Nephrologists' Perspectives on the Barriers and Facilitators of Transitioning Patients from In-Clinic Hemodialysis to Home Hemodialysis

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Table of Contents

Abstract 5
Introduction 6
Background and Significance 7
Problem Statement 11
Needs Assessment 12
Clinical Question 14
Objectives and Aims 14
Review of Literature 15
Theoretical Framework 20
Methodology 22
Design of Project 23
Setting 23
Population 23
Recruitment 24
Study Interventions 24
Data Collection 25
Risk/Harm 26
Consent Procedures 26
Plan for Process Evaluation 27
Subject Costs and Compensation 27
Project Timeline 27
Project Budget and Resources 28
Evaluation Plan 28

Data Maintenance/Security 28
Data Analysis 28
Findings 29
Results: Background Screener Questionnaire 29
Results: NDT-E Survey 31
Results: Mann-Whitney U Test 41
Recommendation and Discussion 42
Discussion 42
Implications 47
Clinical Practice 47
Healthcare Policy 47
Quality and Safety 48
Education 49
Sustainability 49
Translation 50
Dissemination 50
Professional Reporting 51
Future Scholarship 51
Limitations 51
Conclusion 53
References 54
Appendix 1 Table of Evidence 62
Appendix 2 Theoretical Model 69
Appendix 3 NDT-E Survey 70
Appendix 4 Background Screener 75

Appendix 5 Recruitment Flyer 76

Appendix 6 Consent Form 77

Appendix 7 Rutgers University IRB Approval 79

Appendix 8 Timeline 80

Appendix 9 Budget 81

Abstract

Home hemodialysis (HHD) is a sustainable option for patients undergoing dialysis as it reduces medication intake, hospitalizations, and improves quality of life (QoL). Despite these benefits, nephrologists are still more inclined to prescribe in-clinic hemodialysis (ICH) to majority of their patients. This study was conducted to understand the barriers and facilitators of transitioning patients from ICH to HHD from the nephrologists' perspective. This cross-sectional survey utilized a previously validated Nephrology Dialysis Transplantation Education (NDT-E) instrument that was administered to nephrologists working in urban and suburban settings throughout Essex County. To evaluate outcomes, descriptive statistics were calculated for continuous variables. Frequencies and percentages were calculated for categorical variables. The Mann-Whitney U test was used to test the null hypothesis: There is not a significant difference in the facilitators/barriers of HHD between the urban and suburban physicians. Thirty-Two nephrologists completed the survey. Nearly 70% of nephrologists stated Frequent Nocturnal Hemodialysis as the best overall option for patients. Overall, 23 respondents stated patient's own home was the most suitable location to deliver more frequent/extended hemodialysis. Twenty nephrologists reported that barriers to HHD included: patient complexity and comorbidity, fear of self-cannulation, fear of isolation and lack of support, lack of space within patients' homes. This study demonstrated that majority of the nephrologists believed the best place to provide intensive hemodialysis is at patient's home. Patients that are provided HHD can benefit from improved QoL and clinical outcomes. Hence, there needs to be routine discussions of transitioning to HHD during patient-provider interaction for qualified patients.

Keywords: Home hemodialysis, Quality of life, In-clinic hemodialysis, End stage renal disease

Nephrologists' Perspectives on the Barriers and Facilitators of Transitioning Patients from In-Clinic Hemodialysis to HHD

Introduction

In the United States (US), there are two types of hemodialysis treatment modalities (i.e., in-clinic hemodialysis and home hemodialysis [HHD]) for patients suffering from end stage renal disease (ESRD). In-clinic hemodialysis is the most common option and is conducted three to four times a week in a clinical setting. In-clinic hemodialysis is the main choice by nephrologists when compared to other treatment options. In some cases, patients can have the opportunity to transition from in-clinic hemodialysis to HHD or begin with HHD as their first treatment option; however, this is done in rare situations and/or on a case by case basis. Although there is an abundance of literature supporting the use of HHD, many nephrologists are not quick in transitioning their patients from in-clinic dialysis to HHD. Hence, the current project assessed the barriers and facilitators that physicians have in transitioning the established ESRD in-clinic patient population to HHD. The quantitative survey completed by the nephrologists can bring forth some thoughts that nephrologists have for transitioning the treatment modalities for ESRD patients. In some cases, patients who are adherent on their dialysis regimen in the clinical setting may be good candidates for hemodialysis at home; however, this option may not have been discussed after the patient was established in the dialysis clinic. By understanding the nephrologists' point of view on the different treatment modalities of hemodialysis, this project can help to inform the conversation and address the complexities on shifting the treatment from in-clinic to patients' home. Hence, in some ways this survey can proactively shift the hemodialysis landscape by reintroducing the HHD treatment modality to the physicians as another option for the patients.

Background and Significance

Chronic kidney disease (CKD) is defined as the progressive loss of kidney function. It occurs when the kidneys are damaged and/or unable to filter blood causing excess fluids and waste to build up in the body (National Kidney Foundation, 2017). CKD is a result of many primary causes or a combination of comorbidities. The two major causes of CKD amongst Americans are diabetes and high blood pressure (USRDS, 2015). Diabetes and uncontrolled high blood pressure can damage the blood vessels in the kidneys, leading to gradual reduction in kidney function and can speed up the progression of CKD. Other causes of CKD can be attributed to heart disease, obesity, and/or family history of CKD. "Approximately, 1 in 3 adults with diabetes (and 1 in 5 adults with high blood pressure) have CKD" (CDC, 2017).

The eGFR (rate at which the kidneys filter blood) and level of proteinuria are used to classify, and risk stratify patients with CKD (The Renal Association, 2018). The eGFR measures on a linear scale and is then used to assess the stage of kidney disease. In Stage 1; the kidneys have a GFR greater than 90% or higher of normal kidney function. In Stage 2, the kidneys have a GFR of 89-60% with mild loss of kidney function (i.e., mild CKD). Stage 3 is further broken down to 3a and 3b. In stage 3a, the kidneys have a GFR of 59-45% with mild to moderate loss of kidney function. In Stage 3b, the kidneys have a GFR of 44-30% with moderate to severe loss of kidney function. In Stage 4, the kidneys have a GFR of 29-15% with severe loss of kidney function. Finally, at Stage 5, the kidneys have a GFR of less than 15% and this indicates established kidney failure. Patients with Stage 5 CKD require renal replacement therapy (i.e., dialysis or transplant) (National Kidney Foundation, 2018). End stage kidney failure occurs when eGFR levels are <15 and/or when 85-90% of the kidney function has been lost (National

Kidney Foundation, 2018). During this time, dialysis treatment is needed to help remove the waste and excess fluids from the blood through diffusion and/or ultrafiltration (National Kidney Foundation, 2015).

