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Hepatitis C Infection and Kidney Transplant Waiting Time Among End-Stage Renal Disease Patients

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Walden University
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Abstract

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MSN/Ed, University of Phoenix, 2011

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health/Epidemiology

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Abstract

Kidney transplantation is identified as the ideal approach to managing end-stage renal disease (ESRD), yet access for some groups remains an ongoing concern. Research findings support the notion that hepatitis-C-infected ESRD patients benefit from kidney transplantation compared to those remaining on dialysis. Although the disparity in access to kidney transplantation has been well researched, the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients was unknown. The purpose of this quantitative retrospective study was to analyze the association between hepatitis C virus infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. Bronfenbrenner's ecological systems theory was used as the theoretical foundation for this study. Secondary data were provided by the United Network for Organ Sharing for all kidney transplantations performed between January 1, 2010, and December 31, 2020 for adults 18 years of age and older. Kruskal-Wallis and bivariate regression tests demonstrated a significant association between blood type, age, race, and health insurance coverage and kidney transplant waiting times. The Social change implications are that findings may be used to implement programs to address the disparities limiting access to kidney transplantation among ESRD patients.

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Dedication

This dissertation is dedicated to my wife, best friend, and partner in crime, Linda Bernice McCormick (Lin).

Acknowledgments

I must first thank God for giving me the courage to fight and to never give up. The next person I should thank is my wife. Lin, thank you for not giving up on me and seeing me through this journey. It would not have been possible without your support (whether it was to fix the computer when it was broken or replace it when you could no longer fix it). You made sure I had a flash drive to back up my work and an external drive to back up the entire system. You helped find lost documents when I could not remember where I saved them. Most of all, you were always there to listen and cheer me on. Without reservation, I would like to extend my sincere gratitude to all who have invested their times and knowledge to guide me through this long journey. My dissertation chair, Dr. Nancy Rea, you are the lifeline I needed. My committed member, Dr. Sams, you took time to respond to my request for a meeting while you were away on vacation. My university research reviewer, Dr. Naoyo Mori, and my academic advisor, Mr. Williams, you always made it a priority to return my calls. To all of you who have invested your time and your knowledge to make this dream a reality, thank you!

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Chapter 1: Introduction to the Study

The focus of this study was the relationship between hepatitis C virus (HCV) infection, blood type, and kidney transplant waiting time. The purpose of this quantitative, retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting time among end-stage renal disease (ESRD) patients when controlling for age, gender, race, work income, and health insurance coverage. The results may provide information that can be used to develop interventions to guide health care providers, hospitals, and dialysis centers in educating patients regarding their transplant options. Furthermore, such knowledge may be used to support new legislation that may improve the kidney allocation process. This chapter provides information on the background of the study and the problem statement, which represented the foundation for the study. In addition, Chapter 1 includes the background of the study, problem statement, purpose of the study, research questions, nature of the study, definitions, assumptions, scope of delineation, limitations, significance, and a summary.

Background

Kidney transplantation has a long history dating back to the early 1900s. In the early phase of experimenting with kidney transplantation, all attempted transplants (animal-to-animal, animal-to-human, and human-to-human) failed in that they lasted only a few days and none of the recipients survived (Barker, & Markmann, 2013; Hopewell et al., 1964; McCauley, 2018). Kidney transplantation has been identified as the ideal approach in the management of kidney failure (Aguirre et al., 2015; Ozer Etik et al., 2015; Ryerson et al., 2020. In addition to being cost-effective, kidney transplantation has been found to increase the quality of life and survival. Currently, the number of active candidates on the kidney waiting list has increased by almost

50%, nearly doubling over the last decade (UNOS, 2021). In 2019, kidney failure was classified as the 10th leading cause of death in the United States, while the number of Americans diagnosed with ESRD receiving dialysis grown. As of April 2021, more than 83% of qualified individuals on the organ transplant list were kidney candidates (CDC, 2018; UNOS 2020). However, access to kidney transplantation remains an ongoing problem in the United States (Hamoda et al., 2020).

Factors such as racial and ethnic background, socioeconomic status, and comorbid conditions have been identified as barriers to accessing kidney transplantation (Hamoda et al., 2020; Kiberd et al., 2018). HCV infection is a common chronic condition among dialysis patients, accounting for 14% of cases, 10 times higher than in the general population (Aguirre et al., 2015; Sawinski et al., 2019). In addition, the longer patients remain on dialysis, the greater the likelihood they will develop anti-HCV antibodies (Aguirre et al., 2015). Approximately 5%–6% of all waitlist candidates are HCV positive (Sawinski et al., 2019). Although the presence of HCV in ESRD patients has been well studied, how the presence of HCV affects the waiting times for a kidney transplant is unknown. The purpose of this quantitative retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. This study addressed a gap in the literature regarding access to kidney transplantation.

Problem Statement

Disparities in the availability of kidneys for transplantation remain. In 2019, kidney failure became the 10th leading cause of death in the United States (Center for Disease Control

and Prevention [CDC], 2022; Dept. of Health and Human Services Office of Minority Health, 2019). The number of active patients on the waiting list in the United States showed an increase of 45% from 52,503 in 2009 to 95,052 in 2019 (Taherkhani et al., 2022). As of 2021, 650,000 Americans are diagnosed with ESRD, of which 72% (468,000) are receiving dialysis (United Network for Organ Sharing [UNOS], 2021). As of April, 2021, the United Network for Organ Sharing (United Network for Organ Sharing [UNOS], 2021]) database listed 118,195 qualified individuals on the organ transplant list, 83% of whom were kidney transplant candidates. An example is African Americans, who represent nearly13% (12.9%) of the U.S. population but make up 33% of the kidney transplant waitlist population (U.S Department of Health and Human Services [HHS], 2019). African Americans are also found to be under represented on the kidney transplant list. The literature indicated that African Americans develop kidney disease at a rate 3.5 times greater than their White counterparts and 1.5 times greater than that of Hispanics, Latinos, and Native Americans (CDC, 2018). The issue that prompted me to search the literature was the persistent inequalities in access to kidney transplantation (Arriola , 2017; Axelrod et al., 2018; Fu et al., 2020; Gordon et al., 2018; Khana et al., 2020; Ku et al., 2020; Laging et al., 2019, UNOS, 2019).

HCV infection remains a major concern among ESRD patients receiving hemodialysis treatment. Study results showed the longer ESRD patients remain on dialysis, the more likely they are to develop anti-HCV antibodies (Aguirre Valdez et al., 2015; CDC, 2019; Faujdar et al., 2013; Jadoul et al., 2019; Kamal et al., 2018; Kiberd et al., 2018; Sawinski et al., 2019). When patients are diagnosed with ESRD, dialysis treatment is required to sustain their life unless and until kidney transplantation becomes available (American Kidney Fund, 2022;

Cleveland Clinic, n.d.; Merck Manual [Consumer Version], 2022; National Institute of Diabetes and Digestive and Kidney Disease, n.d; National Kidney Foundation, 2022; UNOS, 2019). Study results showed that patients who remain on dialysis for an extended period of time are more likely to develop anti-HCV antibodies (Aguirre Valdez et al, 2015; Kiberd et al., 2018; Sawinski et al., 2019). In my literature search, I discovered that although there was ample information on HCV infection and ESRD, there was limited to no information on kidney transplant waiting times for HCV-infected ESRD patients.

Purpose of the Study

The purpose of this quantitative retrospective study was to analyze an association between HCV infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage.

Table 1

National Kidney Distribution Between January 1, 2010 and December 31, 2020 in Relation to HCV Virus Infection

Year	All HCV	Negative	Not done	Positive	Unknown/cannot disclose	Unknown
2010	10,622	9,547	115	724	236	0
2011	11,043	10,122	129	697	95	0
2012	10,868	10,035	121	654	58	0
2013	11,163	10,325	121	678	37	2
2014	11,570	10,718	99	719	34	0
2015	12,250	11,132	149	938	31	0
2016	13,431	12,325	101	986	19	0
2017	14,038	13,030	85	901	21	1
2018	14,725	13,827	98	785	11	4
2019	16,534	15,562	200	764	7	1
2020	17,583	16,564	283	711	13	12

Research Questions

The research questions (RQs) I sought to answer were the following:

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

RQ2: What is the difference in kidney transplant waiting times by blood type among ESRD patients?

RQ3: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage?

Nature of the Study

The ongoing disparities in kidney allocation in the United States affect some groups more than others. HCV infection is 10 times higher among ESRD patients than the general population (Khan et al., 2020; Ladino et al., 2016; National Kidney Foundation, 2021). Research showed that despite the screening of blood and blood products, nosocomial HCV transmission remains an ongoing issue in hemodialysis units (Aguirre Valadez et al., 2015). Furthermore, documentation supported the idea that the longer patients remain on dialysis, the more likely they are to develop anti-HCV antibodies (Sawinski et al., 2019). Approximately 5%–6% of all waitlist candidates are HCV positive (Kiberd et al., 2018). HCV-positive ESRD patients benefit from kidney transplantation because they have a significantly higher chance of survival compared to those who continue to receive dialysis treatment (Sawinski et al., 2019). Although HCV in ESRD patients has been well studied, how the two affect the waiting times on the transplant list has not been analyzed.

Definitions

ABO-incompatible: The blood type of the donor does not match that of the recipient (Mayo Clinic, 2021).

Chronic kidney disease (CKD): A change in the structure or function of the kidneys that has been going on for more than a month and is bad for a person's health (CDC, 2021).

End-stage renal disease (ESRD): A medical condition in which a person's kidneys stop working for good, requiring long-term dialysis or a kidney transplant to keep the person alive (Center for Medicare and Medicaid Services [CMS]), 2021).

Glomerular filtration rate (GFR): A test used to check how well the kidneys are working. Specifically, GFR estimates how much blood passes through the glomeruli each minute. Glomeruli are the tiny filters in the kidneys that filter waste from the blood. GFR is measured through a blood sample that is tested for creatinine level and then used in a formula (different for adults and children) that includes criteria such as patients' age, blood creatinine measurement, ethnicity, sex, height, and weight (National Kidney Foundation, 2021).

Hepatitis C virus (HCV): A viral infection that spreads through contaminated blood, causing liver inflammation and sometimes leading to serious liver damage (Mayo Clinic, 2021).

Assumptions

CKD is a public health problem that affects a large segment of the U. S. population. As of April 2021, 72% of Americans diagnosed with ESRD were receiving dialysis treatment (UNOS, 2019). CKD is becoming a bigger problem as evidenced by the number of people waiting for a kidney transplant increased from 52,503 in 2009 to 95,052 in 2019 (Taherkhani et al., 2022). Some groups are affected more than others. For example, African Americans represent almost

13% of the U.S. population, but they make up 35% of the kidney transplant list. In addition, as of April 2021, the UNOS database identified 118,195 qualified individuals on the organ transplant list, 83% of whom were kidney transplant candidates. Besides economic constraints, ESRD can also be a major social burden on both patients and the health care system (Queely et al., 2018).

Scope and Delimitations

CKD is a growing health burden. An increasing number of people continue to develop ESRD (Nakhoul et al., 2015; Taherkhani et al., 2022). The current study addressed a gap in the literature related to access to kidney transplantation. The study's purpose was to analyze the association between HCV infection, blood type, and kidney transplant waiting times when controlling for age, gender, race, work income, and health insurance coverage. The study excluded kidney transplant recipients under 18 years of age and those who received a second kidney transplant between 2010 and 2020.

The dependent variable was kidney transplant waiting times (an ordinal variable measured as 1 = 36 months, 2 = 36–48 months, 3 = 49–72 months, and 4 = > 72 months). The independent variables were HCV infection (a categorical variable measured as 0 = N, 1 = P) and blood type (a nominal variable measured as 1 = O, 2 = A, 3 = B, and 4 = AB). The covariates were (a) race, a nominal variable measured as 1 = White, 2 = Black or African American, 3 = Hispanic or Latino, 4 = other race; (b) age, an ordinal variable measured as 1 = 18–34 years, 2 = 35–54 years, and 3 = 55–70 years; (c) gender, a categorical variable measured as 0 = female and 1 = male; (d) work income, a nominal variable measured as 1 = yes an 0 = no; and (e) health insurance coverage, a nominal variable measured as 1 = private insurance, 2 = public insurance Medicaid, 3 = public insurance Medicare, and 4 = other insurance.

The statistical analyses used to answer the research questions were nonparametric analysis, bivariate correlation, and post hoc analysis. A secondary data set from the UNOS database containing de-identified information collected on kidney transplant candidates and recipients for all kidney transplants performed between January 1, 2010, and December 31, 2020, was used in the analysis. This research was conducted during the school year 2023. The target population for which the study results are applicable is HCV-infected ESRD patients.

Limitations

Although study limitations are unavoidable and difficult to discuss, they must be addressed. Limitations are flaws in a research design that can have an impact on the outcomes and conclusions of studies (Connely et al., 2013; Price et al., 2004; Ross et al., 2019). However, a thorough outline of the limitations of any study can benefit editors and reviewers in comprehending any methodological concerns (Ross et al., 2019). Some limitations are controllable by researchers and some are not. Examples of limitations that researchers cannot control are those associated with the study design and instruments. For example, the process of delimitations, which are conscious choices made on inclusion and exclusion criteria during the study planning to help narrow the scope are within researchers' power to control (Price et al., 2004). Like most, if not all others, this study is subject to multiple limitations.

It is worth noticing that the same constraints that apply to other retrospective studies, based on administrative datasets, also apply to this one, as do the limitations of all retrospective studies (Ross et al., 2019). For my study, in particular, there is a lack control over the data that was available to conduct the analysis. Furthermore, there may be unique confounders that were not taken into consideration when compiling the dataset. The number of HCV-positive patients

that are included in the dataset may not constitute a representative sample of the population under study, which may pose a threat to generalizability. Last, as with any research study, I embarked on the journey by performing an extensive review of the literature to determine the scope of previous work done in the subject field. It was determined that there were no earlier studies analyzing for an association between HCV infection and waiting times among ESRD population on the kidney transplant list, which allows for further investigation. The steps I will take to mitigate those limitation is controlling for variables like race, gender, work income, and health insurance coverage.

Significance

HCV infection is a major problem in the ESRD population. According to research, ESRD patients with HCV infection have a significant death and morbidity rate. (Fabrizi, 2019; Goodkin, 2017; Sawinski, 2019) Results from the current study may provide information on the impact of HCV infection on the transplant waiting time in ESRD patients. With enhanced knowledge about the condition's impact, health care professionals may devise strategies to alleviate the stress of extended wait times for patients. Findings may also provide knowledge for HCV-infected ESRD patients. Furthermore, findings may aid in the formulation of new rules that can not only advise health care providers but also defend the rights of HCV-positive ESRD patients seeking kidney transplantation.

Summary and Transition

I analyzed the association between HCV infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. The ecological systems theory of Bronfenbrenner was used as the

study's framework because it explains the interconnectedness and interdependence of people's social environments on their development and the components throughout a health condition (see Arriola, 2017; Cabacungan et al., 2020; Jones, 2000). The goal of this quantitative retrospective study was to look at the relationship between HCV infection, blood type, and kidney transplant waiting periods among ESRD patients when controlling for age, gender, race, and health insurance coverage. Findings may be transformed into knowledge to drive policy creation and initiatives that may be used to improve the kidney allocation process and achieve fair distribution.

The Walden University Institutional Review Board (IRB) reviewed the scope of the study and granted approval to proceed. The study was open only to first-time kidney recipients age 18 and older between January 1, 2010, and December 31, 2020. This study had some limitations, which I attempted to mitigate. This study generated findings that may be used to support the development of interventions to guide practice or new legislation to guide kidney allocation. Chapter 2 provides a review of the literature on barriers to accessing kidney transplantation, HCV infection among ESRD patients, and kidney transplant waiting times.

Chapter 2: Literature Review

The purpose of this quantitative retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. This chapter presents the literature search technique, theoretical foundation, pathophysiology of kidney failure, accessible dialysis treatment, background of organ transplantation, and availability and selection of recipients. Also, I discuss the factors that influence kidney transplant waiting periods. Despite the fact that kidney transplantation is the greatest therapeutic option for ESRD patients, inequities for racial minority populations remain a major concern (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019). Axelrod et al. (2018) discovered that kidney transplantation improves quality of life, reduces ESRD mortality, and is cost-effective.

Racial minorities are more likely than Whites to develop renal disease, yet they have less access to kidney transplantation (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019; Khana et al., 2020; Ku et al., 2020; Laging et al., 2019; U.S. Department of Health and Human Services Office of Minority Health, 2019). According to Arriola (2017), limited access to kidney transplantation may result from racism at every step of the transplantation process. Other factors that interfere with clinical and nonclinical aspects manifest at multiple interlaced levels of an individual's environment may also be to blame for the scarcity of kidney transplants (Ladino et al., 2016). HCV infection is more frequent in ESRD patients than in the general population, especially in hemodialysis patients (Axelrod et al., 2018; Khan et al., 2020; Ladino et al., 2016, Laging et al., 2019). HCV-positive individuals account for 14% of the ESRD population, 10

times greater than the general population (Khan et al., 2020; Ladino et al., 2016; National Kidney Foundation, 2021).

