioral model of health services use, also known as the behavioral model of health services utilization, was the underlying framework for this study. The framework named three components: predisposing factors that predict health care use, enabling factors that hinder or impede health care use, and need-based factors that indicate the need for health care (Andersen, 1995). Predisposing factors, such as sociodemographic factors (e.g., gender, age, race and ethnicity, and socioeconomic status

(SES)), affect health services utilization (Barton, 2010). Using this framework, I described how the predisposing factors (gender, age, and race) differed in the use of VA health services and how short-term outcomes differed by gender of those veterans with AKI. Further research is needed to explore the other components, enabling and need components, of the behavioral model of health services use. Exploring these components will require qualitative methods to determine what hinder health cause use and the need for health care in this study's population, which will lead to a greater understanding of AKI and gender differences in veterans in the inpatient setting and a potential to positive social change.

Implications for Positive Social Change

This retrospective cohort study has potential positive social change impact as a step in identifying and reducing gender inequalities not only in the use VA health services and outcomes among those hospitalized with AKI in a National VA cohort but with other conditions as well. Even though no significant differences were found in this study among gender and health service use, these methods and findings could increase VA administrators and policymakers' knowledge of the significance of gender in VA health services use and outcomes. These findings also have the potential to raise awareness of AKI and gender differences in veterans in an inpatient setting. These results could also assist the VA administrators and policymakers in developing and implementing policies, procedures, or universal standards of care across the VA hospitals nationally to reduce gender inequalities in VA health services use consequently leading to healthier outcomes and overall quality of life in VA patients. These methods could also be used as a path for exploring gender, race, and age disparities in health services use in other health care delivery systems besides the VA.

Conclusions

This retrospective cohort study of hospitalized veterans with AKI provided new insight on gender disparities in VA health services use and outcome measures. As a result of conducting this research, I found that no significant gender, age, or race differences existed in VA health services utilization measures, such as LOS, ICU stay, and inpatient dialysis, among hospitalized veterans with AKI. This finding was consistent with several studies, but those studies did not focus on inpatients. I also found that no significant gender differences existed in short-term outcomes, such as inpatient mortality and the number of readmissions, for hospitalized veteran patients with AKI. This study's findings were not consistent with many previous studies. Researchers, who have previously studied AKI in the veteran population, focused on short-term AKI outcomes after patient discharge and did not explore gender differences in these outcomes in veterans with AKI. This study was the first to my knowledge that addressed this research gap. Although this study was the first step and had several limitations and strengths, more studies are needed using the National VA AKI-CKD cohort to understand AKI and gender differences in veterans in an inpatient setting using the recommendations presented. A greater understanding of this understanding of AKI and gender differences in veterans in the inpatient setting can lead to potential to positive social change at National VA policy level, in improving in VA health service use and outcomes, and in identifying and reducing gender inequalities in the use VA health services and outcomes.

References

Abraham, K. A., Thompson, E. B., Bodger, K., & Pearson, M. (2012). Inequalities in outcomes of acute kidney injury in England. *Quality Journal of Medicine (QJM): Monthly Journal of the Association of Physicians*, *105*(8), 729-740. doi:10.1093/qjmed/hcs037

Aday, L. A., & Andersen, R. (1974). A framework for the study of access to medical care. *Health Services Research*, *9*(3), 208-220. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071804/pdf/hsresearch00560-0030.pdf

Andersen, J. P., Prause, J., & Silver, R. C. (2011). A step-by-step guide to using secondary data for psychological research. *Social and Personality Psychology Compass, 5*(1), 56-75. doi:10.1111/j.1751-9004.2010.00329.x

Andersen, R. M. (1968). *A behavioral model of families' use of health services.* Retrieved from http://www.ssa.uchicago.edu/sites/default/files/uploads/RS25.PDF

Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1-10. Retrieved from http://www.jstor.org/stable/2137284

Andersen, R., & Newman, J. F. (2005). Societal and individual determinants of medical care utilization in the United States. *Milbank Quarterly, 83*(4), 1-28. doi:10.1111/j.1468-0009.2005.00428.x

Babitsch, B., Gohl, D., & von Lengerke, T. (2012). Re-revisiting Andersen's behavioral model of health services use: A systematic review of studies from 1998–2011. *GMS Psycho-Social-Medicine*, *9*, Doc11. doi:10.3205/psm000089

Barton, P. L. (2010). *Understanding the U.S. health services system.* (4th ed.). Chicago, IL: Health Administration Press.