CKD is an enormous public health issue on both a national and global stage. In the US, it is the 9th leading cause of death (CDC, 2017-2). Specifically, one in ten American adults has some type of CKD (USRDS, 2015). Worldwide, CKD affects 10% of the population (National Kidney Foundation, 2015-2). In fact, there has been an 18.4% increase of CKD worldwide since 2005. A key driver in the burden of CKD worldwide can be attributed to an imbalance of over nutrition and lack of exercise leading to obesity (Neuen, 2017).

There are also gender, age, and racial differences for CKD in the US. For instance, CKD is more common in men than women. Furthermore, those between the ages of 45-64 are at the highest risk for being diagnosed with kidney failure (National Kidney Foundation, 2016). In the US, African Americans, Hispanics and Native Americans are at higher risk of developing kidney failure than their Caucasian counterparts. African Americans are four times more likely to develop kidney failure when compared to Caucasians. Furthermore, since 2000, the rates of CKD have increased by more than 70% for the Hispanic population. The disproportionate rates of CKD in these high-risk populations can be attributed to the high incidence of diabetes, cardiovascular disease, and high blood pressure in these minority groups (NIH, 2014; Peralta et al., 2011).

In 1966, a single tax payer system known as Medicare, administered by the US Federal Government was created to provide health coverage to those ages 65 and older. Since then, Medicare has expanded to include coverage to people under the age of 65 with disabilities and

people of any age with ESRD. ESRD is a huge burden to the US healthcare system. In 2013, less than 1% of Medicare beneficiaries had ESRD; however, they account for 6.2% of the Medicare budget (i.e., $34 billion). Furthermore, the annual average cost of dialysis treatment per individual is an estimated $89,000 (USRDS, 2013).

There are many types of dialysis; the three primary types are hemodialysis, peritoneal dialysis, and hemofiltration. There are two ways to administer hemodialysis: in-clinic or at home. In-clinic hemodialysis occurs in a clinical site about 3 to 4 times a week. While in-clinic hemodialysis is very common, the remainder of the dialysis is performed at home (i.e., HHD or peritoneal dialysis). In the 1960s and 1970s, nearly 40% of patients with ESRD utilized HHD. There were only a few outpatient chronic clinics for patients with ESRD (Trinh, 2017). In 2011, only 1.4% of patients with ESRD performed hemodialysis at home (Diaz-Buxo et al., 2015). Furthermore, in 2013, the prevalence rate of HHD was steady at <2% (Nesrallah et al., 2016). HHD faced many hurdles on the infrastructure and patient ends. There were concerns for patient safety, lack of knowledge, capable training facilities, social isolation, and family burden (Diaz-Buxo et al., 2015).

There are many benefits to HHD. For instance, HHD is a sustainable option for patients to set the dialysis at their own schedule and can lead to better clinical outcomes than in-clinic hemodialysis. Both short-daily HHD and nocturnal HHD options have less restriction on food and drink, better energy, sleep, and greater control of their life schedule (National Kidney Foundation, 2015-3). HHD provides added benefits such as taking "fewer medications to control blood pressure, phosphorus levels and anemia, improvements in neuropathy, fewer and shorter hospital stays, having a better QoL, and living longer" (National Kidney Foundation, 2015-3).

Furthermore, studies have demonstrated that longer and/or more frequent hemodialysis at home delivers improved clinical, biochemical, and health outcomes benefits for ESRD patients versus in-clinic hemodialysis (Komenda et al., 2012). Additionally, some studies have demonstrated that patients treated with HHD have greater autonomy and attributed to lower cost to the healthcare system (Komenda et al., 2012; Nesrallah et al., 2016). HHD can contribute to lowering the financial burden on the healthcare system by eliminating the need for a licensed practitioner to monitor the patient during the treatment, as well as reducing the overhead and support cost of having the patient in the clinic receiving treatment.

In 2015, more than 660,000 Americans were treated for ESRD. Of these patients, more than 468,000 Americans were undergoing dialysis treatment (National Kidney Foundation, 2016). In the past few decades, the surge in medical technology has increased exponentially and there are now many different treatment modalities for dialysis; however, nearly 90% of dialysis patients undergo hemodialysis in a clinical setting rather than in their homes (Rivara & Mehrotra, 2014). According to Qamar et al. (2009), in the US, the current approach for patients starting dialysis is to default to an in-clinic hemodialysis. A randomized clinical trial demonstrated that there were significant improvements in clinical outcomes (i.e., "systolic blood pressure, reduction in antihypertensive medication, improvement in left ventricular mass") for patients undergoing HHD than in-clinic hemodialysis (Rivara & Mehrotra, 2014). Furthermore, a qualitative survey of 1,500 international nephrologists concluded that HHD offers ESRD patients a better quality of life (QoL) and may be better for the patient overall; however, a majority of their dialysis patient population used in-clinic dialysis (Fluck et al., 2014). Hence, there seems to be a disconnect with the benefits of HHD and dialysis prescribing patterns of nephrologists.

With improvements in access to medical health information, patients on dialysis are more engaged with their health and QoL than ever before. With the advancements of education and medical technology, patients have the added comfort of taking control of their health with the assurance that professional help is available one call or click away with HHD. In recent years, home dialysis machines have evolved and have become much easier to operate. In some machines, there are systems in place that can conduct a video conference to allow the patient to get in contact with a physician or nurse for live support. Furthermore, HHD machines may even allow healthcare providers to enable online remote supervision (Wallace et al., 2017). Despite all these benefits, nephrologists are still hesitant about prescribing HHD. An observational study concluded that nephrologists believed that patients can perform tasks related to HHD; however, they felt that the patients might not be 'willing' to perform the tasks related to HHD (Yau et al., 2016). Hence, it is important to assess from the nephrologists' perspectives what they believe to be the barriers and facilitators of transitioning patients from in-clinic hemodialysis to HHD.