Literature Search Strategy

A literature search was conducted for works published between 2016 and 2022. Chronic kidney disease, end-stage renal disease, hepatitis C virus, barriers to accessing kidney transplantation, kidney failure, end-stage renal disease patients with hepatitis C virus, and hepatitis C-infected patients on the kidney transplant list were among the keywords used in the search fields. The database searches included CINHAL Plus with Full Text, ERIC, Medline with Full Text, PubMed, EBSCOhost, Google Scholar, and SAGE for relevant articles published from 2016 and later. Statistical data were also obtained from the websites of the following government agencies: the CDC, National Institutes of Health (NIH), National Vital Statistics, the United States Department of Health and Human Services, and UNOS.

Theoretical Framework

Bronfenbrenner's (1975) ecological systems theory is one of the most commonly recognized explanations of how people's social environments influence their development. Bronfenbrenner developed the theory of ecological systems to understand the dynamic interrelationships between diverse personal and environmental elements. The core concept of ecological systems theory is that biological and psychological factors influence behavior at numerous levels, including the intrapersonal level (Cabacungan et al., 2020; CDC, 2022; Hwang et al., 2020). Social and cultural aspects are included at the interpersonal level (Cabacungan et al., 2020; CDC, 2022; Hwang et al., 2020). Finally, there are organizational-level elements, which include community, physical environment, and policy considerations.

According to the ecological systems theory, the environment in which people grow up influences all areas of their lives. Ecological systems theory viewpoints stress the interdependence and interconnection of components across a health situation (Arriola, 2017; Cabacungan et al., 2020; Jones, 2000). In the current study, the ecological systems theory was used to illustrate critical concepts at each level (institutional, community, interpersonal, and individual) that may negatively impact access to kidney transplantation, thereby lengthening the transplant waiting times (see Arriola, 2017; Hwang et al., 2020; Jones, 2000). Ecological systems theory has influenced many psychologists' analyses of the individual and the effects of various environmental systems they have encountered throughout their lives (Cabacungan et al., 2020; CDC, 2022; Hwang et al., 2020).

Addressing racial disparities in access to kidney transplantation requires a complete understanding of racism at all levels of society. To develop policies and interventions that address barriers in access to kidney transplantation, it is critical to understand the complex mechanisms of racism that influence them (Purnell et al., 2021). Arriola (2017) listed the eight steps to attaining a renal transplant; every step involves different levels of the three racial disparities, and racism can occur at each step. In the literature, the disparities for health care racism have been located within the patients and/or health care providers, thereby ignoring the bigger problems of structural violence (Farmer et al., 2006), which is depicted by both structural and social forces bearing down on patients, providers, and the transplant system, as well as the force of racism (Arriola, 2017). Both Arriola (2017) and Jones (2000) used ecological systems theory to explain the connection between racism and organ transplants.

Even though the best treatment for people with ESRD is a kidney transplant, there are clear racial differences in this area (Arriola, 2017; Jones, 2000). Access to renal transplantation is different for people of different races because of factors such as a lack of organs, a faster progression of CKD to ESRD in African Americans, Medicare incentives in the way payments are made, and Social Security Disability (Arriola, 2017). The study by Ariola (2017) supported to the framework of the proposed study, which was based on ecological systems theory. Arriola discussed the role of racism at three different levels of the ecological systems theory: personal, internal, and institutional. Arriola and Molina and James (2016) defined personalized racism as making a decision about someone's motives, abilities, and intentions based only on their race. Unconscious racial bias can affect treatment decisions in a number of ways, such as by omitting to discuss all of the treatments available to patients to help them make educated, informed decisions (Arriola, 2017; Cogburn, 2019; Jones, 2000).

Personally Mediated Racism

Although race-related differences in health outcomes have been well documented in the literature, they remain unexplained. Personally mediated racism is a bias that occurs when people interact with each other, and their personal racial beliefs influence how they interact in public (Arriola, 2017; Jones, 2000; Molina et al., 2016). Personally mediated racism can be intentional or unintentional, or it can be an act of commission or omission.

Internally Mediated Racism

Internally mediated racism is racism within the person. This type of racism consists of culturally influenced private beliefs and biases about race and racism (American Academy of Family Physicians, 2022; Ariola et al., 2017; Jones, 2002). Internally mediated racism is

prejudice against people of a different race, internal oppression, negative beliefs about oneself held by other people of color, or internalized privilege and beliefs held by the majority group about superiority or entitlement. In short, internally mediated racism reflects systems of privilege that a person accepts by internalizing negative messages about people in a stigmatized racial group (Jones, 2000). An example of internally mediated racism is when African American patients devalue their self-worth and do not pursue the most aggressive available treatment (Jones, 2000). Feelings of hopelessness, helplessness, and rejection of a person's own cultural expression are common (Jones, 2000).

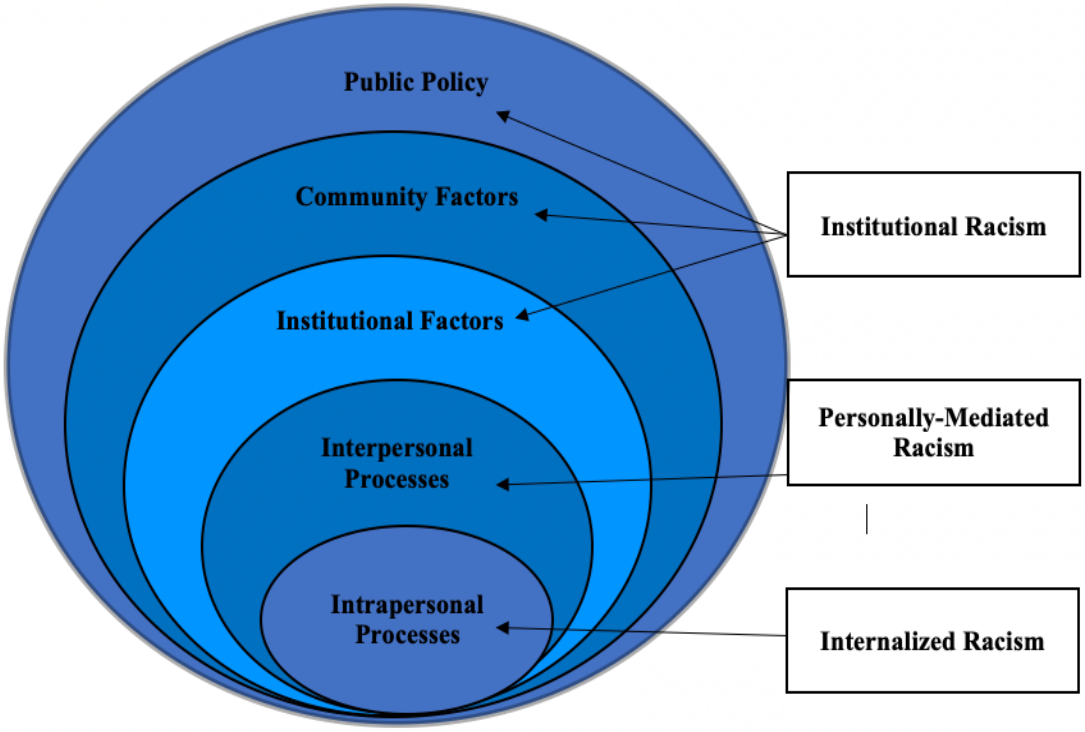
Institutional Racism

Institutional racism impacts racial minority groups in the United States. According to the American Academy of Family Physicians (2022) and Atkins-Jackson et al. (2021), institutional racism is defined as a set of practices and policies that disadvantage people who are not members of society's dominant groups. Institutional racism is the normalization of sometimes legalized practices and customs with consequential differences in services, goods, and opportunities based on race (Arriola, 2017; Nee et al., 2017). The government has the power to decide, act, and control resources. One example of institutional racism is housing policies that result in segregation. Another example is education funding policies that result in accessibility differences in the quality of education children receive in the United States (Arriola, 2017). Race-related health outcomes have been well documented but not well explained (Jones, 2000). Institutional racism can manifest at the community, institutional, and public policy levels (see Figure 1). There is a longstanding existence of racial residential segregation and empirically established links between neighborhood racial composition and dialysis facility-level transplantation rates

(Arriola, 2017). In a study by King et al. (2019), patients with private health insurance, Medicare, and Medicaid were shown to have significant differences in obtaining kidney transplants even after controlling for socioeconomic status.

Figure 1

Classification of Racism



Note. Adapted from Race, Racism, and Access to Renal Transplantation Among African" Americans by K. J. Arriola 2017, *Journal of Health Care for the Poor and Underserved, 28(*1), p. 35. https://doi.org10.1353/hpu.2017.0005. Copyright 2017 by John Hopkins University.

Socioeconomic status and race have a significant impact on access to health care services. The two interact to shape the experience of a person receiving health care in the United States (Altman et al., 2019; Cruz et al., 2019; Villatoro et al., 2018). Racial microaggressions are not an uncommon experience for racial minorities when interacting with health care workers (Almond, 2019; Dovidio et al., 2018; Kanter et al., 2020; Paradies et al., 2015; Snyder et al., 2018). Sue et al. (2007) defined racial microaggressions as "brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color" (p. 271). Frequently, the person committing racial microaggressions does not realize they are occurring (Jones, 2000; Sue et al., 2007; Williams et al., 2021).

Pathophysiology of Kidney Failure

The kidney is an organ whose main job is to filter the blood and get rid of wastes like potassium, acid, and phosphate, which are then passed out of the body in the urine (Mayo Clinic, 2021; Organ Procurement and Transplantation Network, 2018). Reduced kidney function is when the kidneys can't get rid of waste and extra fluid from the blood (CDC, 2021; Mayo Clinic, 2021). Chronic kidney disease (CKD) is the gradual loss of kidney function, which can be fatal if not treated (Sandikc et al., 2019). According to the CDC (2021), an estimated 1 in 7 Americans has CKD, or 15% of the total population, or 39,000 people. Also, the CDC found that CKD is more common in people 65 and older, in non-Hispanic black people, and is 14% more common in women than in men.

A large percentage of kidney disease goes undiagnosed because symptoms can often go unnoticed. A diagnosis of kidney disease confirms the presence of decreased kidney function of

less than 60 ml/min per 1.73 m2 lasting at least three months (National Institute of Health [NIH] (2021), National Kidney Foundation [NKF], & CDC (2021). Primarily, kidney function is assessed through blood and urine tests to measure glomerular filtration rate (GFR) and proteinuria, the presence of protein in the urine (CDC, 2021; NIH, 2021; NKF, 2021; & UNOS, 2019). According to data from the 2019 National Vital Statistics Reports [NVS], kidney disease is one of the top ten leading causes of death in the United States (U.S.) and accounts for 1.8% of all deaths. Studies identified a direct association between diabetes, hypertension, heart disease, obesity, family history, and CKD (CDC, 2021; KDIGO, 2019; NIH, 2021; NKF, 2021; & UNOS, 2019).

Classifications of Kidney Disease

A three-piece information process is required for the diagnosis of chronic kidney disease (CKD). CKD is defined as "abnormalities of kidney structure or function, present for > 1 month, with implications for health" (CDC, 2021; KDIGO, 2019; NIH, 2021; NKF, 2021; & UNOS, 2019). Physicians classify kidney disease using a three-step process known as CGA. In the 2017 Kidney Disease Improving Global Outcomes (KDIGO) Guidelines Recommendation, the glomerular filtration rate (GFR), G1-G5, otherwise known as the G category, is one of the three crucial pieces of information to determine CKD classification (KDIGO, 2017). The G1 category represents normal kidney function, in which the GFR is 90 (normal kidney). In the G2 category, there is mildly decreased kidney function with a GFR of < 60 mg to 89 mg/min per 1.73 m2. It is important to know that neither GFR category G1 nor G2 meet the criteria for CKD unless there is evidence of kidney damage (NKF, 2021). At the same time, G3, G3a, and G3b indicate kidney disease with >60 to 15 mg/min per 1.73 m2. G4 is considered to have severely decreased kidney

function when the GFR is 15-29 mg/min per 1.73 m2. Last, G5 represents >15 mg/min per 1.73 m2 kidney function. The latter is known as ESRD or kidney failure, and patients require kidney replacement (dialysis) to sustain life unless transplantation is available (CDC, 2021; NIH, 2021; NKF, 2021; & Machado, 2014).

According to the National Kidney Foundation [NKF] (2021), CKD is classified using a method called CGA. To come up with the CGA, physicians use three pieces of information: the cause of CKD (C), the glomerular filtration rate (GFR) category (G1-G5), and the assigned albuminuria category (A1-A3). CKD is one of the most notable examples of health inequities in American public health. The high prevalence of CKD makes it a growing public concern because it is associated with higher morbidity and mortality rates and can progress quickly to the debilitating stage known as end-stage renal disease or kidney failure [KF] (Myers, 2018). The types of treatments for ESRD are hemodialysis, which can be performed at home or at a dialysis center, and peritoneal dialysis, which is almost always performed at home. The table below reflects the prognosis of CKD by categories of glomerular filtration rates (GFR) and albuminuria.

Figure 2

Prognosis of CKD by Categories of Glomerular Filtration Rates and Albuminuria

				Persistent Albuminuria Categories Description and Range		
				A1	**A2**	**A3**
				Normal to Mildly Increased	**Moderately Increased**	**Severely Increased**
				<30mg/g <30mg/mmol	30-300mg/g 3-30mg/mmol	>300mg/g >30mg/mmol
GFR Categories (mL/min 1.73 m²) Description and Range	G1	Normal or High	≤90			
	G2	Mildly decreased	60/89			
	G3a	Mildly to Moderately decreased	45-59			
	G3b	Moderately to Severely decreased	30-44			
	G4	Severely decreased	19-29			
	G5	Kidney Failure	<15			

Note. Adapted from KDIGO's 2008 guideline on HCV infection in CKD.

Table 2

Comparison of Tests Measuring Kidney Functions

Category	Estimated GFR (eGFR)	Measured GFR (mGFR)
How it works	A calculation used to estimate how well your kidneys are filtering certain agents produced by your body, such as: • creatinine (a waste product that comes from the normal wear and tear on muscles) • cystatin C (a protein that slows down the breakdown of other protein cells)	A measurement of how well your kidneys are filtering certain agents not produced by your body, such as: • inulin (a kind of fiber that is found in some plant foods) • iohexol (contrast agent used in imaging tests)
Availability	Widely available	Not widely available
Cost	Not expensive	Expensive
Accuracy	Possible inaccurate estimates of GFR, especially in early stages of kidney disease (Stages 1 & 2)	Accurate measures of GFR, including early stages of kidney disease (Stages 1 & 2)
Precision	Can miss early GFR changes, such as a rapid decrease in levels, which may be a sign of diabetic kidney disease	Can identify early GFR changes, such as a rapid decrease in levels, which may be a sign of diabetic kidney disease

Note. From the National "A comparison of Five Areas Between eGFR and mGFR."

Available Dialysis Treatments

Dialysis is a life-saving treatment for people with ESRD who don't have a healthy kidney to donate. Willem Kolff, a Dutch physician, created the dialyzer in 1943, also known as the artificial kidney and the dialysis machine (American Kidney Fund, 2022; Cleveland Clinic, n.d.; Merck Manual [Consumer Version], 2022).When the kidney is unable to adequately remove wastes, toxins, and excess fluid from the blood, immediate alternate treatment is needed to

replace those functions and sustain life (National Kidney Foundation, 2021; UNOS, 2019). At that point, the kidney functions are between 10 and 15%, and the person is considered to be in stage 5G, end-stage renal disease (ESRD), or kidney failure. End-stage renal disease or kidney failure patients have two primary treatment options: long-term dialysis or kidney transplantation (Patzer et al., 2017). The two types of dialysis options available to patients are hemodialysis and peritoneal dialysis (National Kidney Foundation, n.d.; UNOS, 2019). After considering the pros and cons, patients and their physicians decide which type of dialysis to undergo.