Bastian, L. A., Bosworth, H. B., Washington, D. L., & Yano, E. M. (2013). Setting the stage: Research to inform interventions, practice and policy to improve women veterans health and health care. *Journal of General Internal Medicine, 28*(Suppl 2), S491-S494. doi:10.1007/s11606-013-2470-9

Bean-Mayberry, B., Yano, E. M., Washington, D. L., Goldzweig, C., Batuman, F., Huang, C., Miake-Lye, I., & Shekelle, P. G. (2011). Systematic review of women veterans health: Update on successes and gaps. *Women's Health Issues, 21*(4S), S84-S97. doi:10.1016/j.whi.201 1.04.022

Belayev, L. Y., & Palevsky, P. M. (2014). The link between acute kidney injury and chronic kidney disease. *Clinical Opinion in Nephrology and Hypertension, 23*, 149-154. doi:10.1097/01.mnh.0000441051.36783.f3

Belcher, J. M., & Parikh, C. R. (2015). Incidence, trends, and diagnosis of perioperative acute kidney injury. In *Perioperative Kidney Injury* (pp. 3-14). New York, NY: Springer. Retrieved from http://link.springer.com/content/pdf/10.1007%2F978-1-4939-1273-5_1.pdf

Bertakis, K. D., Azari, R., Helms, L. J., Callahan, E. J., & Robbins, J. A. (2000). Gender differences in the utilization of health care services. *Journal of Family Practice,* *49*(2), 147-152. Retrieved from http://go.galegroup.com.proxy.library.vanderbilt.edu/ps/i.do?p=AONE&sw=w&u=tel_a_vanderbilt&v=2.1&it=r&id=GALE%7CA60039859&asid=4f23972e519783fd07a29a21470931d1

Blackwell, D. L., Lucas, J. W., & Clarke, T. C. (2014). Summary health statistics for U.S. adults: National Health Interview Survey, 2012. National Center for Health Statistics. *Vital and Health Statistics, 10*(260). Retrieved from http://www.cdc.gov/nchs/data/series/sr_10/sr10_260.pdf

Borrero, S., Kwoh, K., Santorius, J., & Ibrahim, S. A. (2006). Brief report: Gender and total knee/hip arthroplasty utilization rate in the VA system. *Journal of General Internal Medicine, 21*, S24-57. doi:10.111/j.1525-1497.2006.00375.x

Brody, J. E. (2013). Kidney disease, an underestimate killer. *The New York Times.* Retrieved from http://well.blogs.nytimes.com/2013/07/15/kidney-disease-an-underestimated-killer/?_php=true&_type=blogs&_r=0

Bydash, J. R., & Ishani, A. (2011). Acute kidney injury and chronic kidney disease: A work in progress. *Clinical Journal of the American Society of Nephrology, 6*, 2555-2557. doi:10.2215/CJN.09560911

Cameron, K. A., Song, J., Manheim, L. M., & Dunlop, D. D. (2010). Gender disparities in health and healthcare use among older adults. *Journal of Women's Health, 19*(9), 1643-1650. doi:10.1089=jwh.2009.1701

Carlson, M. D. A., & Morrison, R. S. (2009). Study design, precision, and validity in observational studies. *Journal of Palliative Medicine, 12*(1), 77-82. doi:10.1089/jpm.2008.9690

Carrero, J. (2010). Gender differences in chronic kidney disease: Underpinnings and therapeutic implications. *Kidney & Blood Pressure Research, 33*(5), 383-392. doi:10.1159/000320389

Case, J., Khan, S., Khalid, R., & Khan, A. (2013). Epidemiology of acute kidney injury in the intensive care unit. *Critical Care Research and Practice, 2013,* Article ID: 479730. doi:10.1155/2013/479730

Cerdá, J., Lameire, N., Eggers, P., Pannu, N., Uchino, S., Wang, H., Bagga, A., & Levin, A. (2008). Epidemiology of acute kidney injury. *Clinical Journal of the American Society of Nephrology: CJASN, 3*(3), 881-886. doi:10.2215/CJN.04961107

Center for Medicare & Medicaid Services. (n. d.). *ICD-9 Codes included in Range 584.5 - 584.9*. Retrieved from https://www.cms.gov/medicare-coverage-database/staticpages/icd9-code-range.aspx?DocType=LCD&DocID=29217&Group=1&RangeStart=584.5&RangeEnd=584.9

Chatterjee, S., Rath, M. E., Spiro, A., Eisen, S., Sloan, K. L., & Rosen, A. K. (2009). Gender differences in veterans health administration mental health service use: Effects of age and psychiatric diagnosis. *Women's Health Issues, 19,* 176-184. doi:10.1016/j.whi.200903.002

Chawla, L. S., Amdur, R. L., Shaw, A. D., Faselis, C., Palant, C. E., & Kimmel, P. L. (2014). Association between AKI and long-term renal and cardiovascular outcomes in United States veterans. *Clinical Journal of the American Society of Nephrology: CJASN*, *9*(3), 448-456. doi:10.2215/CJN.02440213

Chawla, L. S., & Kimmel, P. L. (2012). Acute kidney injury and chronic kidney disease: An integrated clinical syndrome. *Kidney International, 82*(5), 516-524. doi:10.1038/ki.2012.208