Problem Statement

Many physicians agree that HHD has numerous clinical benefits. HHD can allow for quality dialysis, improved health outcomes, and the freedom for the patient from being tied a specific chair, time and dependency on transportation (Fluck et al., 2014; Ornstein, 2014; Yau et al., 2016). Despite the abundant literature and real-world clinical outcomes of HHD, nephrologists have not readily adapted this treatment modality as a primary option for new to dialysis or for chronic hemodialysis patients. For example, a qualitative survey of international nephrologists from Europe, Canada, and the US concluded that most nephrologists (61%) that participated in the study, prefer HHD; however, most of their patients (~90%), received dialysis

treatment in the clinic (Fluck et al., 2014). Hence, it is imperative to get the nephrologists' perspectives on the barriers and facilitators for transitioning ESRD patients from in-clinic to HHD.

Needs Assessment

Chronic health problems are not only on the rise in the US, but the rates of these chronic diseases are also increasing worldwide. One such chronic condition is CKD. CKD has devastating effects throughout the world and affects 10% of the global population (National Kidney Foundation, 2015). The overall prevalence of CKD in the US is approximately 14-15% (CDC, 2017-2; NIH, 2016).

The last stage of CKD is ESRD. ESRD is fatal, unless the patient is treated with dialysis or kidney transplant. Kidney transplant may offer the best outcomes; however, a major problem is due to the lack of availability of donors. Hence, dialysis is an alternative treatment option for patients with ESRD. In the US, 660,000 Americans are receiving treatment for ESRD, of which, 468,000 are on dialysis (National Kidney Foundation, 2016). This is almost a 47-fold increase in 40 years (Shinkman, 2016). In 2016, there were 13,056 patients in New Jersey that were receiving dialysis treatment for their ESRD (Dialysis Patient Citizens, 2016). Furthermore, in 2013, there were 1,258 dialysis patients for every one million New Jersey residents (National Kidney Foundation, 2013).

The most common form of dialysis is hemodialysis, which can be utilized in a clinical setting or at home. Despite the advances in modern medicine and technology, there are many barriers to receiving in-clinic dialysis versus HHD. The two predominant barriers that add to cost

and poor dialysis outcomes for in-clinic dialysis include nonadherence (i.e., resulting in missed dialysis) and transportation.

Transportation is a big concern for in-clinic hemodialysis because patients have their chairs booked for a specific time three to four days a week. Patients may receive shorter treatment time or may miss dialysis treatment when the transportation is delayed. Furthermore, the transportation cost in New Jersey for getting patients to and from dialysis via an ambulance service can cost Medicare $200 per ride plus $6 a mile to the clinic location each way. In one year, this can equate to $10,000 per patient (Ornstein, 2014) for just transportation.

Nonadherence is a big problem with in-clinic dialysis. Patients that miss dialysis treatment and/or receive shorter treatments can have detrimental effects on their overall health and wellbeing. Missing dialysis treatment can result in increased healthcare resource utilization through increased visits to hospitals for emergency visits and longer duration of inpatient stays. Furthermore, one missed dialysis treatment or more per month can increase mortality by 10% (Cabness et al., 2007). Hence, although most of the dialysis patients receive in-clinic hemodialysis, other modalities such as, HHD should be recommended as the first-line of renal replacement therapy for qualified patients. Compared to in-clinic hemodialysis, HHD offers patients a greater autonomy, improved QoL, lower cost, better clinical outcomes, etc.

Transitioning qualified patients from in-clinic hemodialysis to HHD will benefit patients greatly; however, despite all its technologic advances, such as easy-to-use machines, only 1.8% of all dialysis prescribed by nephrologists consists of HHD (USRDS, 2017). Studies have been conducted to get the patients' perspective on transitioning from in-clinic dialysis to HHD; however, the primary prescribers of dialysis treatment are nephrologists. Hence, it is imperative

to assess from the nephrologists' perspectives what they believe to be the barriers and facilitators in transitioning patients from in-clinic hemodialysis to HHD. Getting this medical point of view can allow for potential change in prescribing patterns of dialysis to current and new patients with ESRD.

Clinical Question

What are the nephrologists' perspectives on the barriers and facilitators of transitioning ESRD patients from in-clinic hemodialysis to HHD?

Objectives and Aims

The primary purpose of this evidence-based practice project is to understand and identify the potential barriers and facilitators of transitioning patients from in-clinic hemodialysis to HHD from the nephrologists' point of view through a quantitative survey. Through this assessment, the medical community will have a better idea on ways to address some of the concerns to change the dialysis landscape. The secondary goal of this project is to disseminate the knowledge to the medical staff, administrative personnel, patients and caregivers in order to implement a change in prescribing patterns of hemodialysis.

The project's overarching aim is to increase the number of patients receiving HHD and to drive a change in clinical practice by having nephrologists consider and bring about the conversation for HHD as the primary treatment option for current and new-to-dialysis patients.

The objectives of this project are to:

- Assess the barriers and facilitators of HHD through implementing a quantitative survey to practicing nephrologists.

- Address the transitioning of dialysis treatment modalities from in-clinic to HHD.
- Stratify results by demographic regions (i.e., urban and suburban) to assess for similarities and differences amongst the barriers and facilitators of transitioning from in-clinic dialysis to HHD from the nephrologists' perspective.

Review of Literature

A literature search was conducted using PubMed and CINAHL. Key terms consisting of "nephrologist, HHD, surveys and questionnaires" were meshed to retrieve current literature. PubMed search results, dated back to the last 15 years, yielded 44 results. CINAHL search results, dated back to the last 15 years, retrieved 60 results. The purpose of the review was to explore the barriers and facilitators of prescribing HHD to new ESRD patients and transitioning current in-clinic dialysis patients to HHD. The search also explored the benefits and drawbacks of HHD. The implementation of self-dialysis could be influenced by important stakeholders (Ledebo, 2008). Stakeholders were healthcare and reimbursement, nurses and nephrologists, and patients and families.