Hemodialysis Process

This treatment approach is performed via an arteriovenous fistula (AV fistula) or arteriovenous graft (AV graft) that is inserted by a surgeon prior to initiating dialysis treatment and was invented by Dr. Belding Scribner in 1962 (American Kidney Fund, 2022; Cleveland Clinic, n.d.; Merck Manual [Consumer Version], 2022; National Kidney Foundation, 2022; National Institute of Diabetes and Digestive and Kidney Disease; n.d; National Institute of Diabetes and Digestive and Kidney Disease, 2018; & UNOS, 2019). Hemodialysis can be performed at home or in medical settings such as hospitals or dialysis centers. The dialysis machine, also known as a dialyzer or artificial kidney, removes excess fluid and filters toxins (creatinine, potassium, and urea) from the blood via one needle and returns the cleansed blood to the body via another. This process is usually performed by normally functioning kidneys. The entire process may take three to five hours and is required multiple times per week (3–4 times) at a dialysis center or hospital. Patients also have the option of receiving hemodialysis at home. If such an option is chosen, patients and their care partners, along with their doctors, can decide on the most appropriate type of home hemodialysis, which will determine how often to treat and the

type of dialyzer. The available options are: (1) conventional home dialysis, which is performed three times per week for about five hours; (2) short-term home hemodialysis, which is usually performed five to seven times per week for about two hours; and (3) nocturnal home hemodialysis, which is performed while patients are sleeping. Treatments are longer, slower, and performed every other night.

Peritoneal Dialysis Process

This process involves the blood of a tiny blood vessel inside the abdominal lining, also known as the peritoneum, to filter blood with the help of a dialysis solution (American Kidney Fund, 2022; Cleveland Clinic, n.d.; Merck Manual [Consumer Version], 2022; National Kidney Foundation, 2022; National Institute of Diabetes and Digestive and Kidney Disease; n.d; National Institute of Diabetes and Digestive and Kidney Disease, 2018; & UNOS, 2019). The cleansing solution used is made up of water, salt, and other ingredients as ordered by a nephrologist. Like hemodialysis, a surgeon must establish a port (a Y-shaped catheter) prior to starting peritoneal dialysis. Patients who choose peritoneal dialysis have the option of two types: one that uses a machine and another that is performed manually. Peritoneal dialysis is performed at home and is identified as: (1) automated peritoneal dialysis, which uses a cycler machine that pumps the fluid in and out of patients' bodies while they are sleeping; and (2) continuous ambulatory peritoneal dialysis (CAPD), which is a manual process. The process takes between 60 and 90 minutes to drain the fluid after it is injected into the abdominal cavity via one end of the Y-shaped tube. This approach requires the patients to perform multiple treatments daily. The table below provides a comparison of dialysis centers and home hemodialysis.

Table 3

Dialysis Center and Home Hemodialysis Comparison Chart

Category	Dialysis center dialysis	Home hemodialysis
Schedule	Three treatments a week for about 4 hours. Monday, Wednesday, Friday; or Tuesday, Thursday, Saturday.	Flexible. Three to seven short or long treatments per week at times that work best for you.
Availability	Available in most communities; may require travel in some rural areas.	Becoming more widely available as smaller equipment is developed.
Machine/supplies	The clinic has the machine and supplies.	The machine and 2- to 4-weeks' worth of supplies are in the home. You may need minor changes in your home to connect the machine to electricity and water.
Training	The clinic teaches about treatments, diet, liquids, medicines, lab tests, etc.	You and a partner must attend 3 to 8 weeks of home hemodialysis training.
Diet and liquids	Strict limits on liquids, phosphorus, sodium, and potassium intake.	Fewer limits on liquids or diet, based on the amount of hemodialysis and lab tests.
Level of freedom	Less freedom on treatment days. May feel washed out and tired for hours after each treatment.	More freedom because you set the treatment schedule to meet the total amount prescribed. Work and travel are much easier.
Amount of work	Center staff members do hemodialysis tasks. They can teach you to do some tasks.	You and your partner must set up, run, and clean the machine; check vital signs; track the treatments and send in forms; and order supplies.
Payment	Medicare, Medicaid, and most other health plans cover three hemodialysis treatments a week.	Medicare covers up to three hemodialysis treatments a week. May cover additional, if needed for medical reasons. Private health plans may cover all hemodialysis treatments.

Note. From National Institute of Diabetes and Digestive and Kidney Disease. Hemodialysis (n.d). Retrieved from https://www.niddk.nih.gov/health-information/kidney-disease/kidney-failure/hemodialysis

Literature Review Organ Transplantation, Hepatitis C, and Waiting Time

Background of Organ Transplantation

The journey to successful kidney transplants has been a long one. Early experimentation with kidney transplantation began more than a century ago. Needless to say, there were numerous failed attempts (animal to animal, 1902; animal to human, 1907; and human to human, 1933) before the very first successful experiment (Benjamens et al., 2020). Between the 1950s and 1980s, surgeons had to overcome many hurdles (rejection, immunosuppression, organ preservation, and blood group compatibility, among others) before the procedure could be successful (Barker et al., 2013; Calne, 1963; Billingham, 1963; & Johnsen, 2012). The very first kidney transplantation was performed on animals in Austria at the Vienna Medical School in 1902 (Nagy, 1999). In 1933, the first human-to-human kidney transplantation was successfully performed but failed to function due to donor and recipient blood group compatibility. It took until 1954 to perform the first successful human-to-human kidney transplantation (Barker et al., 2013; Calne, 1963; Billingham, 1963; & Johnsen, 2012). The miraculous achievement became a reality on December 23, 1954, when doctors Joseph Murry and John Merrill of Peter Bent Brigham Hospital successfully transplanted a kidney from one twin to the other (Benjamens, 2020; Johnsen, 2012). To date, probably no other branch of medical-biological science has grown since the end of World War II [WWII] (Calne, 1963).

Availability and Selection of Recipient

Kidney transplantation is identified as the ideal treatment approach in the management of ESRD patients. Research has identified that the approach is not only cost-effective but also increases the quality of life and prolongs survival rates (Axelrod et al., 2018; Takerkhani et al.,

2022). Despite all, in the US, the list of qualified active candidates on the waitlist continues to grow in the last decade (CDC.org, 2019; UNOS, 2019). In the United States, for example, the number of ESRD patients on the waiting list has increased dramatically, from 52,503 in 2009 to 95,052 in 2019. (Takerkhani et al., 2022). Surprisingly, of the 103,114 patients on the waitlist, only 19,000 received transplantation in the US in 2016 (Taherkhani et al., 2022; Zhang et al., 2019). It has long been known that, compared to others, ethnic minority groups have lesser access to kidney transplantation and even face a longer waiting time on the transplant list (Kilambi et al., 2019; Levey, 2021; & Meyers et al., 2018). Furthermore, many candidates become unlisted due to death before they are matched with a deceased donor kidney (United Network for Organ Sharing [UNOS] 2019). Prior to patients being listed, they must undergo rigorous testing, which includes medical, physical, psychological, and compatibility [blood and tissue typing and cross-matching] (CDC, 2019; National Kidney Foundation, 2022; UNOS, 2019). For example, depending on the age and health condition of the candidates, some or all of the following tests may be required: blood tests to test for certain viruses and to determine the candidates' hearts, kidneys, liver, thyroid functions, and immune systems. Last, a chest X-ray, an echo and electrocardiogram, a cardiac stress test, cancer screening, a colonoscopy, and gynecological exams, among others, are also required (UNOS, 2019). The growing shortage of organs for transplantation forces the US Department of Health and Human Services (DOH) to develop policies designed to balance equity and utility (Taherkhani, 2022). In 2014, UNOS established the new kidney allocation system (KAS), focusing on dialysis time and high-panel reactive groups (Taherkhani, 2022). The new policy change was implemented with minorities in mind as a way to help address the existing racial disparities (Taherkhani, 2022; Wu et al., 2017).

Can timely placement on the kidney transplant waiting list make a difference? To examine the effectiveness of the 2014 KAS policy, Taherkhani et al. (2022) conducted a retrospective longitudinal cohort study to evaluate the impact of the policy change on wait lists as well as how the new policy's implementation affects racial and ethnic disparities in the US. The study population included patients who started dialysis treatment from January 1, 2005, to December 3, 2014 (pre-KAS group, n = 1,120,655) and those who began dialysis from December 4, 2014, to December 31, 2015 (post-KAS group, n = 132,445). The researchers first applied time-to-event analysis to analyze how the new policy, KAS, affected the time period for the ESRD population from the start of dialysis to the transplant waitlist. Second, they applied trend analysis to analyze the monthly wait listing rates among those not yet placed on the transplant list. The results showed a significant decline in wait listing time for black vs. white comparing the pre-KAS of 19% (HR: 0.81; 95% CI: 0.80-0.82) to the post-KAS 12% (HR: 0.88; 95% CI:.85-0.90; $p = 0.001$). However, the results were not significant for Hispanics and Asians vs. whites.

Factors Affecting Kidney Transplant Waiting Time

Many factors impact the waiting time candidates spend on the cadaveric kidney transplant list. Because of the shortage of deceased donor kidneys, a long waiting period is unavoidable; as a result, waiting time care is significant (Barth et al., 2021; Lee et al., 2019). Although the average waiting time on the kidney transplant waitlist is between three and five years, many factors determine the final time period (Lee et al., 2019; United Network for Organ Sharing [UNOS], 2019; & U.S. Dept. of Health and Human Services Office of Minority Health [DOH], 2019). The two groups of factors directly impacting the kidney transplant waiting time

are the immunologic and the non-immunologic (Lee et al., 2019; United Network for Organ Sharing [UNOS], 2019; & U.S. Dept. of Health and Human Services Office of Minority Health [DOH], 2019). The known immunologic factors that affect the time candidates spend on the transplant list are donor incompatibility, the algorithms utilized for organ distribution, and the success of local kidney recovery (UNOS, 2019). In addition, many non-immunologic factors like age, race, the number of centers listed, and co-morbid conditions like heart disease, obesity, active infection, and cancer are also identified as having an impact on the wait time.

Kidney transplantation has long been proven to be the ideal treatment option for people with ESRD, but for decades, the waiting time has remained a major concern. Sanfilippo et al. (1992) carried out a cohort study to assess the various factors influencing waiting times for cadaveric kidney transplant candidates. Included in their study was data for all candidates listed between October 1, 1987, and June 30, 1990, in all transplant centers in the U.S.; 23,468 active candidates in all. The study identified that the most significant factors in prolonged waiting times were immunologic factors such as candidates for repeat transplantation for HLA antigen pre-sensitization, blood types O or B, and HLA-A or HLA-B antigen phenotypes. In addition, the non-immunologic factors identified were significantly lower in patients under 15 years of age compared to those 15 through 44 (8.4 vs. 12.9 months, $p < .01$). For candidates listed at multiple centers vs. one, the wait time differences were 7.0 vs. 13.3 months ($p = < .01$). Last identified was race: white vs. black (11.9 vs. 15.4 months, $p = < .01$).

Effect of Hepatitis C Virus on Kidney Transplant Waiting Time

HCV remains an concerning health issue associated with serious consequences. The two most common complications of HCV are liver cirrhosis and hepatocellular carcinoma (The

National Kidney Foundation, 2021). ESRD patients receiving hemodialysis have a high prevalence of HCV infection (Baid-Agrawal et al., 2014; Bunchorntavakul et al., 2015; Ladino et al., 2016). In fact, a study by Sawinski et al. (2019) confirmed that the longer patients are on dialysis, the more likely they are to develop anti-HCV antibodies. HCV-positive patients make up a sizable subset of the ESRD population, accounting for 14%, which is ten times higher than the general population (Khan et al., 2020; Ladino, 2016; & National Kidney Foundation, 2021). Although HCV can be associated with serious consequences in kidney transplant recipients, it should not be considered a contraindication (Baid-Agrawal et al., 2014; Bunchorntavakul et al., 2015; Ladino et al., 2016). In addition, HCV-positive ESRD patients who undergo kidney transplantation have a significantly higher chance of survival compared with those who continue to receive dialysis treatment (Sawinski et al. 2019). In addition, data from the Shelton et al. (2018) study revealed that, after a five-year waiting period, a total of 45.2% of HCV-positive candidates received kidney transplantation, of which 35.5% were from HCV-positive donors and 9.7% from HCV-negative donors, while 23.6% died.

This study will fill a gap in the research literature on access to kidney transplantation by looking at what effect HCV might have on how long ESRD patients have to wait for a kidney transplant. The goal of the quantitative retrospective study was to see if there was a link between hepatitis C virus infection, blood type, and waiting time for a kidney transplant among ESRD patients, even when age, gender, race, work income, and health insurance coverage were taken into account. Also, the study could give much-needed information about how long HCV-infected ESRD patients have to wait for a kidney transplant. Such information could be used to make

rules about how to reduce differences in kidney allocation and shorten the time that HCV-positive patients have to wait for a transplant.

Demographic Factors, Kidney Transplantation, and Waitlist Time

Demographic factors play a major role in access to kidney transplantation. Although considered a lifesaving approach, the available supply of deceased kidneys far outweighs the demand (Hall et al., 2011; Hamoda et al., 2020; Park et al., 2022; Patzer et al., 2014). Compared to whites, access to deceased-donor kidneys is significantly lower among ethnic minorities (Eager, 1995; Hall et al., 2011; Ng et al., 2020). It has been well established that minority groups face inequities in receiving deceased-donor kidney transplantation (Hall et al., 2011). Since the establishment of the national organ allocation system in the 1980s, there have been significant geographic disparities in access to deceased-donor kidney transplantation in the US (Zhou et al., 2018).

A lot of people from racial and ethnic minorities who get dialysis treatment live in poor areas. Medical factors like comorbid conditions and Human Leukocyte Antigen (HLA) matching play a major role in access to kidney transplantation, causing a major gap between whites and other racial minorities (Hall et al., 2011; Park et al., 2022). Factors like social determinants of health such as geographic residence, type of health insurance coverage, and socioeconomic status have all been shown to have major racial impact disparities between whites and minorities like African Americans and Hispanics, which further contribute to widening the gap (Cabacungan et al., 2020; Hall et al., 2011; Hamoda et al., 2020).

Nee et al. (2017) used a sample of 739,537 patients who started dialysis treatment between January 1, 2007 and December 31, 2012 to look at how poverty and race/ethnicity

indicators affected pre-ESRD care given by nephrologists at the community and individual levels. In their retrospective cohort study, Nee et al. (2017) used the Medicare-Medicaid dual eligibility status as an indicator of individual-level poverty and zip code-level household median income as predictor variables. They conducted a multivariate logistic regression using pre-ESRD nephrology care as the outcome variable. The results showed that 61.28% of those in the lowest quintile had household income compared to 67.68% in the highest quintile. Similarly, the proportions of those with Medicare-Medicaid dual-eligible status versus the nondual-eligible ones who received pre-ESRD nephrology care were 61.49% and 69.84% ($p = 0.001$). Translating as those in the area-level MHI quintile had a significantly lower likelihood of receiving pre-ESRD nephrology care (aOR 0.86 [95% CI 0.85-0.87]) compared to those in higher quintiles.

A sizeable portion of the US population lives in rural areas. Another study by Hall et al. (2008) looked into the extent to which Asians and Pacific Islanders (API) suffer from poverty and limited access to kidney transplantation. Using a sample size of 552,279 patients who started on dialysis between January 1, 1995, and December 31, 2002, 78% of the population studied lived in urban areas, while 22% resided in rural areas delineated as large, small, and remote. The results were conclusive, supporting the hypothesis that disparity increased in areas with worsening neighborhood poverty (aHR [95% CI] for API vs. whites, 0.64 [0.51-0.80], $p = 0.001$, for areas with 5%, and 0.30 [0.21-0.44], $p = 0.001$, for areas with >20% residents living in poverty). However, another area assessed was access to kidney transplantation among groups in rural vs. urban areas. It was concluded that rural residence had a larger impact on transplant waiting times for non-Hispanic black patients compared to their white counterparts. This study can be used to support how community factors affect kidney allocation.