Cottrell, R. R., & McKenzie, J. F. (2005). *Health promotion & education research methods: Using the five chapter/dissertation model*. Sudbury, MA: Jones and Bartlett Publishers.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Das, S., Mitra, K., & Mandal, M. (2016). Sample size calculation: Basic principles. *Indian Journal of Anaesthesia*, *60*(9), 652-656. doi: 10.4103/0019-5049.190621

Davis, T. D., Deen, T. L., Fortney, J. C., Sullivan, G., & Hudson, T. J. (2014). Utilization of VA mental health and primary care services among Iraq and Afghanistan veterans with depression: The influence of gender and ethnicity status. *Military Medicine*, *179*(5), 515-520. doi:10.7205/MILMED-D-13-00179

Davis, M.B., Maddox, T. M., Langner, P., Plomondon, M. E., Rumsfeld, J. S., & Duvernoy, C. S. (2015). Characteristics and outcomes of women veterans undergoing cardiac catheterization in the veterans affairs healthcare system:

Insights from the VA CART program. *Circulation Cardiovascular Quality and Outcomes, 8*(2 Suppl 1), S39-47. doi:10.1161/CIRCOUTCOMES.114.001613

deKleijn, M., Lagro-Janssen, A. L. M., Canelo, I., & Yano, E. M. (2015). Creating a roadmap for delivering gender-sensitive comprehensive care for women veterans: Results of a national expert panel. *Medical Care, 53*(4 Suppl 1), S156-S164. doi:10.1097/MLR.0000000000000307

Duggal, M., Goulet, J. L., Womack, J., Gordan, K., Mattocks, K., Haskell, S. G., Justice, A. C., & Brandt, C. A. (2010). Comparison of outpatient health care utilization among returning women and men veterans from Afghanistan and Iraq. *BMC Health Services Re*search, *10*, 175. Retrieved from http://www.biomedcentral.com/1472-6963/10/175

Ersek, M., Smith, D., Cannuscio, C., Richardson, D. M., & Moore, D. (2013). A nationwide study comparing end-of-life care for men and women veterans. *Journal of Palliative Medicine, 16*(7), 734-740. doi:10.1089/jpm.2012.0537

Farrokhyar, F., Reddy, D., Poolman, R. W., & Bhandari, M. (2013). Why perform a priori sample size calculation?. *Canadian Journal of Surgery, 56*(3), 207-213. doi: 10.1503/cjs.018012

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, *41*(4), 1149-1160. doi:10.3758/BRM.41.4.1149

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth.

Frayne, S. M., Phibbs, C. S., Friedman, S. A., Berg, E., Ananth, L., Iqbal, S., Hayes, P. M., & Herrera, L. (2010). *Sourcebook: Women veterans in the Veterans Health Administration. Volume 1. Sociodemographic characteristics and use of VHA care*. Women's Health Evaluation Initiative, Women Veterans Health Strategic Health Care Group, Veterans Health Administration, Department of Veterans Affairs, Washington DC. Retrieved from http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=2455

Frayne, S. M., Phibbs, C. S., Saechao, F., Maisel, N. C., Friedman, S. A., Finlay, A., Berg, E., Balasubramanian, V., Dally, S. K., Ananth, L., Romodan, Y., Lee, J., Iqbal, S., Hayes, P. M., Zephyrin, L., Whitehead, A., Torgal, A., Katon, J. G., & Haskell, S. (2014). *Sourcebook: Women veterans in the Veterans Health Administration. Volume 3. Sociodemographics, utilization, costs of care, and health profile*. Women's Health Evaluation Initiative, Women's Health Services, Veterans Health Administration, Department of Veterans Affairs, Washington DC. Retrieved from http://www.womenshealth.va.gov/WOMENSHEALTH/docs/Sourcebook_Vol_3_FINAL.pdf

Frayne, S. M., Yano, E. M., Nguyen, V. Q., Yu, W., & Ananthl, L. (2008). Gender disparities in Veterans Health Administration care: Importance of accounting for veteran status. *Medical Care*; *46*, 549-553. Retrieved from http://www.jstor.org/stable/40221698

Goldstein, K. M., Melnyk, S. D., Zullig, L. L., Stechuchak, K. M., Oddone, E., Bastian, L. A., Rakley, S., Olsen, M. K., & Bosworth, H. B. (2014). Heart matters: Gender and racial differences cardiovascular disease risk factor control among veterans. *Women's Health Issues*, *24*(5), 477-483. doi:10.1016/j.whi.2014.05.005

Goldzweig, C., Balekian, T., Rolón, C., Yano, E., & Shekelle, P. (2006). The state of women veterans' health research. Results of a systematic literature review. *Journal of General Internal Medicine*, *21(*Suppl 3), S82-S92. doi:10.1111/j.1525-1497.2006.00380.x

Grams, M. E., Matsushita, K., Sang, Y., Estrella, M. M., Foster, M. C., Tin, A., Kao, L., & Coresh, J. (2014). Explaining the racial difference in AKI incidence. *Journal of the American Society of Nephrology: JASN, 25*(8), 1834-1841. doi:10.1681/ASN.2013080867