Quantitative surveys taken by nephrologists demonstrated a positive attitude towards HHD. One study concluded that 55% of nephrologists believed the home to be an ideal location for offering an intensive dialysis schedule (Jayanti et al., 2014). Furthermore, when 44 physicians were asked what their treatment modality for dialysis would be if they had ESRD and were waiting for renal transplant, 50% of physicians stated that they would primarily chose HHD (short daily or nocturnal) while only 5% of physicians stated they would choose in-clinic hemodialysis. Physicians were also asked if renal transplant were not an option, then what would

be their dialysis treatment modality. Most of the physicians (66%) stated that in this situation, they would choose HHD as their primary option (Schiller et al., 2010).

Despite the positive attitude towards implementing and utilizing HHD, very few nephrologists prescribed it as their first choice of treatment modality or revisited HHD as an option with the established dialysis patient(s). Fluck et al. (2014) demonstrated that of the 324 nephrologists that took part in the study (~61%) favored HHD as it provides better QoL. They also favored hemodialysis when performed at night than in-clinic as increasing the frequency of dialysis resulted in better overall outcomes for the patients. One thing to note about the participants in this study is that most of their patients (~90%) were prescribed in-clinic hemodialysis.

Studies have differed in determining what the biggest obstacles to initiating HHD are. Financial burden may be one of the main barriers in not receiving treatment at home. A study conducted by Ludlow et al. (2011) revealed that 47% of nephrologists cited the most common barrier to increasing the uptake of HHD was a perception that HHD patients suffer personal financial disadvantage(s) compared with in-clinic institutions. Furthermore, HHD is not fully covered by insurance/Medicare. For example, out of pocket costs for the correct electric connection and proper water connectivity are not reimbursed. HHD could in fact, be more expensive in the short term than in-clinic dialysis (Hajj & Laudanski, 2'/017). Patients choosing HHD may end up with upfront financial loss due to time for undergoing training, cost of plumbing and electrical work in their home(s), etc. Furthermore, many of the HHD patients require a caregiver to be an active member of the patient's care. These members are often unpaid family members (Walker et al., 2017) and thus, contributing to more financial burden for HHD.

Despite the upfront cost, HHD was associated with significant lower overall cost and better health outcomes compared to in-clinic hemodialysis (an annual cost of care difference of $21,000 ($51,252 for in-clinic hemodialysis versus $29,961 for HHD; $p < 0.001$) (Hajj & Laudanski, 2017; Lee et al., 2002). Furthermore, a study conducted in Canada assessed the cost of starting and maintaining a large HHD program. The study found the comprehensive cost per patient from 2004-2005 was $59,179. There was a drop in cost from 2005-2006 as the average cost was $48,648. These costs consisted of start-up, home and in-clinic dialysis, medications, home remodeling, and consumables (Komenda et al, 2012).

In the US, although both in-clinic dialysis and HHD are both covered by Medicare, Medicaid and many private insurances, the cost for in-clinic hemodialysis treatments in the US on an annual cost per patient basis is very high - an average of $89,000 (USRDS, 2013). Although estimates for cost of HHD in the US varies, according to Lee et al., (2002), the cost of HHD fared to be about 42% less than the cost of in-clinic hemodialysis. The main cost drivers of HHD consists of medical supplies and set-up/miscellaneous costs. For example, the initial setup of HHD in the US include furnishing and installing waste and water piping which can range from $750.00 to $1500.00 and the installation a dedicated (i.e., special circuit is not shared by any other appliance) 20 ampere ground fault interrupter by a licensed electrician which can cost $500.00 (AAKP, 2008). These are out of pockets costs that patients have to bear which are not covered by insurance. Patients on HHD must be mindful that they may see an increase in their utility and telephone costs depending on how far they are from the closest clinic (AAKP, 2008).

In the US, the physician reimbursement is calculated by the monthly capitated payment (MCP). The MCP is based on how many times the nephrologist can bill Medicare (between 1 to 4) for in-person visits per month. From 2008-2011, the MCP was $286.00 for four visits to the

in-clinic dialysis service for nephrologists (Golper, 2011). For 2008-2011, nephrologists that provided HHD services were reimbursed $234.00 for the full month. To get reimbursement for the full month for HHD services, the nephrologist must document at least one face-to-face visit (Golper, 2011). Although the reimbursement for HHD services is less, the nephrologist may take in to consideration they only have to visit the patient once, in comparison to four in-clinic visits the nephrologist must make additional meetings with the patient to receive an extra $52.00 a month. For some nephrologists, they may be in favor of fewer visits. The financial deficit in revenues that nephrologists may incur from HHD services can be overcome by maximizing revenue with homecare opportunities (Golper, 2011). For instance, for every newly/retrained patient, up to $500.00 in physician training fees can be billed. Clinics may also bill up to 15 sessions of training per new patient in HHD, thus further increasing their source of revenue (Golper, 2011).

Other common barriers of transitioning to HHD include determining the ideal patients for home dialysis. In most cases, ideal patients for home dialysis include those that do not need special considerations (e.g., caregiver support, patients with other comorbidities, vascular access issues, and bleeding disorders) (Rioux et al., 2010; Tennankore et al., 2013). An observational study conducted by Jayanti et al. (2014) stated that physicians considered complex patients (20.9%) to be the greatest barrier for prescribing HHD, followed by self-cannulation fears (5.1%) and isolation (5%).

A study conducted in 2016 by Yau et al. suggested that 51 nephrologists believed patients are capable of performing dialysis related tasks. Nephrologists believed patients are 'capable' of performing dialysis relevant tasks such as weighing themselves (98%), wiping down the chair and machines (84%), clearing alarms during treatment (53%), taking vital signs (46%), and

cannulating (41%); however, when asked if patients are 'willing' to perform these tasks, the percentages fell to 69%, 34%, 31%, 29%, and 16%, respectively. Hence, the study revealed a "Capability-Willingness Gap" between what the providers thought their patients are able to do versus ready to do. The two reasons nephrologists believe patients are hesitant include intimidating or scary process (75%) and seems like too much work (55%) (Yau et al., 2016).