Another area studied was how social and demographic factors influence preemptive listing. Access to the organ transplant waiting list is a fundamental requirement for organ allocation (Organ Procurement & Transplantation Network [OPTN], n.d.). The estimated post-transplant survival (EPTS) scores are a numerical measure used in the new kidney allocation system to allocate some kidneys (Schold, 2019; Snyder et al., 2018). Schold (2019) analyzed data from the United States Renal Data System (USRDS) and discovered that even with EPTS scores of 20%, being African American, not having commercial health insurance, and living in a lower-income community were all associated with a lower likelihood of being placed on a kidney transplant waitlist. These findings clearly supported the conclusion that race, income, and insurance type were all factors independently associated with being placed on the kidney transplant waiting list (Schold, 2019). The results showed, with great certainty ($p = 0.001$), that of the 34,523 patients who were started on dialysis, 7,922 were preemptively waitlisted, and >50% of those were in the top 20% of EPTS scores. The three-year incidence of waitlist placement was 50% for those with the highest incomes, non-Hispanic white male patients, compared to 25% for those below the low-income threshold. Another study that can be used to support how community factors affect kidney allocation

Demographic Factors, Blood Type, and Hepatitis C Virus

Although kidney transplantation is the ideal treatment approach for managing ESRD patients, blood group incompatibility still remains a significant barrier. Regardless, a transplanted organ will always be perceived as a foreign thing by the recipient's body (Morah et al., 2017). A person's blood type can be one of the following: A, B, AB, or O; each of which is compatible with some but not all. Table 3 below shows recipient blood types and their

compatibilities. Approximately 33% of donors have a blood group that is incompatible with the recipient (Yabu et al., 2015). The purpose of the review by Yabu et al. (2015) was to evaluate a blood group incompatible protocol using pre-transplant therapeutic plasma exchange (TPE), which includes high-dose intravenous immunoglobulin and rituximab in addition to prednisone, mycophenolate mofetil, and tacrolimus. The study sample consists of 16 donor-recipient partners from the Stamford University Medical Center who underwent ABO-incompatible (ABOI) kidney transplantation. Simultaneously, 26 donor recipient pairs were in the KPD program, where 12 patients received a transplant through the exchange (Yabu et al., 2015). A particularly detailed protocol structured the study. The results were conclusive, showing that the survival rate was 100% with a mean creatinine value of 1.3 0.3 mg/dl at the last median follow-up of 2.6 years (range 0.75 to 4.7 years). This study supports the proposed study as blood group incompatibility is an identified barrier for deceased donor recipients (Yabu et al., 2015).

Table 4

Recipient Blood Type and Donor Compatibility

Recipient blood type	Donor compatibility
A	A or O
B	B or O
AB	A, or B, or AB, or O
O	O

HCV infection is common among ESRD patients receiving hemodialysis. Hemodialysis is a process of cleansing the blood of a patient whose kidneys are not working properly (National Institute of Diabetes and Digestive and Kidney Diseases, 2018). In their study, Goodkin et al. (2017), compared the HCV infection status of 76,689 patients for various factors. An analysis of the burdens of HCV was applied to ESRD in the following four major areas: mortality,

hospitalization, hemoglobin deficiency necessitating blood transfusions, and overall quality of life. Using an HR (95% CI), the results were conclusive in all four areas. HCV in ESRD patients is associated with a higher risk of death at 5.90 (3.67 to 9.50), hospitalization at 4.40 (3.14 to 6.15), and complications from anemia (hemoglobin level <8.5g/dl, 1.12 [1.03 to 1.21]; commonly received blood transfusion at 1.36 [1.20 to 1.55]; gastrointestinal bleed at 1.32 [1.13 to 1.54]). In general, the results are conclusive that HCV-positive patients had poorer quality of life scores, *(p 0.05* for both mental and physical components), in addition to greater risk of hospitalization, anemic complications, and death. This study supports the proposed study on the burden of HCV infection among ESRD patients.

Another study by Jeon et al. (2019) found that the longer transplant wait time is due to the growing number of people with ESRD and the lack of kidney donors. The goal of the study was to find out what factors affect the likelihood of deceased donor kidney transplantation (DDKT) in ESRD patients on the renal transplant waiting list. This was done by comparing the baseline characteristics and comorbidities of patients who had kidney transplants to those who stayed on dialysis. The results showed that the non-transplanted group had a higher rate of blood type O ($p = 0.006$), hemodialysis ($p = 0.009$), and ESRD caused by diabetes ($p = 0.030$) than the transplanted group (Jeon et al., 2019).The results of this study are used to show that getting a kidney transplant for ESRD is hard because of problems at the personal level. Jeon et al. (2019) came to the conclusion that HCV infection should be treated more often, since most of these cases are not treated anywhere in the world. The strength of this study was the large initial number of patients that were compared.

HCV infection remains a public health concern. HCV, a common bloodborne infection, is directly related to liver cirrhosis, fibrosis, and hepatocellular carcinoma, in addition to other hepatic complications (Behal et al., 2010; Li et al., 2016; Mahnoor et al., 2021). Determining an accurate incidence of new cases of HCV infection is not an easy task as there may be an absence of clinical symptoms, and as a result, many cases go unreported (Mahnoor et al., 2021). The historic focus on people born between 1945 and 1965 has shifted to anyone at risk, regardless of age (Ryerson et al., 2020). Studies have linked HCV to demographic factors like blood groups, Rh factors, geographic area, age, and gender (Behal et al., 2010; Li et al., 2016; Mahnoor et al., 2021). According to the HCV epidemiology in the US, the virus is found to be 60% more prevalent in men and affects predominantly whites, followed by Hispanics and blacks (Ryerson et al., 2020).

The dialysis population contains a large subset of HCV infection. In fact, the prevalence of HCV infection in hemodialysis patients is approximately 8%, nearly five times higher than the general US population (Li et al., 2016; Manhmoor et al., 2021). Manhmoor et al. (2021) started on a quest to explore for associations between HCV and blood groups, Rh factors, age, and gender in a Pakistani population. Two hundred and forty-six patients who tested positive for HCV were included in the study. Results showed that a higher viral load was found in <60% of those with type O blood groups and Rh negative factors. In addition, HCV was more aggressive in women than men.

Yabu et al. looked at two groups of patients and found that blood group compatibility was a problem for people who got organs from dead donors. Patients were compared on the basis of their HCV infection status. In general, the results were conclusive that HCV-positive patients

had poorer quality of life scores (p *0.005)* for both mental and physical components), in addition to greater risk for hospitalization, anemia complications, and death (Yabu et al., 2015). While Jean et al. (2019) analyzed the extended transplant wait time and concluded that it can be blamed on the increased incidence of ESRD and the continued shortage of donor kidneys (Yabu et al., 2015). The results of those studies can be used to support the intrapersonal level hurdle in accessing kidney transplantation for ESRD.

Summary and Transition

HCV infection is more common in people with ESRD, especially those on hemodialysis, than in the rest of the population. This study will look for a link between ESRD patients who have the hepatitis C virus, their blood type, and how long they have to wait for a kidney transplant, taking into account their age, gender, race, work income, and health insurance coverage. This review of the literature looked at scholarly articles in several different areas, including HCV infection and organ transplants. The proposed study will be based on the ecological systems theory, which says that different parts of the environment affect how people grow and change. In a commentary from 2017, Arriola used ecological systems theory to explain the link between racism and organ transplantation. Also, Arriola talked about the role of racism at the personal, internal, and institutional levels of ecological systems theory, and Jones (2000) explained each one.

There are significant racial/ethnic disparities in health outcomes in the US. Race-related outcomes in health care are well documented but still not well explained (Jones, 2000). Microaggressions, for example, are not uncommon experiences of minorities when interacting with healthcare workers (Almond, 2019; Dovidio et al., 2018; Kanter et al., 2020; Snyder et al.,

2018). Arriola (2017) listed the eight steps to attaining a kidney transplant, and every step involves different levels of the three racial disparities and racism that can occur at each step. In the literature, the disparities in healthcare racism are often located among the patients and/or healthcare providers.

Kidney transplantation is identified as the ideal treatment for ESRD patients. Axelrod et al. (2018) found that the treatment approach is not only cost-effective in the long run but also increases the quality of life and prolongs survival rates. Chronic kidney disease (CKD) is one of the most notable examples of health inequities in American public health. Diabetes, hypertension, heart disease, obesity, family history, and CKD have all been linked in studies (CDC, 2021; NIH, 2021; & NKF, 2021). Although kidney transplantation is the ideal treatment for ESRD, non-whites are underrepresented in the transplant population, especially African Americans. Medical, physical, and social factors make up the rigid guidelines used to determine eligibility for kidney transplantation (UNOS, 2019). Compared to the general population, HCV is a systemic disease that often leads to multiple organ dysfunctions (Chaudhari et al., 2021). The two most common complications of HCV are liver cirrhosis and hepatocellular carcinoma (The National Kidney Foundation, 2021). Every year, there are an estimated 1.5 million new HCV infections in the US (National Kidney Foundation, 2021). In 2019, 290,000 people died from hepatocellular carcinoma (primary liver cancer) and cirrhosis (Chaudhari et al., 2021; The National Kidney Foundation, 2021; WHO, 2018).

HCV infection is on the rise in the United States. According to Campbell et al. (2017), there was a 3-fold increase in HCV infections between 2010 and 2015. Patients with HCV should be closely monitored, especially those listed for liver or other organ transplantation

(Chaudhari et al., 2021). WHO (2018) recommended that everyone over 12 years of age diagnosed with chronic HCV be provided with treatment. Interferon and ribavirin have now replaced combination therapy of oral direct-acting antiviral agent regimens (World Health Organization, 2018). Abrahams et al. (2020) study concluded that treating and monitoring HCV are simplified treatments that can be administered in primary care settings. Specifically, the interaction between HCV and the liver-muscle-adipose axis creates a threat to the entire health of the person, particularly the body organs, if not treated (Chaudhari et al., 2021). In 1984, the US Congress passed legislation establishing the UNOS, which administers the OPTN (UNOS, 2013a). However, criteria also vary depending on the type of organ (UNOS, 2013b).

Killic et al. (2020) used secondary data from UNOS in their study. The findings showed that waitlist outcomes, including mortality, have improved in addition to the increased number of transplants performed. There has also been a policy change for multi-organ transplants that took place in 2018 (Afflu et al., 2020). The study by Kim et al. (2018) can be used to support the role of dialysis providers in the kidney transplantation process. To compare the characteristics of the responders and nonresponders, a sensitivity analysis was performed (Kim et al., 2018). The findings showed that only 19% of healthcare workers were aware of racial disparities involving transplantation wait lists.

Many other factors contribute to the long waiting times often associated with kidney transplantation. Although proven to be the ideal approach to managing ESRD patients, blood group incompatibility is a significant barrier in the kidney transplantation process (Yabu et al., 2015). 16 donor-recipient partners from Stanford University Medical Center that underwent ABO-incompatible (ABOI) kidney transplantation were analyzed. Often, patients die (drop out)

while on the kidney transplant list (Jean et al., 2019). The authors concluded that the extended transplant waiting time can be blamed primarily on the increased incidence of ESRD and the continued shortage of donor kidneys (Jean et al., 2019). Although the US Congress passed many laws to address access to kidney transplantation and reduce disparities, much more needs to be done to address racism at each level identified by the ecological system theory as reported by Arriola (2017).

Chapter 3: Research Method

The purpose of this quantitative retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. Kidney transplantation has been identified as the ideal treatment for ESRD patients. In addition to being cost-effective in the long run, the procedure is also said to increase the quality of life and survival rates for ESRD patients (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019; Khana et al., 2020; Ku et al., 2020; Laging et al., 2019; U.S. Dept. of Health and Human Services Office of Minority Health, 2019). However, disparities in kidney allocation, as identified by prolonged waiting times on the transplant list, remain a growing concern (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019; Khana et al., 2020; Ku et al., 2020; Laging et al., 2019). Chapter 3 provides information on the research design, methodology, and target population. Furthermore, this chapter presents information on sampling and power calculation, instrumentation and operationalization of constructs, setting and sample size, and data collection. Finally, the chapter covers statistical analysis, research questions and hypotheses, protection of human participants, and threats to validity.

Research Design and Approach

To answer the research questions, I used retrospective secondary data from UNOS for first-time kidney transplants performed between January 1, 2010, and December 31, 2020. Upon receiving IRB approval (12-01-22-0494259), I requested access to the identified data set from UNOS. The data were analyzed and scrubbed, and variables were recoded as necessary. The dependent variable was kidney transplant waiting times (an ordinal variable measured as 1 = 36

months, 2 = 36-48 months, 3 = 49-72 months, and 4 = > 72 months). The independent variables were HCV infection, a categorical variable measured as 0 = N, 1 = P, and blood type, a nominal variable measured as 1 = O, 2 = A, 3 = B, and 4 = AB. The covariates were (a) race, a nominal variable measured as

1 = White, 2 = Black or African American, 3 = Hispanic/Latino, and 4 = other race; (b) age, an ordinal variable measured as 1 = 18–34 years, 2 = 35–54 years, and 3 = 55–70 years; (c) gender, a categorical variable measured as 0 = female and 1 = male; (d) work income, a nominal variable measured as 1 = yes, 0 = no; and (e) health insurance coverage, a nominal variable measured as 1 = private insurance, 2 = public insurance Medicaid, 3 = public insurance Medicare, and 4 = other insurance. A quantitative approach with a retrospective design was used because it aligned with the three research questions I sought to answer:

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

RQ2: What is the difference in kidney transplant waiting times by blood type among ESRD patients?

RQ3: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage?

Furthermore, the chosen design aligned with the research problem, the secondary data on hand, their measurements, and the statistical analyses.

Methodology

Target Population

This study was intended for the HCV-infected ESRD patients. Kidney transplantation is the optimal treatment approach for ESRD. However, optimizing access to kidney transplants and eliminating access inequalities remain ongoing problems. As of April 2021, 650,000 Americans have been diagnosed with ESRD, of which 468,000 are on dialysis. As of April 2021, the UNOS (2021) database showed 118,195 qualified individuals on the organ transplant list, 98,592 of which were kidney transplant candidates. The number of active patients on the waiting list in the United States has increased over the last decade from 52,503 in 2009 to 95,052 in 2019 (Taherkhani et al., 2022). To complete the analysis in the current study, I included secondary data from UNOS of all kidney transplants performed between 2010 and 2020.

Sampling and Power Calculations

Determining the optimal sample size to answer the research question is a vital part of any study. Because conducting a study using an entire population is usually impossible, researchers employ a variety of methods to select samples that are representative of the entire population, analyze the data from the selected samples, and estimate the parameters of the entire population (Beck, 2013; Faul et al., 2009; Kang et al., 2020). The sample size must be large enough to answer the research question but not so large that too many participants are involved when fewer would have been sufficient (Sullivan, n.d.). Statistical power, also known as sensitivity, is defined as the probability of rejecting a false null hypothesis (Beck, 2013). For the current study, I used the free downloadable software, the G*POWER Analysis Version 3.1.9.2 for Macintosh OS X 10.7 to 12. G*POWER is a statistical power analysis tool that is used to compute statistical

power analyses for various types of statistical tests (Beck, 2013). The statistical methods I used were nonparametric correlations, independent-sample Kruskal's Wallis test, bivariate regression analysis, post hoc analysis, and descriptive statistics. The statistical significance, also known as the alpha value, was set at 0.05 (a err prob = 0.05), and the power was set at 0.95 (95% confidence interval, [CI], 1-β err prob).

Setting and Sample Size

UNOS collects data from various sources using organ-specific forms for adults and children. The following forms illustrate the types of data that OPTN currently collects for adult deceased donors, recipients, and candidates, recipient histocompatibility (UNOS, 2021). The questions in the deceased, recipients, histocompatibility worksheet, and candidates are set to collect the data needed to make up a complete profile of donor and recipient. Transplant hospitals, histocompatibility laboratories, and organ procurement groups enter the OPTN database in UNet to manage their waitlisted patients. UNOS updates UNet to meet OPTN contract standards. UNet is connected to all 58 organ procurement organizations, 254 transplant hospitals, and 150 histocompatibility laboratories (UNOS, 2021). Before transplant, most of the information is gathered from the waitlist and match runs (UNOS, 2021). Pretransplant information on both candidates and recipients, as well as pos-transplant information about recipients, is collected by transplant experts using OPTN data collection forms that are organ specific. The donor organ disposition record contains information that is used to reconcile donor and recipient data concerning the transplant.

To ensure that the study population would be sufficient to obtain a statistical effect size, I calculated the sample size for low (d =.2), medium (d =.5), and large (d =.8) effect sizes. The

selected parameters were *z* tests, logistic regression, a priori, and 2-tail. The results were as follows: For a power of 95 (95%) using a power level of .5, the sample size needed to be $N = 777$ cases to achieve a statistical power of 95%.

Instrumentation and Operationalization of Constructs

OPTN has been collecting data on all organ transplants performed in the United States, Hawaii, and Puerto Rico since 1987. Since 1989, UNOS (2019) has collected and managed all data in the OPTN network pertaining to organ recipients, donors, and candidates. UNOS uses multiple organ- and age-group-specific forms (for adults or children) to collect transplant data (Massie et al., 2014). UNOS uses these data to help its members make decisions, meet regulatory obligations, and conduct successful quality assurance and performance improvement activities. These data have also been made available to the public upon request for research purposes, many of which benefit organ transplantation.

Independent Variables

The independent variables were HCV infection and blood type. HCV was a categorical variable that was coded as 1 = positive and 0 = negative. The variable was listed as HCV Serostatus on the Adult Kidney Transplant Recipient Registration Worksheet under the Viral Detection section. Blood type was a nominal variable measured as 1 = O, 2 = B, 3 = A, and 4 = AB. The variable was listed as ABO Blood Group in the Clinical Information: AT LISTING section.