Grams, M. E., Sang, Y., Ballew, S. H., Gansevoort, R. T., Kimm, H., Kovesdy, C. P., Naimark, D., Oien, C., Smith, D. H., Coresh, J., Sarnak, M. J., Stengel, B., & Tonelli, M. (2015a). A meta-analysis of the association of estimated GFR, albuminuria, age, race, and sex with acute kidney injury. *American Journal of Kidney Diseases (AJKD), 66*(4), 591-601. doi: 10.1053/j.ajkd.2015.02.337

Grams, M. E., Sang, Y., Coresh, J., Ballew, S., Matsushita, K., Molnar, M. Z., Szabo, Z., Kalantar-Zadeh, K., & Kovesdy, C. P. (2015b). Acute kidney injury after major surgery: A retrospective analysis of Veteran Health Administrative Data. *American Journal of Kidney Diseases (AJKD)*. In press. doi:10.1053/j.ajkd.2015.07.022

Haskell, S. G., Gordon, K. S., Mattocks, K., Duggal, M., Erdos, J., Justice, A., & Brandt, C. A. (2010). Gender differences in rates of depression, PTSD, pain, obesity, and military sexual trauma among Connecticut war veterans of Iraq and Afghanistan. *Journal of Women's Health, 19*(2), 267-271. doi:10.1089/jwh.2008.1262

Ho, P. M., Peterson, P. N., & Masoudi, F. A. (2008). Evaluating the evidence: Is there a rigid hierarchy? *Circulation*, *118*, 1675-1684. doi:10.1161/CIRCULATIONAHA.107.721357

Hoerger, T. J. Simpson, S. A., Yarnoff, B. O., Pavkov, M. E., Burrows, N. R., Saydah, S. H., Williams, D. E., & Zhuo, X. (2015). The future burden of CKD in the United States: A simulation model for the CDC CKD initiative. *American Journal of Kidney Diseases*, *65*(3), 403-411. doi:10.1053/j.ajkd.2014.09.023

Hoste, E. A. J., & Schurgens, M. (2008). Epidemiology of acute kidney injury: How big is the problem?. *Critical Care Medicine*, *36*(4), S146-S151. doi:10.1097/CCM.0b013e318168c590

Hsu, C. (2010). Where is the epidemic in kidney disease?. *Journal of the American Society of Nephrology, 21*, 1607-1611. doi:10.1681/ASN.2010050546

Institute of Medicine. (2011). *Sex differences and implications for translational neuroscience research: Workshop summary*. Washington, DC: The National Academies Press. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK53385/pdf/TOC.pdf

James, M. T., & Wald, R. (2014). AKI: not just a short-term problem. *Clinical Journal of the American Society of Nephrology, 9*,435-436. doi:10.2215/CJN.00500114

Johnsen, M. (2004). Service Utilization Research. In *Encyclopedia of Homelessness* (pp. 495-499). Thousand Oaks, CA: Sage Publications, Inc. doi:10.4135/9781412952563.n141.

Johnson, C. E., Bush, R. L., Harman, J., Bolin, J., Evans Hudnall, G., & Nguyen, A. M. (2015). Variation in Utilization of Health Care Services for Rural VA Enrollees With Mental Health-Related Diagnoses. *The Journal of Rural Health: Official Journal of the American Rural Health Association and the National Rural Health Care Association, 31*(3), 244-253. doi:10.1111/jrh.12105

Kam Tao Li, P., Burdmann, E. A., Mehta, R. L., & For the World Kidney Day Steering Committee 2013. (2013). Acute kidney injury: Global health alert. *Journal of Nephropathology*, *2*(2), 90-97. doi:10.12860/JNP.2013.15

Kellum, J. A., Unruh, M. L., & Murugan, R. (2011). Acute kidney injury. *BMJ Clinical Evidence*, *2011*, 2001.

Kent, J. A, Patel, V., & Varela, N. A. (2012). Gender disparities in health care. *Mount Sinai Journal of Medicine*, *79,* 555-559. doi:10.1002/msj.21336

Khan, S. S., Kazmi, W. H., Abichandani, R., Tighiouart, H., Pererira, B. J. G., & Kauz, A. T. (2002). Health care utilization among patients with chronic kidney disease. *Kidney International, 62,* 229-236. doi: 10.1046/j.1523-1755.2002.00432.x

Kidney Disease Improving Global Outcomes. (2012).Clinical practice guideline for acute kidney injury. Section 2: AKI definition. *Kidney International Supplement*, 2, 19-36. Retrieved from http://www.nature.com/kisup/journal/v2/n1/pdf/kisup201132a.pdf

Kim, J., & Seo, B. S. (2013). How to Calculate Sample Size and Why. *Clinics in Orthopedic Surgery, 5*(3), 235-242. doi: 10.4055/cios.2013.5.3.235