Despite the system barriers (i.e., funding, training, psychological outreach, and home dialysis machinery accessibility [Ludlow et al., 2011]) for HHD, if these barriers were overcome, 72% of nephrologists that completed a quantitative survey stated that they would recommend HHD to a greater portion of their patients (Ludlow et al., 2011). The in-clinic dialysis treatments occur three days a week, on a Monday, Wednesday, and Friday schedule or Tuesday, Thursday, and Saturday schedule with each treatment time running a span of 3 to 4 hours. Evidence from the literature shows that mortality rates have increased nearly 42% when patients have four or less hours of dialysis treatment time (Brunelli et al., 2010; Marshall et al., 2006; Saran et al., 2006). Daily home dialysis and nocturnal home dialysis facilitate better health outcomes than traditional hemodialysis conducted in a clinical setting. Multiple studies have demonstrated the positive clinical outcomes with HHD including, "reduction in blood pressure, fluid control, uremic toxins and renal anemia, discontinuation of antihypertensive medication, and reduction in erythropoietin and iron supplements" (Basile et al., 2010; David et al., 2009; Poon et al., 2015; Rocco et al., 2011). Experts from the National Kidney Foundation have also found similar evidence of the benefits of HHD. For instance, patients undergoing HHD tended to "live longer, have a better QoL, fewer and shorter hospital stays, have more energy for daily tasks, and take fewer medications to control blood pressure and phosphorus levels" (National Kidney Foundation, 2015-3)

The use of HHD aims to provide patients their autonomy and independence. This in turn can have a positive impact on their QoL and overall wellbeing (Lee, 2002). Home nocturnal hemodialysis was associated with a higher utility score which translated to higher QoL than in-clinic hemodialysis (0.77 ± 0.23 vs. 0.53 ± 0.35, $p= 0.03$, respectively) (Lee,2002; Mcfarlane et al., 2003). Furthermore, there was a significant increase in physical health composite scores for HHD vs in-clinic dialysis (3.4 ± 0.8 vs 0.2 ± 0.8; $p=0.004$, respectively) (FHN, 2010; Lee et al., 2002).

To summarize, this review of literature summarized in the table of evidence (Appendix 1) demonstrates the benefits of HHD despite the system barriers of transitioning patients from in-clinic to HHD. It further confirms that understanding the nephrologists' perspectives on the barriers and facilitators of transitioning to HHD may be a first step towards patients achieving optimal health and economic outcomes in the long run. Thus, the implementation of the Nephrology Dialysis Transplantation Education (NDT-E) survey, may help to proactively shift the treatment paradigm for hemodialysis.

Theoretical Framework

Life is all about change and change is inevitable. Some of these changes can be imperative to one's growth and development, while other changes may not be as welcomed. In 1969, Elizabeth Kubler-Ross developed the Change Curve, which addressed the five different stages of grief and how patients deal with the news when they have a terminal illness. The five stages are: "denial, anger, bargaining, depression, and acceptance" (Kubler-Ross, 1969). Throughout the past few decades, the Kubler-Ross Change Curve expanded to the workforce and has played a role in understanding how change impacts an organization (Cameron & Green,

2015). On an organizational level, the Change Curve model can help upper management predict how the workers may react to the forthcoming change(s). When change is implemented at work, people tend to go through a similar series of reactions/emotions that are comparable to the stages of dealing with grief. This can help the management team by ensuring that they are providing the proper support for their workers so that the transition is made as seamless as possible.

The theoretical framework of the Kubler-Ross Change Curve can also be adapted in this study through three main stages: awareness and identify, assess and implement, and acceptance and integration (Appendix 2). Stage one includes bringing forth awareness of HHD and identifying the problem. Despite the advances made in medical technology, most ESRD patients utilize in-clinic hemodialysis. Furthermore, many nephrologists are aware of the positive clinical outcomes of HHD; however, they have not prescribed this treatment modality to their patients. In the US, a majority of the dialysis is conducted in the clinic. Only 11.5% of dialysis treatments are conducted in a home setting, and of the home dialysis patients, only 15.8% utilize HHD (USRDS, 2015). Furthermore, there have been interventional clinical trials that demonstrates the positive clinical outcomes of HHD versus in-clinic hemodialysis. Hence, it is imperative to identify the barriers of HHD from the nephrologists' perspective as it will allow one to understand the reasoning(s) behind its lack of utility in a real-world setting.

Stage two consists of assessing the literature to identify a quantitative questionnaire and then implementing this survey to nephrologists in various clinical environments (i.e., urban and suburban) to better understand their perspective on barriers and facilitators of transitioning from in-clinic to HHD. After the survey has been implemented and data has been collected, statistical

testing is performed to evaluate the feedback from the nephrologists and assess if there are any trends in the results based on demographic locations.

Stage three entails acceptance of the study results by the medical community and integrating the findings into daily practice by the nephrologists. To do this, the study findings must be disseminated to not only the nephrologists, but to other stakeholders including, medical and administrative staff, patients and caregivers, etc. This stage is about informing the public of the study results to bring to light other avenues of dialysis treatment modalities. Furthermore, an in-service should be provided to address the status quo with not only the results but to also address questions related to the transitioning of dialysis treatment from in-clinic to HHD.

Methodology

This DNP project assessed the nephrologists' perspectives on the barriers and facilitators of transitioning ESRD patients from in-clinic to HHD. Jayanti et al. (2014) concluded in their study that majority of the nephrologists (55%) that took part in the Nephrology Dialysis Transplantation Education (NDT-E) survey believed that the patient's home was the ideal location for dialysis. This project expanded on the work conducted by Jayanti and colleagues and utilized the NDT-E survey in urban and suburban clinical settings throughout Essex County, New Jersey to obtain the perspectives of these practicing nephrologists on the barriers and facilitators of transitioning from in-clinic dialysis to HHD. Results from study may potentially redefine the landscape of HHD.

Design of Project

This descriptive cross-sectional survey research design utilized the NDT-E questionnaire instrument (Appendix 3) and background screener questionnaire (Appendix 4). Cross-sectional surveys allow an opportunity to assess associations and differences between subgroups within a population of interest (Reis & Judd, 2000). The two subgroups of interest in this study consisted of obtaining the nephrologists' perspectives for those that practiced in suburban setting compared to those that practiced in an urban setting in Essex County as it consists of both geographic regions. Furthermore, quantitative data was collected using self-reported demographic information and through the implementation of NDT-E questionnaire.

Setting

This survey intervention was distributed to 43 nephrologists working in urban and suburban nephrology offices throughout Essex County of New Jersey.