Dependent Variable

The dependent variable, kidney transplant waiting times, was a continuous variable but was coded as an ordinal variable measured as 1 = 36 months, 2 = 36–48 months, 3 = 49–72

months, and 4 = > 72 months. This variable was listed under the Date of Listing or Add and tx date under the Candidate Information section on the Adult Kidney Transplant Recipient and Candidate Registration Worksheet under the Recipient and Candidate Information.

Covariates

The covariates were age, gender, work income, and health insurance coverage. Age was a continuous variable and was coded as 18 and older. The variable was listed as *DOB* on the Adult Kidney Transplant Recipient Registration Worksheet under the Recipient Information. Gender was a categorical variable measured as 0 = female and 1 = male. This variable was listed as gender on the Adult Kidney Transplant Recipient Registration Worksheet under the Recipient Information. Work income was a categorical variable recoded as 1 = yes and 0 = no. This variable was listed as working for income under the Clinical Information: PRETRANSPLANT section on the Adult Kidney Transplant Recipient Registration Worksheet under the Recipient Information. Last, the covariate race was a nominal variable listed on the Deceased Donor Registration and the Adult Kidney Transplant Candidate Registration Worksheets under Ethnicity/Race. This variable was recoded as 1 = White, non-Hispanic; 2 = Black or African American; 3 = Hispanic/Latino; and 4 = other (Asian, Native American, Native Hawaiian, Other Pacific Islander, and multiracial). To answer the research questions, I analyzed secondary data from the UNOS for all kidney transplantations performed from January 1, 2010 to December 31, 2020. After obtaining IRB approval, I requested access to the documents in Statistical Analysis System (SAS) format. Data were analyzed, manipulated, and recoded as needed.

Table 5

Operationalization of Study Measures

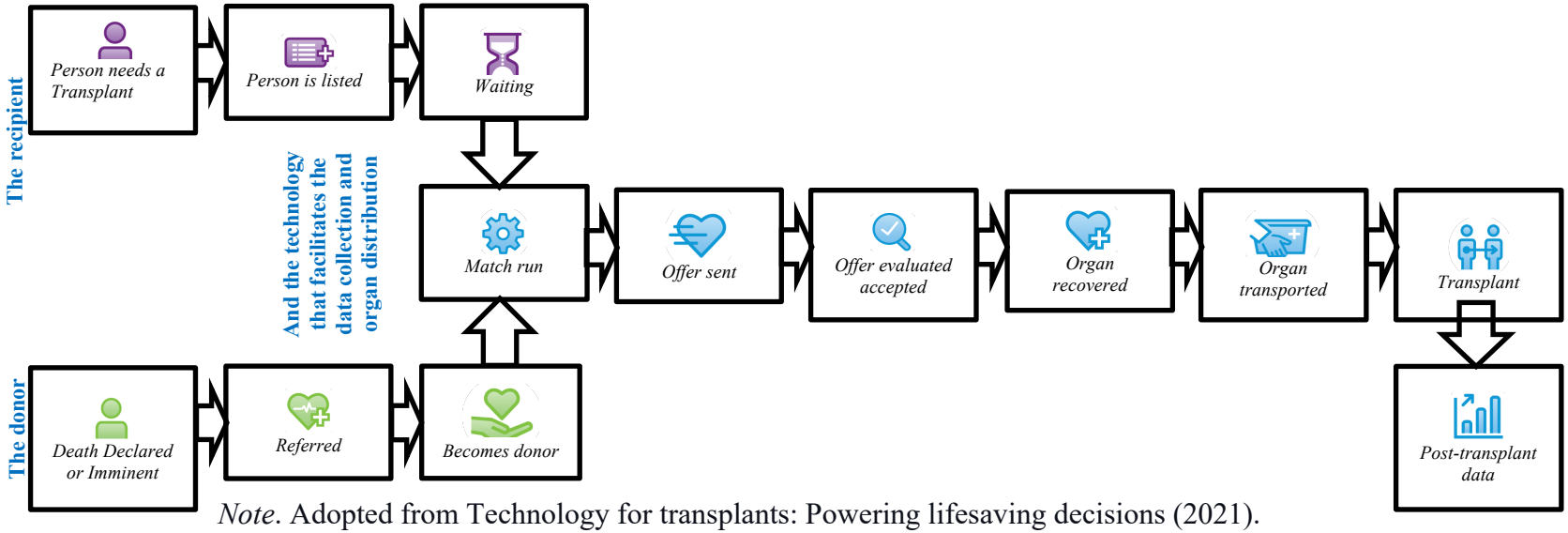
Variable description	Analysis variable	Response category	Level of measurement
Kidney transplant waiting time	Dependent	1 = <36 months 2 = 36–48 months 3 = 49–72 months 4 = >72 months	Nominal
Hepatitis C virus infection	Independent	0 = Negative (97%) 1 = Positive (1.8%)	Categorical
Blood type	Independent	1 = O 2 = A 3 = B 4 = AB	Nominal
Race	Covariate	1 = White Non-Hispanic 2 = Black or African American; 3 = Hispanic/ Latino 4 = Other	Nominal
Age	Covariate	1 = 18–34 years old 2 = 35–54 years old 3 = 5–-70 years old 4 = >70	Nominal
Gender	Covariate	1 = Male 2 = Female	Categorical
Work income	Covariate	0 = No 1 = Yes	Nominal
Health insurance coverage	Covariate	1 = Private insurance 2 = Public insurance-Medicaid 3 = Public insurance-Medicare 4 = Other insurance	Nominal

Data Collection

OPTN has been collecting reliable data on patients waiting for organ transplants, matching recipients, and donors since 1987. As of 1989, however, UNOS, an OPTN-based registry, has been responsible for the collection and management of data pertaining to patients' waitlists, donations, matching, and organ transplantation that take place on the OPTN database (CDC, 2019; Massie et al., 2014, & UNOS, 2019). UNOS extracts data from multiple organ-specific forms that are specifically geared toward adults and children (Massie et al., 2014). UNet, the technology that facilitates data collection and storage, extracts information from the (1) deceased donor registration, (2) transplant candidate registration, (3) transplant recipient registration, (4) transplant recipient follow-ups, (5) adult post-transplant malignancies, (7) recipient histocompatibility, and (8) donor histocompatibility. Those forms are completed by members of the transplant teams from hospitals, transplant centers, and laboratories and managed by the UNOS staff data team

Figure 3

UNOS Data Collection Process



Note. Adopted from Technology for transplants: Powering lifesaving decisions (2021).

Recreated using some graphic from United Network for Organ Sharing (2021). *https://unos.org/technology/technology-for-transplantation/*

Statistical Analysis

The Statistical Package for Social Sciences (SPSS) version 28 will be used to perform the analysis. Originally released in 1968 by SPSS Inc., the software was acquired by IBM in 2009. To test the three research questions, nonparametric correlations, Kruskal-Wallis (because the data did not meet all the assumptions for OLR), bivariate logistic regression, and post hoc analysis were used as the statistical analyses. The original plan was to use OLR because its major strengths are to help eliminate confounding factors in addition to allowing simultaneous analysis of multiple explanatory variables (Ojih, J., 2016; Sperandei, S., 2014). In his doctoral dissertation, Ojih (2014), applied logistic regression in a quantitative descriptive study to investigate an association between physical inactivity, length of stay in the US, immigrants' health status, and food security as risk factors for developing essential hypertension among African-born immigrants after controlling for age and education. Using OLR for my study can also help simplify the interaction of dependent variables, which may have many ordered levels, with one or more independent variables (Sperandei, 2014). However, the data did not support all the assumptions

Research Questions and Hypotheses

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

$H_0$1: There is no association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients.

H_a1: There is an association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients.

RQ2: What is the difference between kidney transplant waiting times by blood type among ESRD patients?

$H_0 2$: There is no difference in kidney transplant waiting times by blood type among ESRD patients.

$H_a 2$: There is difference between kidney transplant waiting times by blood type among ESRD patients with end-stage renal disease (ESRD).

RQ3: What is the association between hepatitis C virus infection and kidney transplant waiting times among patients with ESRD when controlling for age, gender, race, work income, and health insurance coverage?

$H_0 3$: There is no association between hepatitis C virus infection and kidney transplant waiting times among patients when controlling for age, gender, race, work income, and health insurance coverage.

$H_a 3$: There is an association between hepatitis C virus status and kidney transplant waiting times among ESRD patients controlling for age, gender, race, work income, and health insurance coverage.

Protection of Human Participants

Although secondary data analysis does not entail human interaction, the definition of the human subject, as addressed in 45 CFR 46.102(f), includes living individuals about whom an investigator acquires identifiable private information for research purposes (White, 2020). For this study, I planned to use a de-identified secondary dataset from

UNOS, which is made available to researchers for public use with granted access. In order for Walden University's institution to demonstrate that it is in compliance with the rules now imposed by the federal government, an Institutional Review Board (IRB) has been established. In particular, the university adheres to the guidelines outlined in the Federal Policy for the Protection of Human Subjects [45 CFR 46] (Walden University Catalog, 2022–2023). Approval to collect data will be granted by Walden University's internal review board (IRB) office. Data will be downloaded and stored in a password-protected computer backup on an external flash drive kept in a locked drawer that cannot be accessed by anyone else. To comply with regulations, researchers are required to keep copies of study data for at least three years after the research is completed and closed with the IRB. Therefore, the data will be safeguarded and kept for three years, or as directed by the Walden IRB office, and then destroyed.

Threats to Validity

In order to conduct reliable studies, it is essential that researchers identify and mitigate potential threats to the study's validity. Frankfort-Nachmias and Nachmias (2008) attested that "the research design is the 'blueprint' that enables the investigator to come up with solutions to these problems and guide him or her in the various stages of the research" (p. 89). Threats can occur at any stage of the research. There are two types of validity: internal validity and external validity. Internal validity is the degree of certainty that the causal relationship being examined is reliable and not affected by other factors (Creswell, 2014). In other words, to establish validity, researchers must be able to answer with certainty that the change to the independent variable is directly responsible

for the changes to the dependent variables. External validity, on the other hand, relates to how well a study's findings can be extrapolated to other settings, groups, or events (Creswell, J. W., 2014; Frankfort-Nachmias and Nachmias, 2008). External validity relates to how well a study's findings may be extrapolated to other settings, groups, or events. Threats to validity can occur at any stage of a study, but are mostly detected at the beginning and during data analysis and interpretation (Creswell, J. W., 2014; Frankfort-Nachmias and Nachmias, 2008). This study falls under the category of correlational design, a method of research that involves the use of the correlational statistic to characterize and assess the degree of association or relationship between two or more variables. UNOS manages the OPTN database, which is then extracted by UNet. Because such data is used to match organ recipient candidates with organ donors, accuracy in data entry is crucial. I will run descriptive statistics to help identify and remove incomplete data.

In scientific research, creating a hypothesis is the first step before testing it through observation or experiment. For statistical significance testing, hypotheses, null (H_o), and alternative (Ha), are categorized by the predicted difference between the study groups for the purpose of determining whether or not they are statistically significant (Banerjee et al., 2009). When researchers incorrectly reject the null hypothesis, it is identified as a type I error, but failure to reject the alternative hypothesis is known as a type II error. Nonetheless, researchers can reduce type I and II errors by having a large enough sample and setting the effect size at 0.05, which means that there is only a 5% chance of a type I error and a 95% (CI) confidence that the results were not by chance.

The same goes for a set at 0.01, which is called the power, which means that there is only a 10% chance of a type II error. Therefore, the researchers will accept 90% of the findings of an association. In my study, I will set the statistical significance at 0.05% (95% CI) to help reduce type I error and power at.01%, which will leave me with a 10% chance of a type II error.

Summary and Transition

Access to kidney transplantation remains an issue of concern for ethnic minority groups. Compared to dialysis treatment in managing ESRD, kidney transplant is not only cost-effective in the long run but also helps achieve a better quality of life and higher survival benefits (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019; Khana et al., 2020; Ku et al., 2020; & Laging et al., 2019; Massie et al., 2014; & U.S. Dept. of Health and Human Services Office of Minority Health, 2019). Nonetheless, access inequities as identified by prolonged waiting times on the transplant list remain a growing concern (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019; Khana et al., 2020; Ku et al., 2020; & Laging et al., 2019). This is evident in the number of active patients on the waiting list in the United States, which has increased over the last decade, from 52,503 in 2009 to 95,052 in 2019 (Taherkhani et al., 2022). The population of interest is HCV-infected ESRD patients who received their first kidney transplantation between 2010 and 2020. The research approach I plan to use is quantitative with a retrospective design. I propose the following three research questions to examine the association between waiting times and HCV infection among ESRD patients: (1) What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD

patients? (2) What is the difference in kidney transplant waiting times by blood type among ESRD patients? (3) What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage?

Using nonparametric correlations, Kruskal-Wallis, and bivariate regression analysis, I analyzed retrospective secondary data from UNOS. Inclusion criteria are: (1) first-time adult kidney transplant recipients between 18 years of age and older, and (2) who received kidney transplantation between January 1, 2010, and December 31, 2020. Exclusion criteria are (1) those under 18 years of age and (2) those who received more than one kidney transplant during the timeframe provided above. The following variables were entered in the analysis: The independent variables are hepatitis C virus infection, a categorical variable measured as 0 = N, 1=P, and blood type, a nominal variable measured as 1=O, 2=A, 3 = B, and 4=AB. The covariates are (1) race, a nominal variable measured as 1=Whites, 2=Black or African Americans, 3=Hispanic/Latino, 4=Other race, (2) Age, an ordinal variable measured as 1 = 18–34 years, 2 = 35–54 years, and 3 = 55–70 years; (3) Gender, a categorical variable measured as 0 = male and 1 = female; (4) Work income, a nominal variable measured as 1 = yes, 0 = no; and (5) health insurance coverage, a nominal variable measured as 1 = private insurance, 2 = public insurance Medicaid, 3 = public insurance Medicare, and 4 = other insurance.

Chapter 4: Results

The purpose of this quantitative retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting time among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. I used secondary data collected by UNOS from the adult transplant candidate and transplant recipient forms. One dependent variable (transplant wait time) was investigated. The two independent variables were HCV infection and blood type. I also controlled for five independent variables: age, gender, race, health insurance coverage, and work income. The variables were coded on categorical and nominal scales. Sociodemographic variables were gender (male, female), age (18-34, 35-48, 48-70, > 70), race (White, Black/African American, Hispanic/Latino, other), working for income (yes, no), and primary health insurance coverage (private insurance, public insurance Medicaid, public insurance Medicare, and other insurance). The goal was to answer three research questions:

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

RQ2: What is the difference in kidney transplant waiting times by blood type among ESRD patients?

RQ3: What is the association between hepatitis C virus infection and the kidney transplant waiting time among ESRD patients when controlling for gender, age, race, work income, and health insurance coverage?

For each research question, the null hypothesis stated there were no associations or differences, and the alterative hypothesis stated there were associations and differences. This chapter presents a revision of the data collection process outlined in Chapter 3 and any applicable discrepancies. In addition, I present the results of the preliminary analyses conducted, which include associated tables and graphs, and a summary of statistics that include frequency and distributions, measures of central tendency, and cross-tabulations for each variable. The results of the nonparametric, correlational, and bivariate analyses, along with associated tables and graphs, are also presented. This chapter concludes with a summary and transition to Chapter 5.

Data Collection

G-Power analysis revealed that there needed to be at least 777 participants to achieve 95% statistical power. Transplant recipients who received kidney transplants between January 1, 2010, and December 31, 2020, made up the study sample (N = 4,730). The data came from a secondary data set that UNOS provided with permission from their IRB. The original data set had 1,062,662 cases for all organ transplants performed in the United States from 1987 to 2021. Information for the current study sample was taken from two forms, the Transplant Candidate Registration (TCR) and the Transplant Recipient Registration (TRR), as shown by the variable collection forms.

Characteristics of the Sample

The frequency and percentage distribution of the variables used in the sample size were calculated. Gender was distributed as follows: 61.6% male and 38.4% female. For blood type, the largest percentage in the sample had type O blood (48.2%), followed by

34.9% type A, 12.6% type B, and 3.9% type AB. The remaining 4% were treated as missing. Participants races were distributed as follows: 57.4% Whites, 24.6% Blacks/African Americans, 13.6% Hispanics, and 4.5% other. For the variable work income, 59.5% reported not having a work income, 37.7% reported having income from work, and 2.9% reported missing values.

The largest percentage of the sample (48%) reported private insurance as the primary source of payment, 40.8% identified Medicare as the primary source, 9.7% were covered by Medicaid as the primary insurance, and 1.4% were covered by other. AgeR identified the age group of 35-54 as the largest recipient of kidney transplantation (68%), while those belonging to the 55-70 age group had the lowest percentage (10.7%) of kidney transplantation. However, the age group of 18-34 received 21% of all kidney transplants. Transplant waiting times varied, with most of the sample having a wait of less than 36 months (91.5%); 4.3% had a wait time of 36-48 months, 2.7% waited between 49 and 72 months, and 1.3% waited longer than 72 months, with.2% of the sample missing a value for this variable. For the variable HCV infection, 96.6% of the participants were HCV negative, 1.8% were missing, and 1.8% were HCV positive (86 participants). Results are displayed on tables 6-14.