Lafrance, J. P., & Miller, D. R. (2010a). Acute kidney injury associated with increased long-term mortality. *Journal of American Society of Nephrology, 21*(2), 345-351. doi:10.1681/ASN.2009060636

Lafrance, J. P., & Miller, D. R. (2010b). Defining acute kidney injury in database studies: The effects of varying the baseline kidney function assessment period and considering CKD status. *American Journal of Kidney Diseases*, *56*(4), 651-660. doi: 10.1053/j.ajkd.2010.05.011

Levey, A. S., & Coresh, J. (2012). Chronic kidney disease. *The Lancet*, *379*(9811), 165-180. doi:10.1016/S0140-6736(11)60178-5

Lewington, A. J. P., Cerdá, J., & Mehta, R. L. (2013). Raising awareness of acute kidney injury: A global perspective of a silent killer. *Kidney International*, *84*, 457-467. doi:10.1038/ki.2013.153

Macintyre, S., Hunt, K., & Sweeting, H. (1996). Gender differences in health: Are things really as simple as they seem?. *Social Science & Medicine, 42*(4), 617-624. doi:10.1016/0277-9536(95)00335-5

Maguen, S., Cohen, B., Cohen, G., Madden, E., Bertenthal, D., & Seal, K. (2012). Gender differences in health service utilization among Iraq and Afghanistan veterans with posttraumatic stress disorder. *Journal of Women's Health, 21*(6), 666-673. doi:10.1089/jwh.2011.3113

Maguen, S., Ren, L., Bosch, J. O., Marmar, C. R., & Seal, K. (2010). Gender differences in mental health diagnoses among Iraq and Afghanistan veterans enrolled in Veterans Affairs health care. *American Journal of Public Health, 100*(12), 2450-2456. doi:10.2105/AJPH.2009.166165

Mann, C. J. (2003). Observational research methods. Research design II: Cohort, cross sectional, and case-control studies. *Emergency Medical Journal*, *20*, 54-60. Retrieved from http://emj.bmj.com/content/20/1/54.full.pdf

Matheny, M. E., Peterson, J. F., Eden, S. K., Hung, A. M., Speroff, T., Adbel-Kader, K., Parr, S. K., Ikizler, T. A., & Siew, E. D. (2014). Laboratory test surveillance following acute kidney injury. *PLoS ONE*, *9*(8), e103746. doi:10.1371/journal.pone.0103746

Mathioudakis, N. N., Giles, M., Yeh, H. C., Haywood. C., Greer, R. C., & Golden, S. H. (2016). Racial differences in acute kidney injury of hospitalized adults with diabetes. *Journal of Diabetes and its Complications*, *30*(6), 1129-1136. doi: 10.1016/j.jdiacomp.2016.03.031

Mengeling, M. A., Sadler, A. G., Tomer, J., & Booth, B. (2011). Evolving comprehensive VA women’s health care: patient characteristics, needs, and preferences. *Women’s Health Issues, 21*(4S), S120-S129. doi:10.1016/j.whi.2011.04.021

Montgomery, A. E., & Byrne, T. H. (2014). Services utilization among recently homeless veterans: A gender-based comparison. *Military Medicine*, *179*(3), 236-239. doi:10.7205/MILMED-D-13-00426

Murugan, R., & Kellum, J. A. (2011). Acute kidney injury: What's the prognosis? *Nature Reviews – Nephrology, 7*, 209-217. doi:10.1038/nrneph.2011.13

Nitsch, D., Grams, M., Sang, Y., Black, C., Cirillo, M., Djurdjev, O., Iseki, K., Jassel, S. K., Kimm, H., Kronenberg, F., Øien, C. M., Levey, A. S., Levin. A. Woodward, M., & Hemmelgarn, B. R. (2013). Associations of estimated glomerular filtration rate and albuminuria with mortality and renal failure by sex: a meta-analysis. *BMJ*, 346, f324. doi:10.1136/bmj.f324

Norris, K., & Nissenson, A. R. (2008). Race, gender, and socioeconomic disparities in CKD in the United States. *Journal of American Society of Nephrology, 19*(7), 1261-1270. doi:10.1681/ASN.2008030276

Ostermann, M., & Chang, R. W. (2011). Challenges of defining acute kidney injury. *Quarterly Journal of Medicine (QJM), 104,* 237-243. doi:10.1093/qjmed/hcq185

Östlin, P., Eckermann, E., Mishra, U.D., Nkowane, M., & Wallstam, E. (2007). Gender and health promotion: A multisectoral policy approach. *Health Promotion International*, *21*(S1). doi:10.1093/heapro/dal048

Ouimette, P., Wolfe, J., Daley, J., & Gima, K. (2003). Use of VA health care services by women veterans: Findings from a national sample. *Women & Health, 38*(2), 77-91. doi:10.1300/J013v38n02_06