Population

This study aimed to sample all 78 nephrologists that were practicing at various demographic regions throughout Essex County from October 15, 2018 through December 31, 2018. These 78 nephrologists were identified by compiling a list of nephrology practices from online search tools (Google.com and Google Maps).

The study participants were recruited through purposive sampling method. This sampling method allowed a better way to assemble and understand the viewpoints of people that are experts in their field (Etikan & Bala, 2017). A purposive sample of adult nephrologists with at least 12 months of experience as a practicing clinician, employed in either urban or suburban offices located in Essex County was selected for this study. The purpose of using only nephrologists in this study was because they can prescribe the different treatment modalities for

dialysis to provide feedback on what are the barriers and facilitators of transitioning patients from one treatment modality to another.

Nephrologists who had less than 12 months of experience were excluded from the study due to a potential lack of experience serving patients in the region. Participants were also excluded from the study if they were medical residents, nurse practitioners, and/or physician assistants as this study aimed to replicate the Jayanti et al. (2014) study.

Recruitment

The Principal Investigator (PI) recruited practicing nephrologists for this study. Project participants were not identified individually and their responses to the background screener questionnaire and NDT-E survey were anonymous. The PI first identified the clinics that had nephrologists working in Essex County, NJ using two websites: www.google.com and Google Maps. The PI faxed over, and hand delivered a recruitment flyer (Appendix 5) to each of the offices where the nephrologists practiced. The recruitment flyer provided an overview of the study background and objectives along with the PI's contact information. One to two weeks after sending out the recruitment flyer, the PI traveled to the various offices and met with the nephrologists to ensure they received the study flyer, understood their role for taking part in the study and that participating in the study was completely voluntary. Furthermore, during this visit the nephrologists also received the study consent form (Appendix 6) and the Background Screener (Appendix 4) and NDT-E questionnaires (Appendix 3).

Study Interventions

The nephrologists utilized the NDT-E survey instrument (Appendix 3) and Background Screener questionnaire (Appendix 4) for this study. This quantitative survey was designed and

validated by Anuradha Jayanti and her colleagues at the Manchester Royal Infirmary in Manchester, United Kingdom. Jayanti et al. (2014) implemented the NDT-E survey in their research to assess the viewpoints of healthcare professionals to understand current clinical practice of hemodialysis, organizational set-up and the perspectives of alternative HHD modality.

The NDT-E survey consisted of two sections. The first section contains six site-specific questions about the setup/provision for HHD therapy. The second section has 12 opinion-based responses involving the attitudes and belliefs for various aspects of dialysis therapy and treatment modality (Jayanti et al., 2014). Permission and approval was sought from Dr. Jayanti prior to the implementation of this survey for this study.

The participants also completed the Background Screener questionnaire which comprised of answering four demographic-related questions that were utilized ensure the participants met the inclusion criteria of the study.

Data Collection

After obtaining IRB approval (Appendix 7) from Rutgers University, data was collected from those nephrologists that consented to completing the survey by paper. The PI met with the nephrologists one to two weeks after the recruitment flyer was delivered. Furthermore, collected data was de-identified as none of the forms asked for personal information to be filled out. The data was collected then stored in a locked cabinet in the PI's home office. Once the surveys were returned, they were uploaded into the PI's password protected laptop for data analysis.

Risk/Harm

Participation in the study was voluntary. A potential risk for participating in this project was study burden. The questionnaire was designed to have the participant commit about 15 minutes of their time to complete the survey. In offices that are fast paced and busy, this may have led to a study burden. To reduce the study burden for this project, the participants were made aware they had 30 days to complete the survey and that the PI could pick it up if they desired.

Another potential risk for this study included loss of confidentiality. All necessary precautions were taken to ensure that there was no breach to privacy for the participants or the data that was collected. All data collected for this project was saved in a password-protected file on the PI's laptop. The PI's laptop was also password protected and accessed only by the PI throughout the duration of the study. The study documents were stored safety in a locked file cabinet in the PI's home office located on the ground floor.

Consent Procedures

Participation in the project was voluntary. The informed consent of the study participants was provided in accordance with IRB requirements from Rutgers University (Appendix 6). By taking part in the survey, the participant acknowledged that they had read the information provided by the PI and agreed to participate in this research, with the knowledge that they could not opt out of their participation because the survey responses were anonymous. The consent document was developed using the Rutgers University IRB Informed Consent form template. Documentation of informed consent was captured.

Plan for Process Evaluation

Nephrologists who treated patients on dialysis and have been practicing in their field for more than 12 months in urban and suburban parts of Essex County, New Jersey completed the NDT-E instrument. The PI provided the survey, study overview, and consent form to the nephrologists. The PI visited nephrology offices in Essex County and distributed the surveys and consent forms. The PI asked the participants if they understood the study objectives and if they had any questions. The surveys that the PI handed out took 15 minutes to complete and were collected.

Subject Costs and Compensation

Participants that took part in this study did not incur any cost to themselves or their institution. For this study, participants needed only a pen to complete the survey. The PI provided the participant with a printed copy of the recruitment flyer, consent and survey documents. The participants were not remunerated for their time. Participants of the study were told they would get a copy of the results once the study was completed.

Project Timeline

From the time the proposal process started to presentation of the findings in the Spring of 2019, this project took 1.5 years to complete. The Gantt chart (Appendix 8) highlights the timings for each of the tasks along with the anticipated end date. The surveys were distributed from October 15, 2018 through December 31, 2018 at 43 nephrology offices throughout Essex County. Data collected from the surveys were imputed into Microsoft Excel from January 5, 2019 to January 10, 2019. Data were analyzed, and results were reported January 31st. The project was completed as of March 28, 2019.

Project Budget and Resources

The budget and resources that were used for this study totaled $233 (Appendix 9). The cost covered the printing of the surveys and consent forms, recruitment flyers, study overview and results flyer for dissemination. The cost of ink, paper, and a printer was included in the total printing cost of $107.35. The fuel costs traveling to the various clinics in the urban and suburban areas amounted to $125.65.

Evaluation Plan

Data Maintenance/Security

Consent forms and paper surveys were provided at the nephrologist's private practice office or via fax. All answers to the survey remained anonymous as the survey responses did not ask for any personal identification information. The consent forms and surveys from nephrologists were secured in a locked file cabinet at the PI's home office. The only person to access the locked file cabinet was the PI. The PI's laptop was password protected. The spreadsheet containing the participant response data was password protected to ensure utmost security of survey results. Once the project is completed, the raw data and statistical analyses will be maintained for 6 years after the closure of the study. Study records will then be destroyed as per guidance from Rutgers University.