Table 6

Descriptive Statistics of the Variables

Statistic	Recipient age	Race	Gender	Work income	Primary payment source	Blood type	Transplant wait time month	HCV status
Valid	4730	4730	4730	4595	4730	4709	4730	4649
Missing	0	0	0	135	0	21	0	81
Mean	42.75	1.6518	.6163	.3878	1.9569	1.72	13.6689	.02
Median	43.00	1.0000	1.0000	.0000	2.0000	2.00	8.5000	.00
Mode	39[a]	1.00	1.00	.00	1.00	1	.27	0
Std. Deviation	9.045	.87655	.48634	.48730	.97127	.831	15.76456	.135
Range	52	3.00	1.00	1.00	3.00	3	132.07	1

Note. Multiple modes exist. The smallest value is shown.

Table 7

Frequency and Percentage Distribution for the Variable Race

Race		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	White	2714	57.4	57.4	57.4
	Black	1162	24.6	24.6	81.9
	Hispanic	641	13.6	13.6	95.5
	Other	213	4.5	4.5	100.0
	Total	4730	100.0	100.0	

Table 8

Frequency and Percentage Distribution for the Variable Gender

Gender		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	.00	1815	38.4	38.4	38.4
	1.00	2915	61.6	61.6	100.0
	Total	4730	100.0	100.0	

Table 9

Frequency and Percentage Distribution for the Variable Work Income

Work income		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	No	2813	59.5	61.2	61.2
	Yes	1782	37.7	38.8	100.0
	Total	4595	97.1	100.0	
Missing	System	135	2.9		
Total		4730	100.0		

Table 10

Frequency and Percentage Distribution for the Variable Primary Payment Source

Primary payment source		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Private	2270	48.0	48.0	48.0
	Public Medicaid	461	9.7	9.7	57.7
	Public Medicare	1932	40.8	40.8	98.6
	Other	67	1.4	1.4	100.0
	Total	4730	100.0	100.0	

Table 11

Frequency and Percentage Distribution for the Variable Blood Type

Blood type		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	O	2280	48.2	48.4	48.4
	A	1649	34.9	35.0	83.4
	B	594	12.6	12.6	96.1
	AB	186	3.9	3.9	100.0
	Total	4709	99.6	100.0	
Missing	System	21	.4		
Total		4730	100.0		

Table 12

Frequency and Percentage Distribution for the Variable HCV Status

HCV status		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Negative	4563	96.5	98.2	98.2
	Positive	86	1.8	1.8	100.0
	Total	4649	98.3	100.0	
Missing	System	81	1.7		
Total		4730	100.0		

Table 13

Frequency and Percentage Distribution for the Variable Transplant Wait Time

Transplant wait time		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Less than 36 months	4328	91.5	91.7	91.7
	36–48 months	204	4.3	4.3	96.0
	49–72 months	126	2.7	2.7	98.7
	Greater than 72 months	61	1.3	1.3	100.0
	Total	4719	99.8	100.0	
Missing	System	11	.2		
Total		4730	100.0		

Table 14

Descriptive Statistics for Independent Variable Blood type

Blood type	Mean	Std. deviation	*N*
O	14.79	17.201	2,280
A	12.53	13.863	1,649
B	13.19	14.376	594
AB	11.54	16.134	186
Total	13.67	15.749	4,709

I further analyzed the variables HCV infection against the variables age group, blood type, race, and gender using the crosstabulation analysis by gender. The results showed that of the 86 HCV+ kidney transplant recipients, 61.6% were male, 83.7% fell into the 35–54 age group, 62.8% were Type O blood group members, and 68.8% were White. To gain a deeper understanding of the variables in the dataset, I performed descriptive statistics for the age and transplant wait time and ran a cross-tabulation analysis to identify the percentage of HCV+ by age group, blood type, race, and gender. Results are displayed in Tables 15–17.

Table 15

HCV Status Age Group

Variable			18–34	35–54	55–70	
HCV_virus infection	Negative	Count	965	3,111	487	4,563
		% within HCV virus infection	21.1%	68.2%	10.7%	100.0%
		% within Age_group	99.4%	97.7%	98.4%	98.2%
	Positive	Count	6	72	8	86
		% within HCV virus infection	7.0%	83.7%	9.3%	100.0%
		% within Age_group	0.6%	2.3%	1.6%	1.8%
Total		Count	971	3,183	495	4649
		% within HCV_virus infection	20.9%	68.5%	10.6%	100.0%
		% within Age_group	100.0%	100.0%	100.0%	100.0%

Table 16

HCV Status Race Crosstabulation

Variable			White	Black	Hispanic	Other	
HCV_status	Negative	Count	2,606	1,122	627	208	4,563
		% within HCV virus infection	57.1%	24.6%	13.7%	4.6%	100.0%
		% within Race	98.0%	98.6%	98.1%	98.1%	98.2%
	Positive	Count	54	16	12	4	86
		% within HCV virus infection	62.8%	18.6%	14.0%	4.7%	100.0%
		% within Race	2.0%	1.4%	1.9%	1.9%	1.8%
Total		Count	2660	1138	639	212	4649
		% within HCV virus infection	57.2%	24.5%	13.7%	4.6%	100.0%
		% within Race	100.0 %	100.0%	100.0%	100.0%	100.0%

Table 17

HCV Status GenderR Crosstabulation

Variable			Female	Male	
HCV_Status	Negative	Count	1,755	2,808	4,563
		% within HCV virus infection	38.5%	61.5%	100.0%
		% within Gender	98.5%	97.9%	98.2%
	Positive	Count	27	59	86
		% within HCV_virus infection	31.4%	68.6%	100.0%
		% within Gender	1.5%	2.1%	1.8%
Total		Count	1782	2867	4649
		% within HCV_ virus infection	38.3%	61.7%	100.0%
		% within GenderR	100.0%	100.0%	100.0%

Study Results

Research Questions and Hypotheses

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

$H_0$1: There is no association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients.

H_a1: There is association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients.

RQ2: What is the difference in kidney transplant waiting times by blood type among ESRD patients?

$H_0$2: There is no difference in kidney transplant waiting times by blood type among ESRD patients.

H_a2: There is difference in in kidney transplant waiting times by blood type among ESRD patients.

RQ3: What is the association between kidney hepatitis C virus infection and kidney transplant waiting times when controlling for age, race, gender, work income, and health insurance coverage?

$H_0$3: There is no association between kidney hepatitis C virus infection and kidney transplant waiting times when controlling for age, race, gender, work income, and health insurance coverage.

H_a3: There is association between kidney hepatitis C virus infection and kidney transplant waiting times when controlling for age, race, gender, work income, and health insurance coverage.

Descriptive Statistics of the Study Sample

As previously mentioned, UNOS provided the secondary dataset for this study. The data was scrubbed as follows: (1) filtered to remove all transplants performed prior to January 1, 2010 and after December 31, 2020; (2) only cases marked as KI (kidney) and KIPAN (kidney and pancreas) were included, and all others were filtered out; (3) last, kidney recipients under the age of 18 were excluded from the sample size, leading to a total of 4,730 cases. Before conducting the analyses necessary to verify the hypotheses, preliminary analyses were conducted on the following in order to obtain a baseline analysis of the variables: kidney transplant waiting times, hepatitis C virus infection, blood type, race, age, gender, work income, and health insurance coverage. Each variable in the 2010–2020 kidney transplant data subset was analyzed. The results of the descriptive statistics showing mean and standard deviation are displayed on Tables 6–9. To select the relevant analyses, tests were conducted to determine whether or not certain assumptions concerning normality, homoscedasticity, and linearity were satisfied.

The dataset contained information on both the candidates and recipients. However, the study sample contained information extracted from the transplant candidate registration and transplant recipient registration forms entered into the UNOS database by transplant team staff from hospitals, transplant centers, and laboratories. The software that UNOS uses, UNet, makes data extraction and storage easier. Access to the dataset is

available upon request, provided requirements are met. For the present study, I utilized a quantitative, non-experimental, correlational methodology, drawing on secondary data.

Data Coding

Data dictionary labeled as KIDPAN_DATA was downloaded into an excel file as recommended in the data access instruction from UNOS and used to determined variable origination and coding. To create the needed subset, the following variables were renamed and recoded into new variables as follow:

1) DAYSWAIT_CHRON_KI, TOTAL DAYS ON KIDNEY WAITING LIST, the dependent variable was coded in days but was renamed as Transplant_Wait_Time and recoded as an ordinal variable where 1=>36 months, 2 = 36-48 months, 3 = 49-72 months, and < 72 months.
2) HCV_SEROSTATUS, RECIPIENT HEP C STATUS, primarily coded as coded as a 0 = N, 1 =P, 2 = UNK/Cannot Disclose, and 3 = Not done. This variable was renamed as HCV status and recoded as 0=N, 1=P, and all others were treated as system missing.
3) ABO coded as RECIPIENT BLOOD GROUP @ REGISTRATION original coded as 1 = O, 2 = A, 3 = B, 4 = AB, 5 = A1, 6 = A1B, 7 = A2, was recoded as Blood_Type 1 = O, 2 = A, 3 = B, 4 = AB, and all others were treated as system missing (0.4% or 21 cases).
4) AGE, RECIPIENT AGE (YRS), continuous variable 0-72 but was renamed and recoded as Age_R as an ordinal variable with three categories 1 = 18-34, 2 = 35-54, and 3 = 55-70. Excluded were all cases under 18 and older than 70.

5) GENDER – TCR RECIPIENT GENDER a string variable was recoded as GenderR as a nominal 0 = female and 1 = male.
6) The nominal variable ETHCAT labeled as ETHNICITY CATEGORY with nine categories was recoded with four categories as follows: 1=White, 2= Black, 3 = Hispanics/Latinos, and 4 = Other (Asian, American Indian, Native Hawaiian and other Pacific Islander, and Mixed raced)
7) The string variable, WORK_INCOME_TCR, labeled as TCR WORKING FOR INCOME, was recorded as a nominal variable with 0 = No work income and 1 = Yes work income.
8) Last, the nominal variable PRI_PAYMENT_TCR_KI labeled as CR KIDNEY PRIMARY PROJECTED SOURCE PAY with 12 categories as follows: 1 = Private insurance, 2 = Public insurance – Medicaid, 3 = Public insurance – Medicare FFS (Fee for Service), 4 = Public insurance – Medicare & Choice, 5 = Public insurance – CHIP (Children's Health Insurance Program); this category was omitted because it covers children under 18, 6=Public insurance – Other government, 7 = Self, 8 = Donation, 9 = Free Care, 10 = None, 1 = Public insurance – Medicare Unspecified , and 12 = US/State Govt Agency. The variable was renamed Primary_Payment_Source and recoded as a nominal with five categories 1 = Private insurance, 2 = Public insurance - Medicaid, 3 =Public insurance - Medicare FFS (Fee for Service), 3 = Public insurance - Medicare & Choice, the category 5 = Public insurance - CHIP (Children's Health Insurance Program) - was excluded as this insurance

covers children under 18 and the population being analyzed is from 18-70 years old, and all others fell into the fourth category 4 = Public insurance – Other government - 4 = Self, 4 = Donation, 4 = Free Care, 4 = None, 3 = Public insurance - Medicare Unspecified, 3 = US/State Govt Agency.

Preliminary tests were run using SPSS' to determine the data distribution. Unlike the null hypothesis (H_0), which assumed that the data were normally distributed, the null hypothesis (Ha) projected that the data would not be normally distributed. The Shapiro-Wilk test indicated that the data were not normally distributed ($p = .01$), which was further corroborated by the skewness (2.378) and kurtosis of the data (8.003). The rejection of the null hypothesis at a.05 level of confidence shows that the assumption of normalcy was violated. The analysis also revealed that OLR was no longer an option as initially suggested in Chapter 3. Because the dependent variable was coded nominal (1 = 36 months, 2 = 36-48 months, 3 = 49-72 months, and 4 = >72 months), nonparametric analysis, also known as a distribution-free test, was the deed the appropriate most analysis. Tables 18-20 display the results of the Shapiro-Wilk test for normality and the descriptive statistics for the dependent variable.

Table 18

Results of the Shapiro-Wilk Test of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Variable	Statistic	*df*	Sig.	Statistic	*df*	Sig.
Recipient age	.052	4,730	<.001	.990	4,730	<.001

Table 19

Descriptive Statistics of the Dependent Variable Kidney Transplant Wait Time by Month

Variable	Statistic	Value	Std. error
Transplant Wait Time Month	Mean	13.67	.229
	95% Confidence Interval for lower bound	13.22	
	Mean upper bound	14.12	
	5% Trimmed Mean	11.66	
	Median	8.50	
	Variance	248.521	
	Std. Deviation	15.765	
	Minimum	0	
	Maximum	132	
	Range	132	
	Interquartile Range	16	
	Skewness	2.378	.036
	Kurtosis	8.003	.071

a. Lilliefors Significance Correction

Table 20

Descriptive Statistics of the Variables Transplant Wait Time Month and Blood Type Showing That They Are Not Normally Distributed

Variable	Blood type			Statistic	Std. Error
Transplant wait time month	O	Mean		14.79	.360
		95% Confidence Interval for Mean	Lower Bound	14.08	
			Upper Bound	15.50	
		5% Trimmed Mean		12.58	
		Median		9.13	
		Variance		295.872	
		Std. Deviation		17.201	
		Minimum		0	
		Maximum		132	
		Range		132	
		Interquartile Range		17	
		Skewness		2.318	.051
		Kurtosis		7.352	.102
	A	Mean		12.53	.341
		95% Confidence Interval for Mean	Lower Bound	11.86	
			Upper Bound	13.20	
		5% Trimmed Mean		10.89	
		Median		7.90	
		Variance		192.190	
		Std. Deviation		13.863	
		Minimum		0	
		Maximum		112	
		Range		111	
		Interquartile Range		14	
		Skewness		2.198	.060
		Kurtosis		7.027	.120
	B	Mean		13.19	.590
		95% Confidence Interval for Mean	Lower Bound	12.03	
			Upper Bound	14.35	
		5% Trimmed Mean		11.35	
		Median		8.50	
		Variance		206.659	
		Std. Deviation		14.376	
		Minimum		0	
		Maximum		97	
		Range		97	
		Interquartile Range		14	
		Skewness		2.191	.100
		Kurtosis		6.039	.200
	AB	Mean		11.54	1.183
		95% Confidence Interval for Mean	Lower Bound	9.20	
			Upper Bound	13.87	
		5% Trimmed Mean		9.12	
		Median		6.53	
		Variance		260.296	
		Std. Deviation		16.134	
		Minimum		0	
		Maximum		119	
		Range		119	
		Interquartile Range		13	
		Skewness		3.520	.178
		Kurtosis		16.880	.355

Research Question 1

What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients? H_0: There is no association between hepatitis C virus and kidney transplant waiting times among ESRD patients, and Ha: There is an association between HCV infection and kidney transplant waiting times among patients with end-stage renal disease (ESRD). To test the hypotheses, a nonparametric correlations test was conducted. The results were not statistically significant ($r = .20$, $p = .089$). Hence, the null hypothesis was supported, and based on the results, it was concluded that there was no relation between HCV infection and kidney transplant waiting times.

Table 21

Hypothesis of Kendall's tau b for Correlations

Variable	Kendall's tau_b	Significance(2-tailed)	95% Confidence Intervals (2-tailed)[a] Lower	95% Confidence Intervals (2-tailed)[a] Upper
Transplant Waiting Times byMonth – HCV virus	-.020	.089	-.039	-.001

a. Estimation is based on Fisher's r-to-z transformation.

Table 22

Negative Correlations Between Hepatitis C Virus Infection and Transplant Wait Time

Statistic	Column A	Column B	Column C	Column D
Kendall's tau_b	Transplant Waiting Times by Month	Correlation Coefficient	1.000	-.020
		Sig. (2-tailed)		.089
	HCV_virus infection	Correlation Coefficient	-.020	1.000
		Sig. (2-tailed)	.089	

Research Question 2

What is the difference in kidney transplant waiting times by blood type among ESRD patients? The H_0 stated there is no difference in kidney transplant waiting times by blood type among ESRD patients. The Ha states there is difference in kidney transplant waiting times by blood type among ESRD patients. Given the characteristics of the variables, it was determined that the Independent-Samples Kruskal-Wallis test was appropriate to determine whether blood groups A, B, AB, and O have a substantial impact on kidney transplant waiting times. Results of the test (shown below in tables 23-25) concluded there was differences in mean values for each blood group, supporting that Independent-Samples Kruskal-Wallis is the appropriate analysis.