Palevsky, P. M. (2012). CHAPTER 6 - Epidemiology, etiology, pathophysiology, and diagnosis of acute kidney injury. In *Nephrology Secrets (Third Edition)* (pp. 43-50). Saint Louis, MO: Mosby. Retrieved from http://www.sciencedirect.com/science/article/pii/B9781416033622000154

Phillips, K. A., Morrison, K. R., Andersen, R., & Aday, L. A. (1998). Understanding the context of healthcare utilization: assessing environmental and provider-related variables in the behavioral model of utilization. *Health Services Research*, *33*(3 Pt 1), 571-596. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1070277/

Regitz-Zagrosek, V. (2012). Sex and gender differences in health: Science & Society Series on Sex and Science. *EMBO Reports*, *13*(7), 596-603. doi:10.1038/embor.2012.87

Rewa, O., & Bagshaw, S. M. (2014). Acute kidney injury – epidemiology, outcomes, and economics. *Nature Reviews – Nephrology, 10,* 193-207. doi:10.1038/nrneph.2013.282

Ronco, C., & Chawla, L. S. (2013). Kidney attack must be prevented. *Nature Reviews – Nephrology, 9,* 198-199. doi:10.1038/nrneph.2013.19

Sambamoorthi, U., Mitra, S., Findley, P. A., & Pogach, L. M. (2012). Decomposing gender differences in low-density lipoprotein cholesterol among veterans with or at risk for cardiovascular illness. *Women's Health Issues, 22*(2), e201-e208. doi:10.1016/j.whi.2011.08.012

Schissler, M., Zaidi, S., Kumar, H., Deo, D., Brier, M., & McLeish, K. R. (2013). Characteristics and outcomes in community-acquired versus hospital-acquired acute kidney injury. *Nephrology, 18*(3), 183-187. doi:10.1111/nep.12036

Schroeder, E. B., Bayliss E. A., Daugherty, S. L., & Steiner, J. F. (2014). Gender differences in Cardiovascular Risk Factors in Incident Diabetes. *Women's Health Issues, 24*(1), e61-e68. doi:10.1016/j.whi.2013.09.008

Sedgwick, P. (2014). Retrospective cohort studies: advantages and disadvantages. *BMJ. 348*, g1072. doi:10.1136/bmj.g1072

Siew, E. D., & Davenport, A. (2015). The growth of acute kidney injury: a rising tide or just closer attention to detail? *Kidney International, 87*, 46-61. doi:10.1038/ki.2014.293

Siew, E. D., Peterson, J. F., Eden, S. K., Hung, A. M., Speroff, T. Ikizler, T. A., & Matheny, M. E. (2011). Outpatient nephrology referral rates after acute kidney injury. *Journal of the American Society of Nephrology*, *23*, 305-312. doi:10.1681/ASN.2011030315

Silbiger, S., & Neugarten, J. (2008). Gender and human chronic renal disease. *Gender Medicine, 5*(Supp. A), S3-S10. doi:10.1016/j.genm.2008.03.002

Silbiger, S. R. (2011). Raging hormones: gender and renal disease. *Kidney International, 79*, 382-384. doi:10.1038/ki.2010.474

Song, J. W., & Chung, K. C. (2010). Observational Studies: Cohort and Case-Control Studies. *Plastic and Reconstructive Surgery*, *126*(6), 2234–2242. doi:10.1097/PRS.0b013e3181f44abc

Srisawat, N., & Kellum, J. A. (2011). Acute kidney injury: definition, epidemiology, and outcome. *Critical Opinion in Critical Care, 17*, 548-555. doi:10.1097/MCC.0b013e32834cd349

Statistical Package for the Social Sciences (SPSS Version 21.0) [Computer software]. Armonk, NY: IBM Corp.

Thomas, M. E., Blaine, C., Dawnay, A., Devonald, M. A. J., Ftouh, S., Laing, C., Latchem, S., Lewington, A., Milford, D. V., & Ostermann, M. (2015). The definition of acute kidney injury and its use in practice. *Kidney International, 87,* 62-73. doi:10.1038/ki.2014.328.

U.S. Census Bureau. (2013). 2013 American Community Survey 1-Year Estimates. Retrieved from http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/13_1YR/B21001

U.S. Centers for Disease Control and Prevention, National Center for Health Statistics. (2015). *FastStats: Kidney disease*. Retrieved from http://www.cdc.gov/nchs/fastats/kidney-disease.htm

U.S. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. (2015). *Chronic kidney disease.* Retrieved from http://www.cdc.gov/diabetes/programs/initiatives/kidney.html

U.S. Centers for Medicare & Medicaid Services. (n. d.). *Inpatient or outpatient hospital status affects your costs*. Retrieved from https://www.medicare.gov/what-medicare-covers/part-a/inpatient-or-outpatient.html