Data Analysis

All analyses were conducted using Microsoft Excel® version 2010 provided by Rutgers University. Descriptive statistics (i.e., means and standard deviations) were calculated for continuous variables. Frequencies and percentages were calculated for categorical variables. All data collected was evaluated using measures of central tendency. Bivariate analyses were utilized

to compare clinical practice in urban and suburban groups on the study variables. The Mann-Whitney U test was tested on the null hypothesis. The Mann-Whitney U test is a nonparametric test to compare the outcomes between two independent groups (BUMC, 2017). The null hypothesis for the study stated the following: There is not a significant difference in the facilitators/barriers of HHD between the urban and suburban physicians.

Findings

The study findings are discussed below with, the quantitative results presented below. All data collected was evaluated using measures of central tendency. The data collection for this study began on October 15, 2018 through December 31, 2018. All survey information was picked up from the various private practices and was transcribed into Microsoft Excel. Thorough review and quality check was completed to ensure all the data points were entered properly into the program. Of the 78 nephrologists in Essex County, 46 nephrologists were not available to complete the survey. Ten nephrologists were not available due to retirement and 15 nephrologists had invalid office address. Additionally, 10 nephrologists listed their primary specialty as transplant nephrology and 11 nephrologists declined to participate.

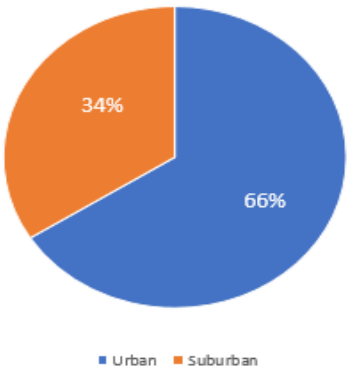
Results: Background Screener Questionnaire

This study consisted of 32 board-certified nephrologists practicing in Essex County, New Jersey that completed the Background Screener questionnaire. All 32 nephrologists had practiced in their field for more than 12 months (Table 1). Most of the participants (66%) practiced in an urban setting, while the remainder of the 11 participants (34%) practiced in a suburban setting (Figure 1).

Table 1 Background Screener (Total Population)

	Frequency	Percent
Is your practice located in Essex County of New Jersey?		
Yes	32	100%
No	0	0%
What demographic is the majority of your patients located in?		
Suburban	11	34%
Urban	21	66%
Are you a board-certified nephrologist?		
Yes	32	100%
No	0	0%
Have you practiced as a nephrologist for at least >12 months?		
Yes	32	100%
No	0	0%

Figure 1: Geographic Region (Total Population)



Results: NDT-E Survey

The previously validated NDT-E survey was completed by 32 nephrologists for this study. Results demonstrate that majority of the nephrologists (97%) specialized in clinical nephrology while the remainder specialized in dialysis (3%). The main center type where the nephrologists worked consisted of freestanding dialysis units (63%), hospital settings (31%), and academic department (6%), Table 2a. The mean (standard deviation, SD) number of patients on hemodialysis and peritoneal dialysis in the overall program for each nephrologist were 105.6 (117.2) and 98.3 (77.7) for urban and suburban areas, respectively. The mean (SD) number of patients on HHD in the overall program for each nephrologist were 4.28 (11.2) and 1.8 (2.1) for urban and suburban areas, respectively (Table 2b).

Table 2a: Physician Practice Background (Total Population)

	Frequency	**Percent**
Your region is:		
Europe	0	0
Middle East	0	0
Asia	0	0
North America	32	100%
Central and South America	0	0
Oceania	0	0
Africa	0	0
Your age is:		
<35 yrs	0	0
35-44 yrs	7	22%

45-54 yrs	10	31%
55-64 yrs	10	31%
>65 yrs	5	16%
Your main activity field is:		
Clinical nephrology	31	97%
Dialysis	1	3%
Transplantation	0	0
Research	0	0
Administration	0	0
The type of your center is:		
Academic department	2	6%
Hospital	10	31%
Free-standing dialysis unit	20	63%
Other	0	0
What is your role in patient management?		
Physician	32	100%
Trainee	0	0
Nurse	0	0
Other	0	0

Table 2b: Physician Practice Background (Urban vs Suburban)

		Mean (Standard Deviation)	Median	Mode
How many patients in your overall dialysis (PD + HD) program?	Urban	105.57 (117.22)	60	100
	Suburban	98.3 (77.68)	97.5	0
How many patients on HHD in your organization?	Urban	4.28 (11.20)	0	0
	Suburban	1.8 (2.14)	1	1

Of the 32 nephrologists, 41% answered that they discuss the different dialysis treatment modality options with their patients. Majority of the participant (50%) responded that the choice of HHD is offered at all stages including: routinely in CKD stage 4 and 5, routinely in ESRD patients on hemodialysis, and on patient's request only. Furthermore, majority of the nephrologists (31%) stated that there is already a protocol/policy in place for setting up patients with HHD in the unit. Half of the nephrologists stated that the set up for training HHD patients is offered in their units (Table 3).

Table 3: HHD Background

	Total Population Frequency	Total Population Percent	Urban Frequency	Suburban Frequency
In your program, who mainly discusses dialysis modality options with patients?				
a. Myself	13	41%	9	4
b. A dedicated education team	2	6%	2	0
c. Other staff	0	0	0	0
d. All of above	17	53%	10	7
e. None of above	0	0	0	0