Table 23

Descriptive Statistics of the Variable

Variable	*N*	Mean	Std. Deviation	Minimum	Maximum	Percentiles 25th	50th (Median)	75th
Kidney Transplant Waiting Times by Month	4730	13.67	15.765	0	132	2.83	8.50	18.53
BloodType	4709	1.72	.831	1	4	1.00	2.00	2.00

Table 24

Hypothesis Test for the Independent-Samples Kruskal-Wallis Test

Null hypothesis	Test	*Sig.*[a,b]	Decision
The distribution of TransplantWaitTime_Month is the same across categories of BloodType.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis

Using a CI of.05 (table 19), the Kruskal-Wallis test revealed a statistically significant difference in kidney transplant waiting times across blood groups: X^2 (3, N = 15.025, *p=.002.* Transplant wait times were lower in patients with blood type AB (Md = 11.54) in comparison to candidates with blood types O (*Md* = 14.79), B (*Md* = 13.19), and A (*Md* = 12.54).

Table 25

Mean Rank

Variable	BloodType	*n*	Mean rank
Kidney Transplant	O	2,274	2386.09
Waiting Times by	A	1,647	2316.04
Months	B	592	2326.07
	AB	185	2272.50
	Total	4,698	

Table 26

Mean Comparisons

BloodType	Kidney TransplantWaiting Time by Month
O	14.79
A	12.53
B	13.19
AB	11.54
Total	13.67

Table 27

Independent-Samples Kruskal-Wallis Test Summary

Test Statistics	TransplantWaitTime
Total *N*	4,709
Test Statistic	15.508[a]
Degree of Freedom	3
Asymptotic Sig.(2-sided test)	.001

a. The test statistic is adjusted for ties.

b. Grouping Variable: BloodType

Further comparisons of Mean Rank revealed blood group O (Mean Rank = 2415.47) has statistically higher rates of transplantation compared to groups AB (Mean Rank = 2085.13), the least transplanted. Displayed in table 20 are the mean ranks for blood groups and a visual graphic in figures 4 and 5.

Table 28

Pairwise Comparisons of Blood Groups Shows Type O Ranks Highest in Transplant Waiting Time Followed by Types A, B, and AB

Variable	BloodType	*n*	Mean rank
Kidney TransplantWaiting Times by Months	O	2,280	2415.47
	A	1,649	2292.71
	B	594	2380.33
	AB	186	2085.13
	Total	4,709	

Figure 4

Graphic Display of Extreme Values Between Blood Groups

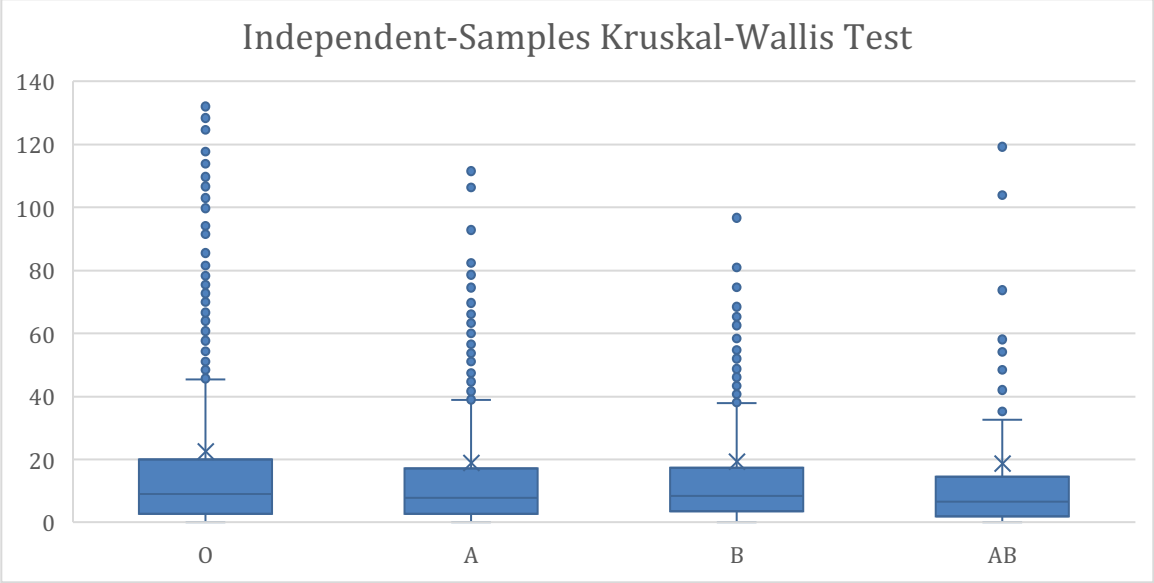
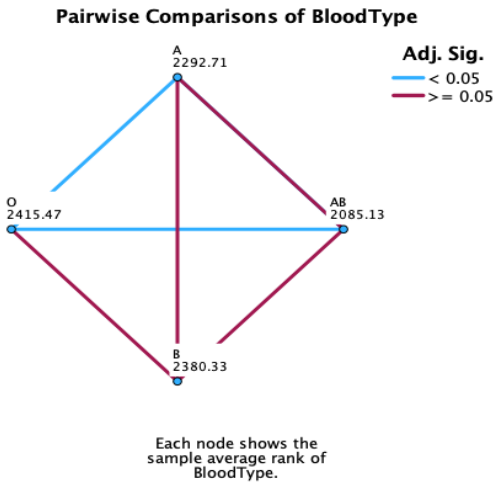


Figure 5

Graphic Display of the Pairwise Comparisons of Blood Type



In addition, pairwise comparisons analysis was performed to determine the effect size between blood type categories. The results (table 21) revealed a statistically significant difference between the blood groups AB-O (z statistic = 3.186, p =.009) and A-O (z statistic = 2.793, p = .031). The latter indicated that there is a statistically significant difference for those two groups (AB-O and A-O), while comparisons of all other groups were not significantly different. Last, post hoc analysis, the results displayed in Table 22 was conducted to determine the statistically significant difference between one blood group and all others.

Table 29

Effect Sizes of Pairwise Comparisons Between Groups

Blood type	Test statistic	Std. error	Std. test statistic	Sig.	Adj. sig.[a]
AB-A	207.577	105.156	1.974	.048	.290
AB-B	295.194	114.230	2.584	.010	.059
AB-O	330.338	103.671	3.186	.001	.009
A-B	-87.617	65.057	-1.347	.178	1.000
A-O	122.761	43.949	2.793	.005	.031
B-O	35.144	62.628	.561	.575	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.
Significance values have been adjusted by the Bonferroni correction for multiple tests.

Table 30

Post Hoc Analysis for Blood Groups Comparisons

	(J)	Mean			95% Confidence Interval	
(I) BloodType	BloodType	Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
O	A	2.26*	.508	<.001	.95	3.57
	B	1.60	.724	.119	-.26	3.46
	AB	3.25*	1.198	.034	.18	6.33
A	O	-2.26*	.508	<.001	-3.57	-.95
	B	-.66	.752	.819	-2.59	1.28
	AB	1.00	1.215	.846	-2.13	4.12
B	O	-1.60	.724	.119	-3.46	.26
	A	.66	.752	.819	-1.28	2.59
	AB	1.65	1.320	.594	-1.74	5.05
AB	O	-3.25*	1.198	.034	-6.33	-.18
	A	-1.00	1.215	.846	-4.12	2.13
	B	-1.65	1.320	.594	-5.05	1.74

Based on observed means.
The error term is Mean Square(Error) = 246.913.
*. The mean difference is significant at the 0.05 level.

Research Question 3

What is the association between hepatitis C virus status and transplant waiting times among patients with end stage renal disease (ESRD) when controlling for age, race, gender, primary health insurance coverage, and working for income? The hypothesis for this research question was tested using a bivariate correlation. To test the hypothesis for this research question, dummy variables were created for race categories

(Hispanic/Latinos, Blacks/African Americans, and other races) and primary payment source (Private Insurance, Public Insurance-Medicaid, and Other Payment). Using whites and people with public insurance (Medicare) as comparison groups According to the results in the Model Summary (table 23), R2 and Adj R2 did not change, with a F Change of = 8.537 and a p = <. 01. Nevertheless, when the hepatitis C virus infection is added as a variable, there is no discernible difference (p =.153; >.05 (CI); p = <.01, race (Blacks African Americans) B =.-1.376, p = <.01, and health insurance coverage (Private insurance, B = 2,098, p = <.01, and Public Insurance Medicaid, B = 4.628, p = <.01) are all displayed in the coefficient table. A statistically significant change was not seen when the hepatitis C virus infection was included in the model (B = 2,098, p =.153). Yet, after accounting for all other factor, no statistically significant difference was observed.

Table 31

Shows No Significant Change in Model 2 so Hepatitis C Virus Infection Was Added to the Model

Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	*R* square change	*F* change	*df*1	*df*2	Sig. *F* change
1	.122[a]	.015	.013	14.754	.015	8.537	8	4512	<.001
2	.124[b]	.015	.013	14.752	.000	2.046	1	4511	.153

a. Predictors: (Constant), Hispanic_Latinos, Other_Payment, GenderR, PublicInsuranceMedicaid, Work_Income, RECIPIENT AGE, Blacks_AfricanAmerican, Private_Insurance
b. Predictors: (Constant), Hispanic_Latinos, Other_Payment, GenderR, PublicInsuranceMedicaid, Work_Income, RECIPIENT AGE, Blacks_AfricanAmerican, Private_Insurance, HCVvirus infection

Table 32

Coefficient Table Shows No Significant Change in Model 2 so Hepatitis C Virus Infection Was Added to the Model

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	8.901	1.161		7.669	<.001	6.626	11.176
	RECIPIENT AGE	.088	.025	.054	3.477	<.001	.038	.138
	Blacks_AfricanAmerican	-1.376	.535	-.040	-2.571	.010	-2.426	-.327
	GenderR	-.890	.458	-.029	-1.943	.052	-1.788	.008
	Private_Insurance	2.098	.537	.071	3.904	<.001	1.045	3.152
	PublicInsuranceMedicaid	4.621	.782	.093	5.910	<.001	3.088	6.153
	Other_Payment	1.541	1.956	.012	.788	.431	-2.293	5.375
	Work_Income	-.015	.522	.000	-.029	.977	-1.038	1.008
	Hispanic_Latinos	.014	.674	.000	.021	.983	-1.307	1.335
2	(Constant)	8.880	1.161		7.652	<.001	6.605	11.155
	RECIPIENT AGE	.090	.025	.055	3.543	<.001	.040	.140
	Blacks_AfricanAmerican	-1.393	.535	-.040	-2.601	.009	-2.442	-.343
	GenderR	-.883	.458	-.029	-1.929	.054	-1.781	.014
	Private_Insurance	2.091	.537	.070	3.890	<.001	1.037	3.145
	PublicInsuranceMedicaid	4.632	.782	.093	5.925	<.001	3.099	6.164
	Other_Payment	1.495	1.956	.011	.765	.445	-2.339	5.329
	Work_Income	-.033	.522	-.001	-.062	.950	-1.056	.991
	Hispanic_Latinos	.004	.674	.000	.006	.995	-1.317	1.325
	HCV virus infection	-2.343	1.638	-.021	-1.431	.153	-5.554	.868

a. Dependent Variable: TransplantWaitTime_Month

The results of the model coefficient (table 25) concluded that for the variable age, it was found that for every one unit increase in age, the odds of transplant wait time increase by 0.88 percent; for gender, the odds decrease by -.890, p = .001; for race, African Americans, the odds decrease by -1.376; and for Hispanic Latinos, the odds increase by 0.14 percent; for private and other payment, the odds decrease by -.154. Last, for work income, the odds decreased by .004. However, for those covered by private insurance, the odds increase by 2.098, while for those covered by public insurance Medicaid, the odds increase by nearly 50% (4.621).

Summary

In this chapter, we went over the study's goal again and gave a detailed explanation of how the study sample (N = 4,730) was chosen by screening and cleaning the data. Shapiro-Wilk was used to do some preliminary tests to see how the data were spread out. These tests showed that the data were not normally distributed and that the normality assumption was not met. The results concluded that the data were not normally distributed. To test the hypotheses in the study, independent-samples Kruskal-Wallis, nonparametric correlations, bivariate regression, crosstabulation, and post hoc analyses were conducted.

A nonparametric correlations test was conducted to answer the first research question and find out if there was an association between hepatitis C virus and kidney transplant waiting times among ESRD patients. There was no statistically significant association between kidney transplant waiting times and hepatitis C virus infection. The Kendall's tau_b table (Fig. 1-2) revealed a negative correlation between the two variables, p =*.089,* with a Kendall's value of -.020. As a result, the H_0 was retained.

A nonparametric Kruskal-Wallis was used to address the second research question and determine if there was any difference in kidney transplant waiting times by blood type. Using a confidence level of.05, the test findings (shown in Table 14) revealed that there is a statistically significant difference: *X2 (3*, N = 4709), = 15.508, p = .001. Therefore, the null hypothesis was rejected. Further analysis was conducted using pairwise comparisons to determine the effect size across categories of blood and kidney transplant wait times. The results showed statistically significant differences for the blood

groups AB-O (z statistic = 3.186, p = .009) and groups A-O (z statistic = 2.793*, p* = .031*),* while all other groups showed no significant difference.

Last, research question 3 was addressed using bivariate regression analysis to determine if there was an association between kidney transplant waiting times and Hepatitis C virus infection when controlling for age, gender, race, primary insurance coverage, and work income. The test results concluded no change in R^2 and Adj R^2 with an F Change of = 8.537 and *a p*-value of .001. However, no significant change was observed when adding the variable Hepatitis C virus infection (p = .153), which is >.05 CI. The Coefficient table shows statistical significance in transplant wait time when controlling for age (B = .088, p = <.001), race (Blacks/African American (B = .-1.376, p = <.001), health insurance coverage (Private Insurance, B = 2,098, p = <.001, and Public Insurance Medicaid B = 4.628, p = <.001). Adding HCV infection to the Model did not produce any statistically significant change (B = 2,098, p = .153). In addition, there was no statistical significance when controlling for all other variables. As a result the null hypothesis was retained concluding there was no association between Hepatitis C virus infection and kidney transplant waiting times. A detailed discussion of the study, strength, weaknesses, conclusions, and recommendations will be addressed in chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative retrospective study was to analyze the association between HCV infection, blood type, and kidney transplant waiting time among ESRD patients when controlling for age, gender, race, work income, and health insurance coverage. I used secondary data collected by UNOS between January 1, 2010, and December 31, 2020. The variable data were extracted from the adult transplant candidate and transplant recipient forms. One dependent variable, kidney transplant waiting times, was investigated. The two independent variables were HCV infection and blood type, while controlling for five independent variables: age, gender, race, primary health insurance coverage, and work income.

The variables were coded on categorical and nominal scales. Sociodemographic variables were gender (male, female), age (18-34, 35-48, 48-70, >70), race (White, Black/African American, Hispanic/Latino, other), working for income (yes, no), and primary health insurance coverage (private insurance, public insurance Medicaid, public insurance Medicare, and other insurance). The goal of the study was to answer three research questions:

RQ1: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients?

RQ2: What is the difference in kidney transplant waiting times by blood type among ESRD patients?

RQ3: What is the association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients, when controlling for age, gender, race, work income, and primary insurance coverage?

Interpretation of the Findings

In this section, the results from Chapter 4 are used to compare the results of this study to the results of other studies. One of the main reasons for conducting this study was to examine whether there are still differences in who can receive a kidney transplant. The hypotheses and research questions for this study were based on old problems that had not been solved in this population. The main goal of this quantitative retrospective study was to examine whether HCV infection, blood type, and waiting times for kidney transplants were related among patients with ESRD.

The nonparametric correlations test was used to test H_a1, which predicted that there was an association between HCV infection and kidney transplant waiting times among ESRD patients. The results of the analysis indicated that there was no statistically significant association between transplant waiting times and HCV infection (p = .089, Kendall's value = -.02). Therefore, H_01 was retained. Other studies showed that some groups were negatively affected more than others by the differences in how kidneys were distributed in the United States. According to Khan et al. (2020), Ladino et al. (2016), and the National Kidney Foundation (2021), HCV infection was 10 times higher among ESRD patients receiving hemodialysis than the general population. Research showed that despite the screening of blood and blood products, nosocomial HCV transmission remained an ongoing issue in hemodialysis units (Aguirre Valadez et al., 2015).

Furthermore, documentation supported the idea that the longer patients remain on dialysis, the more likely they are to develop anti-HCV antibodies (Sawinski et al. 2019).