U.S. Department of Veterans Affairs, Office of the Actuary, Veteran Population Projection Model (VetPop) 2014; Veterans Benefits Administration; Veterans Health Administration, Office of the Assistant Deputy Under Secretary for Health for Policy and Planning. http://www.va.gov/vetdata/docs/Quickfacts/Stats_at_a_glance_12_31_14.pdf

U.S. Department of Veterans Affairs. (2012). *Women Veterans Health Care Fact Sheet.* Retrieved from http://www.womenshealth.va.gov/WOMENSHEALTH/docs/WH_facts_FINAL.pdf

U.S. Department of Veterans Affairs. (2014). *Veterans Health Administration.* Retrieved from http://www.va.gov/health/aboutvha.asp

U.S. Department of Veterans Affairs. (n. d.). *I am a Veteran.* Retrieved from https://www.va.gov/opa/PERSONA/index.asp

U.S. Department of Veterans Affairs, National Center for Veterans Analysis and Statistics. (2014) *Unique Veteran User Report FY 2012.* Retrieved from http://www.va.gov/vetdata/docs/SpecialReports/Profile_of_Unique_Veteran_Users.pdf

U.S. Department of Veterans Affairs, National Center for Veterans Analysis and Statistics. (2015). *Profile of Veterans: 2013*. Retrieved from http://www.va.gov/vetdata/docs/SpecialReports/Profile_of_Veterans_2013.pdf

U.S. Department of Veterans Affairs, Office of Research & Development. (2014a). *Health care disparities.* Retrieved from http://www.research.va.gov/research_topics/disparities.cfm

U.S. Department of Veterans Affairs, Office of Research & Development. (2014b). *Kidney disease.* Retrieved from http://www.research.va.gov/research_topics/Kidney_disease.cfm

U.S. Department of Veterans Affairs, Office of Research & Development. (2014c). *VA R&D Women's health.* Retrieved from http://www.research.va.gov/programs/womens_health/

U.S. Department of Veterans Affairs, Office of Research & Development. (2015). *Kidney disease factsheet.* Retrieved from http://www.research.va.gov/pubs/docs/va_factsheets/KidneyDisease.pdf

U.S. Department of Veterans Affairs, Office of Research & Development. (2016). *VA research on Kidney Disease.* Retrieved from http://www.research.va.gov/topics/kidney_disease.cfm

U.S. Department of Veterans Affairs, VA Information Resource Center. (2015) *The Researchers Guide to VA Data: VA Information Resource Center.* Retrieved from http:www.virec.research.va.gov

U.S. Renal Data System. (2014). Methods: Chronic Kidney Disease. [In USRDS 2013 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States], *American Journal of Kidney Diseases, 63*(1 Suppl), e137-e150. doi:10.1053/j.ajkd.2013.10.024

Vaidya, V., Partha, G., & Karmarkar, M. (2012). Gender differences in utilization of preventive care services in the United States. *Journal of Women's Health, 21*(2), 140-145. doi:10.1089/jwh.2011.2876

Vimalananda, V. G., Miller, D. R., Palnati, M., Christiansen, C. L., & Fincke, B. G. (2011). Gender disparities in lipid-lowering therapy among veterans with diabetes. *Women's Health Issues, 21*(4 Supp.), S176-S181, doi:10.106/j.whi.2011.04.009

Washington, D. L., Bean-Mayberry, B., Hamilton, A. B., Cordasco, K. M., & Yano, E. M. (2013). Women veterans' healthcare delivery preferences and use by military service era: Findings from the national survey of women veterans. *Journal of General Internal Medicine, 28*(Suppl 2), 571-576. doi:10.1007/s11606-012-2323-y

Washington, D. L., Bean-Mayberry, B., Riopelle, D., & Yano, E. M. (2011). Access to care for women veterans: Delayed healthcare and unmet need. *Journal of General Internal Medicine, 26*(Suppl 2), 655-661. doi:10.1007/s11606-011-1772-z

Washington, D. L., Yano, E. M., Simon, B., & Sun, S. (2006). To use or not to use: What influences why women veterans choose VA health care. *Journal of General Internal Medicine, 21*(Suppl 3):S11-S18. doi:10.111/j.1525-1497.2006.00369.x

Wolfe, D. (2011). Gender differences in outpatient health services utilization among operation enduring freedom and operation Iraqi freedom veterans enrolled at a central Mississippi Veterans Affairs Medical Center between October 1, 2002 and September 31, 2008. *Researcher: An Interdisciplinary Journal*, *24*(2), 79-110. Retrieved from http://www.jsums.edu/researcher/wp-content/blogs.dir/335/files/2013/11/Complete-Fall-2011.pdf?x38727

Wonnacott, A., Meran, S., Amphelett, B., Talabani, B., & Phillips, A. (2014).

Epidemiology and outcomes in community-acquired versus hospital-acquired AKI. *Clinical Journal of American Society of Nephrology, 9*(6), 1007-1014. doi:10.2215/CJN.07920713

Wooten, N. R., Mohr, B. A., Lundgren, L. M., Adams, R. S., Merrick, E. L., Williams, T. V., & Larson, M. J. (2013). Gender differences in substance use treatment utilization in the year prior to deployment in Army service members. *Journal of Substance Abuse Treatment*, *45*, 257-265. doi:10.1016/j.jsat.2013.04.001

Yano, E. M., Haskell, S., & Hayes, P. (2014). Delivery of gender-sensitive comprehensive primary care to women veterans: Implications for VA patient aligned care teams. *Journal of General Internal Medicine*, *29*(Suppl 2), S703-S707. doi:10.1007/s11606-013-2699-3

Yu, M. K., Katon, W., & Young, B. A. (2015), Associations between sex and incident chronic kidney disease in a prospective diabetic cohort. *Nephrology*, *20*, 451-458. doi:10.1111/nep.12468.

Appendix A: List of Abbreviations

ACR	Albumin-Creatinine Ratio
AKI	Acute Kidney Injury
AKI-CKD	Acute Kidney Injury- Chronic Kidney Disease
AKIN	Acute Kidney Injury Network
AOR	Adjusted Odd Ratio
ANOVA	Analysis of Variance
ARF	Acute Renal Failure
AUD	Alcohol Use Disorders
BMI	Body Mass Index
BP	Blood Pressure
CA-AKI	Community-Acquired Acute Kidney Injury
CAN	Care Assessment Need
CART	Clinical Assessment, Reporting, and Tracking (CART)
CBOC	Community-Based Outpatient Clinic
CDC	Centers for Disease Control and Prevention
CDW	Corporate Data Warehouse
CI	Confidence Interval
CKD	Chronic Kidney Disease
CMS	Centers for Medicare & Medicaid Services
CPOE	Computerized Physician Order Entry
CPRS	Computerized Patient Record System
CPT	Current Procedural Terminology
CTS	Contingency Tracking System
CV	Cardiovascular
CVD	Cardiovascular Disease
DART	Data Access Request Tracker
DEERS	Defense Eligibility and Enrollment Services
df	Degrees of Freedom
DoD	Department of Defense
DSS-NDE	Decision Support System-National Data Extract
EDIS	Emergency Department Integration Software
eGFR	Estimated Glomerular Filtration Rate
EMR	Electronic Medical Records
EOL	End-of-Life
ER	Emergency Room
ESRD	End-Stage Renal Disease
η^2	Eta Squared
FY	Fiscal Year
HA-AKI	Hospital-Acquired Acute Kidney Injury
HbA1c	Hemoglobin A1c
Ho	Null Hypothesis
HRQL	Health-Related Quality of Life

HSR&D	Health Services Research and Development Services
ICD	International Classification of Diseases
ICD-9	International Classification of Diseases and Related Health Problems, 9th Revision
ICD-10	International Classification of Diseases and Related Health Problems, 10th Revision
ICU	Intensive Care Unit
IOM	Institute of Medicine
IPEC	InPatient Evaluation Center
IRB	Institutional Review Board
IRR	Incidence Rate Ratio
KDIGO	Kidney Disease Improving Global Outcomes
Λ	Lambda
LDL	Low-Density Lipoprotein
LOS	Length of Stay
M	Mean
MACE	Major Adverse Cardiac Event
MAKE	Major Adverse Kidney Event
MANOVA	Multivariate Analysis of Variance
MARCE	Major Renocardiovascular Event
MST	Military Sexual Trauma
N	Sample Size
NCHS	National Center for Health Statistics
NCVAS	National Center for Veterans Analysis and Statistics
NPCD	National Patient Care Database
NPPD	National Patient Prosthetics Database
NRWV	National Registry of Women Veterans
OA	Osteoarthritis
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OND	Operation New Dawn
OR	Odd Ratio
PTH	Parathyroid Hormone
PTSD	Posttraumatic Stress Disorder
RIFLE	Risk, Injury, and Failure; and Loss; and End-stage kidney disease
R&D	Research and Development
RRT	Renal Replacement Therapy
SA	Substance Abuse
SCr	Serum Creatinine
SD	Standard Deviation
SES	Socioeconomic Status
Sig.	Significance
SMR	Standardized Mortality Ratios
SPSS	Statistical Package for the Social Sciences

SQL	Structured Query Language
SSMS	SQL Server Management Studios
SUDX	Substance Use Diagnosis
SUT	Substance Use Treatment
U.S.	United States
USRDS	United States Renal Data System
USVARD	United States Department of Veteran Affairs, Office of Research & Development
VA	Department of Veterans Affairs
VAMC	Veterans Affairs Medical Center
VHA	Veteran Health Administration
VINCI	VA Informatics and Computing Infrastructure
VIReC	VA Information Resource Center
VISN	Veteran Integrated Services Network
VistA	Veterans Health Information Systems and Technology Architecture
WHC	Women's Health Clinic
WVs	Women Veterans
χ^2	Chi Square