Furthermore, approximately 5%–6% of all waitlist candidates were HCV positive (Kiberd et al., 2018). HCV-positive ESRD patients benefit from kidney transplantation because they have a significantly higher chance of survival compared to those who remain on dialysis treatment (Sawinski et al. 2019). Although the current study cannot support the findings of Sawinski et al. (2019) that HCV-seropositive patients had limited access to the kidney transplant waitlist, it can support the conclusion that once waitlisted, there is no difference in kidney transplant rates between HCV-positive and HCV-negative patients.

For RQ2, $H_0 2$ stated there is no difference in kidney transplant waiting times by blood type among ESRD patients, while $H_a 2$ stated there is a difference in kidney transplant waiting times by blood type among ESRD patients. Applying a CI of .05, the Kruskal-Wallis test revealed that there was a statistically significant difference in kidney transplant waiting times by blood type, $X2$ (3, N = 4,698) = 15.508, p = .002. As a result, the null hypothesis was rejected, and I concluded that there was a statistically significant difference in kidney transplant waiting times by blood type. Further comparisons of mean rank revealed Blood Group O (mean rank = 2415.47) had statistically higher rates of transplantation compared to Group AB (mean rank = 2085.13), the least transplanted. In addition, pairwise comparisons were conducted to determine the size of the effect between blood type categories. The results revealed a statistically significant difference between the Blood Groups AB-O (z = 3.186, p = .009) and A-O (z = 2.793, p = .031).

The latter indicated that there was a statistically significant difference for those two groups, while comparisons of all other groups were not significantly different.

Post hoc analysis was conducted to determine the statistically significant difference between one blood group and all others. The results did not support certain findings from Barth et al. (2021) and Lee et al. (2019), while supporting other parts of their findings. According to Barth et al. and Lee et al., many factors have an impact on the length of time candidates spend on the cadaveric kidney transplant list. Although the average waiting time is between 3 and 5 years, immunologic and nonimmunologic factors determine the final time period (Lee et al., 2019; UNOS, 2019; U.S. Dept. of Health and Human Services Office of Minority Health [DOH], 2019). The known immunologic factors are donor incompatibility, the algorithms utilized for organ distribution, and the success of local kidney recovery (UNOS, 2019). The results of the current study support the findings of Barth et al. that blood group is an instrumental factor in determining access to kidney transplantation but did not support the finding that patients with the O blood group must remain on the candidate list a lot longer compared to those with other blood groups.

For RQ3, $H_0$3 stated there is no association between hepatitis C virus infection and kidney transplant waiting times among ESRD patients when controlling for age, race, gender, work income, and primary health insurance coverage. H_a3 stated there is an association between HCV infection and kidney transplant waiting times among ESRD patients when controlling for age, race, gender, primary health insurance coverage, and work income. H_a3 was tested using a bivariate regression. The test results revealed no

change in R^2 and Adj $R^{2,}$ with an *F* change of 8.537 and a *p* value of .001. However, no significant change was observed when the variable HCV infection was added (*p* = .153), which was > .05 CI. The coefficient table showed statistical significance in transplant wait time when controlling for age (*B* = .088, *p* .001), race (Black/African American, *B* = -1.376, *p* = .001), and primary health insurance coverage (private insurance, *B* = 2,098, *p* .001, and public insurance Medicaid, *B* = 4.628, *p* .001). Adding HCV infection to the model did not produce any statistically significant change (*B* = 2,098, *p* =.153).

In addition, there was no statistical significance when controlling for all other variables. As a result, $H_0$3was retained. The results of the analyses for this RQ3 revealed new information and helped strengthen findings from previous studies. However, findings challenge the results of a study conducted by Kilbert et al. (2018), which indicated that although many HCV-positive recipients received kidneys from HCV-positive donors, they still had to wait a lot longer than the average. Current results are consistent with the findings of Sawinski et al. (2019), which indicated that older age was associated with a lower probability of placement on the waiting list. In addition, current findings helped strengthen the conclusion of the Sawinski et al. study.

The ecological systems theory was used as the conceptual framework for the current study because it offered a better basis for developing interventions to address the disparities in kidney distribution and maximize access to kidney transplantation for racial minority groups. The theory acknowledges the interdependence and interconnectedness of components throughout a health condition (Arriola, 2017; Cabacungan et al., 2020; Jones, 2000). The ecological systems theory can help illustrate critical concepts at every

level (institutional, community, interpersonal, and individual) that may negatively impact access to kidney transplantation, thereby supporting the development of interventions to address barriers at each level and helping improve early placement on the transplant list (Arriola, 2017; Hwang et al., 2020; Jones, 2000).

The main problem with this study was that it used a random sample over which no control could be exerted. The way the data were collected makes it harder to understand and interpret the study's conclusions. Furthermore, after scrubbing the data, a very large sample (N = 4,730) was obtained, whereas the required sample size for power was 777 participants. The proportion of HCV-positive cases was only 1.98% (86 cases), which may have an impact on the generalizability of the study. In addition, the male to female ratio showed that females were underrepresented (32.9%) compared to males (67.1%). Furthermore, the use of a convenience sample raises the likelihood of bias within the study group of HCV-positive ESRD patients. Almost 2% (1.98%) of the HCV infection status was either unknown or could not be disclosed, leading to a decreased number in the study population and thereby decreasing generalizability. The usefulness of this study should be underestimated despite these limitations, as it reveals that regardless of HCV infection status, factors like blood type, race, and health insurance coverage remain instrumental and continue to significantly affect kidney transplant waiting times. In addition, more focus should be placed on ensuring that hemodialysis patients have documented HCV infection status and that this information is disseminated between hospitals, transplant centers, and dialysis centers.

Recommendations

This study revealed that regardless of hepatitis C virus infection status, blood type, race, or health insurance coverage, among others, these factors continue to play a significant role in kidney transplant waiting times. In addition, more focus should be placed on ensuring that hemodialysis patients are educated on their transplant options as early as possible and encouraged them to consider to be evaluated for kidney transplantation. In addition, all dialysis patients should be tested regularly for hepatitis C virus and have their status documented. Their viral load should monitored to ensure they remain eligible for kidney transplantation. Last, HCV infection status should be shared between hospitals, transplant centers, and dialysis centers. The findings of this study can have a social impact by influencing future policies and can be used as a framework to create educational interventions for both patients and professionals involved in facilitating access to kidney transplantation for patients receiving dialysis. It is recommended that this study be replicated using a study population that is more representative of the HCV positive ESRD population.

On July 10, 2019, President Donald J. Trump signed an Executive Order to Advance American Kidney Health (AAKH), articulating a bold, all-encompassing vision to break away from laws and practices that have been detrimental to people with kidney disease. The Presidential Order formally initiated a new Department of Health and Human Services (HHS) initiative to enhance the kidney health of Americans. Alex Azar, secretary of the Department of Health and Human Services, has highlighted kidney health as one of the top health concerns on which the department can have a substantial impact.

The results of this study provide a useful roadmap for dialysis centers, hospitals, and transplant centers staff to continue to view the issues of access to kidney transplantation as dire. The data presented indicates that sociodemographic factors remain major determining factors in access to kidney transplantation.

This study revealed that regardless of hepatitis C virus infection status, factors like blood type, race, and health insurance coverage, among others, remain the major factors kidney transplant waiting times. In addition, more focus should be placed on ensuring that hemodialysis patients have documented HCV infection status and that accurate information is shared between hospitals, transplant centers, and dialysis centers. The findings of this study can have a social impact by influencing future policies and can be used as a framework to create educational interventions for both patients and professionals involved in facilitating access to kidney transplantation for patients receiving dialysis. It is recommended that this study be replicated using a study population that is more representative of the HCV ESRD population.

Implications

Compared to long-term dialysis, kidney transplantation is the best form of renal replacement therapy because it leads to a longer and better quality of life, and lowers overall medical costs (Fiorentino et al., 2021). Past studies have concluded that disparities in access to kidney transplantation for the minority population remain a significant concern (Axelrod et al., 2018; CDC.gov, 2019; Gordon et al., 2019). The findings of this research study have significant implications for the ethnic minority and the economically disadvantaged ESRD population because of the high prevalence of

ESRD and the disparities in access to kidney transplantation. The findings are relevant to, and primarily serve the interests of, the HCV virus-infected ESRD kidney transplant candidates. Results from past studies suggested that patients who remain on dialysis for an extended period of time are more likely to develop anti-HCV antibodies (Aguirre Valdez, 2015; Kiberd et al., 2018; Sawinski et al., 2019).

While the results of this study may not fully support past findings, they offer new insights into the barriers to kidney transplantation. Major barriers to accessing kidney transplantation have previously been identified at the community- and institutional-level factors (patient-provider communication), intrapersonal (lack of patient education), and intrapersonal factors (low health literacy and economic disparities). Browne et al. (2021), at the community level, identified transportation and distance to the transplant center as two major barriers to kidney transplantation (63.7% and 29.7%, respectively). In addition, low health literacy, low socioeconomic status, and a lack of understanding about the transplant process were identified as intrapersonal factors affecting access to kidney transplantation. The results of this study strengthened the need for improved patient-provider communication across all entities.

Conclusion

Everyone does not have the same opportunity in accessing kidney transplants, and there are a number of known reasons why this is the case. This study examined the association between hepatitis C virus infection and kidney transplant waiting times, the difference in blood group and transplant waiting time, and lastly, the association between HCV infection and kidney transplant waiting times when taking into consideration age,

gender, race, health insurance coverage, and work income. The findings indicated that transplant wait times are dependent on many sociodemographic factors such as blood type, race (Black or African Americans), gender, work income, and health insurance coverage, among others. This study provided new insights into a better understanding of transplant waiting times and HCV infection among patients with ESRD. Above all, the findings of this study demonstrated the importance of making concerted efforts to advance access to kidney transplantation for all. The findings of this study suggest the need to continue to focus on sociodemographic factors affecting kidney transplant waiting times. Although, no significant relationship was found between kidney transplant waiting times and HCV- infected ESRD patients, more research could be completed to explore if there are other mitigating factors to explain why ESRD patients do not see an impact on kidney transplant waiting times. It could also mean that any patient receiving a kidney transplant regardless of the reason for the need to receive a kidney transplant experiences the same waiting times.

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Appendix A: Adult Kidney Transplant Candidate Registration Worksheet

Adult Kidney Transplant Candidate Registration Worksheet

Note: These worksheets are provided to function as a guide to what data will be required in the online TIEDI® application. Currently in the worksheet, a red asterisk is displayed by fields that are required, independent of what other data may be provided. Based on data provided through the online TIEDI® application, additional fields that are dependent on responses provided in these required fields may become required as well. However, since those fields are not required in every case, they are not marked with a red asterisk.

Provider Information

Recipient Center:

Candidate Information

Organ Registered: **Date of Listing or Add:**

Last Name: * **First Name:** * **MI:**

Previous Surname:

SSN: **Gender:** * Male Female

HIC: **DOB:** *

State of Permanent Residence: *

Permanent ZIP Code: * -

Ethnicity/Race: *

(select all origins that apply)

American Indian or Alaska Native

- American Indian
- Eskimo
- Aleutian
- Alaska Indian
- American Indian or Alaska Native: Other
- American Indian or Alaska Native: Not Specified/Unknown

Asian

- Asian Indian/Indian Sub-Continent
- Chinese
- Filipino
- Japanese
- Korean
- Vietnamese
- Asian: Other
- Asian: Not Specified/Unknown

Black or African American

- African American
- African (Continental)
- West Indian
- Haitian
- Black or African American: Other
- Black or African American: Not Specified/Unknown

Hispanic/Latino

- Mexican
- Puerto Rican (Mainland)
- Puerto Rican (Island)
- Cuban
- Hispanic/Latino: Other
- Hispanic/Latino: Not Specified/Unknown

Native Hawaiian or Other Pacific Islander

- Native Hawaiian
- Guamanian or Chamorro
- Samoan
- Native Hawaiian or Other Pacific Islander: Other
- Native Hawaiian or Other Pacific Islander: Not Specified/Unknown

White

- European Descent
- Arab or Middle Eastern
- North African (non-Black)
- White: Other
- White: Not Specified/Unknown

Citizenship: *

- **US Citizen**
- **Non-US Citizen/US Resident**
- **Non-US Citizen/Non-US Resident, Traveled to US for Reason Other Than Transplant**
- **Non-US Citizen/Non-US Resident, Traveled to US for Transplant**

Country of Permanent Residence:

Year of Entry to the U.S. **ST=**

Highest Education Level: *

- **NONE**
- **GRADE SCHOOL (0-8)**
- **HIGH SCHOOL (9-12) or GED**
- **ATTENDED COLLEGE/TECHNICAL SCHOOL**
- **ASSOCIATE/BACHELOR DEGREE**
- **POST-COLLEGE GRADUATE DEGREE**
- **N/A (< 5 YRS OLD)**
- **UNKNOWN**

Functional Status: *

Appendix B: Adult Kidney Transplant Recipient Registration Worksheet

Adult Kidney Transplant Recipient Registration Worksheet

Note: These worksheets are provided to function as a guide to what data will be required in the online TIEDI® application. Currently in the worksheet, a red asterisk is displayed by fields that are required, independent of what other data may be provided. Based on data provided through the online TIEDI® application, additional fields that are dependent on responses provided in these required fields may become required as well. However, since those fields are not required in every case, they are not marked with a red asterisk.

Recipient Information

Name: **DOB:**

SSN: **Gender:**

HIC: **Tx Date:**

State of Permanent Residence: *

Permanent Zip: * -

Provider Information

Recipient Center:

Surgeon Name: *

NPI#: *

Donor Information

UNOS Donor ID #:

Recovering OPO:

Donor Type:

Patient Status

Primary Diagnosis: *

Specify:

Date: Last Seen, Retransplanted or Death *

Patient Status: *

- **LIVING**
- **DEAD**
- **RETRANSPLANTED**

Primary Cause of Death:

Specify:

Contributory Cause of Death:

Specify:

Contributory Cause of Death:

Specify:

Transplant Hospitalization:

Date of Admission to Tx Center: *

Date of Discharge from Tx Center:

Clinical Information : PRETRANSPLANT

Functional Status: *

Working for income: * **YES** **NO** **UNK**

Source of Payment:

Primary: *

Specify:

Height: * ft. in. cm **ST=**

Weight: * lbs kg **ST=**

BMI: kg/m^2

Previous Transplants:

Previous Transplant Organ	Previous Transplant Date	Previous Transplant Graft Fail Date

Appendix C: UNOS Data Use Agreement

optn.transplant.hrsa.gov

DATA USE AGREEMENT - I

Pursuant to a contract with the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services, through the Organ Procurement and Transplantation Network (OPTN), The United Network for Organ Sharing (UNOS) will provide the individual identified below (Recipient) with the patient level, non identifiable data extracted from the OPTN research database maintained by UNOS, solely for the Use specified in the initial data request.

While seeking to provide transplant data for biomedical, economic, and other research, UNOS has a great responsibility to ensure the confidentiality of organ donors and transplant recipients. Every effort has been made to exclude from the computer files identifying information on individual patients and facilities. Certain demographic information such as gender, race, etc. are provided for research purposes but may not be used to attempt to identify individuals or institutions.

In order for UNOS to provide a public-use or another version of data to you, it is necessary that you agree to the following provisions:

1. You will neither use **nor permit others** to use the Data in any way other than for statistical reporting and analysis.
2. You will neither release **nor permit others** to release the Data to any person (including media and subcontractors) except with the written approval of UNOS.
3. You will not present and/or publish the Data in which an individual may be identifiable.
4. You will not use the Data for any commercial purpose that could have a negative impact on patient welfare, such as offering, denying, or allocating insurance.
5. You will neither attempt **nor permit others** to attempt to combine or link the Data with patient level records in another database or source of information.
6. You will neither attempt **nor permit others** to attempt to learn the identity of any person whose information is contained in the Data.
7. If the identity of any person is discovered, then you must do the following:
   a) you will not use this knowledge in any way,
   b) you will notify UNOS of the discovery, and
   c) you will not inform anyone but UNOS of the identity that was discovered.
8. If accessing the Data from a centralized location on a time-sharing computer system or LAN with any statistical package, you will not share your logon name and password with any other individuals. You will also not allow any other individuals to use your computer account after you have logged on with your logon name and password.
9. As Primary Investigator, you certify that you are responsible for ensuring any staff assigned to this project with access to the Data likewise will follow all of these provisions.
10. All publications using the Data will contain the standard disclaimer, "The data reported here have been supplied by the United Network for Organ Sharing as the contractor for the Organ Procurement and Transplantation Network. The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy of or interpretation by the OPTN or the U.S. Government."
11. All publications or graphic presentations will note the date and source of the Data. The source of the Data would be "OPTN data" and the run date is provided with the released data. For example, "Based on OPTN data as of October 1, 2015."

My signature indicates that I agree to comply with the above stated provisions.

Signature _____ Date December 2 2022

Name Marie J. Anglade-McCormick Organization Walden University

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