When is the choice of Home HD offered to your patients?				
a. Routinely in CKD 4 & 5 clinics	13	41%	6	7
b. Routinely in ESRD patients on hemodialysis	3	9%	3	0
c. On patients requests only	0	0%	0	0
d. At all above stages	16	50%	12	4
e. Choice not offered/available to patients in my unit	0	0%	0	0
What is the set up for providing HHD in your unit (patient pathway)? Tick all that apply				
a. Presence of a clinical lead for HHD	12	19%	9	3
b. Patient pathway is well defined	12	19%	9	3
c. Training policy/protocol exists	20	31%	13	7
d. Have a support system for patients on HHD	14	22%	9	5
e. None of the above	6	9%	3	3
What is the set up for training home HD patients?				
a. Training offered in my unit	16	50%	10	6
b. Training offered to my patients through another unit	13	41%	10	3
c. Do not offer home HD training to ESRD patients	1	3%	0	1
d. Not sure or not applicable	2	6%	1	1
Based on your current financial model, would the unit suffer financial disadvantage, if there were more patients who opted for HHD?				
a. Yes	2	6%	2	0

b. No	20	63%	12	8
c. Not sure	10	31%	7	3
Generally, in the organization you work in, is there a continual search for ways to improve operations and patient services?				
a. Yes, new ideas are greeted with enthusiasm	25	78%	18	7
b. No, there is generally a strong resistance to changing already established ways of doing things	3	9%	1	2
c. No, rules and procedures limit scope for consideration of new possibilities	5	16%	2	3

Nearly all the nephrologists (91%) reported that they always place the patient's choice of dialysis treatment modality above everything else. Twenty-one nephrologists (66%) also reported that they always try and persuade their patients to choose dialysis treatment modality that offers best outcomes even if the patient is nervous about it, (Table 4).

Table 4: Patient Preference (Total Population)

	Frequency	**Percent**
As regards your own practice, do you place patient's choice of modality above everything else, in the context of kidney replacement therapy?		
a. Always	29	91%
b. Sometimes	3	9%
c. Never, as they are not knowledgeable	0	0
Do you try and persuade your patients to choose dialysis modality that offers best outcomes, even if they are nervous about trying it?		

a. Never	1	3%
b. Sometimes	10	31%
c. Always	21	66%

The survey results demonstrated that majority of the nephrologists, (78%) believed that there was sufficient evidence in the current literature to highlight and favor longer or more frequent hemodialysis schedules. Furthermore, 69% of the nephrologists stated that Frequent Nocturnal hemodialysis (5-6 nights per week) offered the best overall patient outcome, in any setting (Table 5).

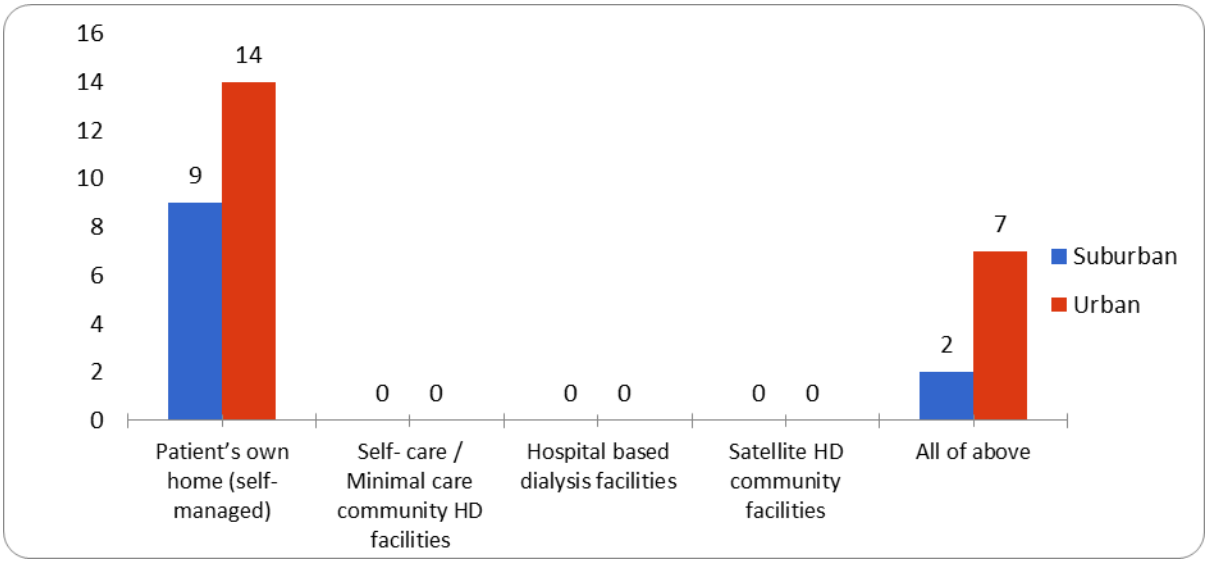
Table 5: HHD Treatment Modality (Total Population)

	Frequency	**Percent**
Do you believe that there is sufficient evidence in the current literature, in favor of longer or more frequent HD schedules, to offer it to your patients?		
a. Yes	25	78%
b. No	3	9%
c. Not sure	4	13%
Which hemodialysis modality do you believe offers the best overall patient outcomes, in any setting? Choose one		
a. Frequent Nocturnal HD (5-6 nights per week)	22	69%
b. Nocturnal HD (3-4 nights per week)	2	6%
c. Short daily (2-3 hrs. 5-6 per week)	4	13%
d. Alternate day HD (4hrs, 3-4 times per week)	2	6%
e. Hemodiafiltration 3 times per week	0	0
f. Conventional standard HD (3 times per week)	2	6%
g. Not sure	0	0

There were five options (i.e., patient's own home, self-care/minimal care community hemodialysis facilities, hospital-based dialysis facilities, satellite hemodialysis facilities, all the

above) listed for where the nephrologists believed to be the most suitable location to deliver more frequent or extended hemodialysis. Fourteen nephrologists practicing in urban setting stated patient's own home (self-managed) was deemed to be the most suitable location to deliver more frequent or extended hemodialysis while nine nephrologists practicing in suburban setting stated patient's own home (self-managed) was deemed to be the most suitable location to deliver more frequent or extended hemodialysis (Figure 2).

Figure 2: Where do you believe is the most suitable location to deliver more frequent or extended hemodialysis?



There were seven options listed for the benefits of HHD over in-clinic HD including: improved patient QoL and less travel, improved biochemical control with fewer medications, improved longevity, patient empowerment, lower treatment costs than in-clinic hemodialysis, all of the above, none of the above. Twenty-three nephrologists from the overall population reported that all of the above benefits were most important for the benefits of HHD over in-clinic hemodialysis (Figure 3).

Figure 3: The benefits of HHD over in-clinic HD is/are mainly due to (Total Population):

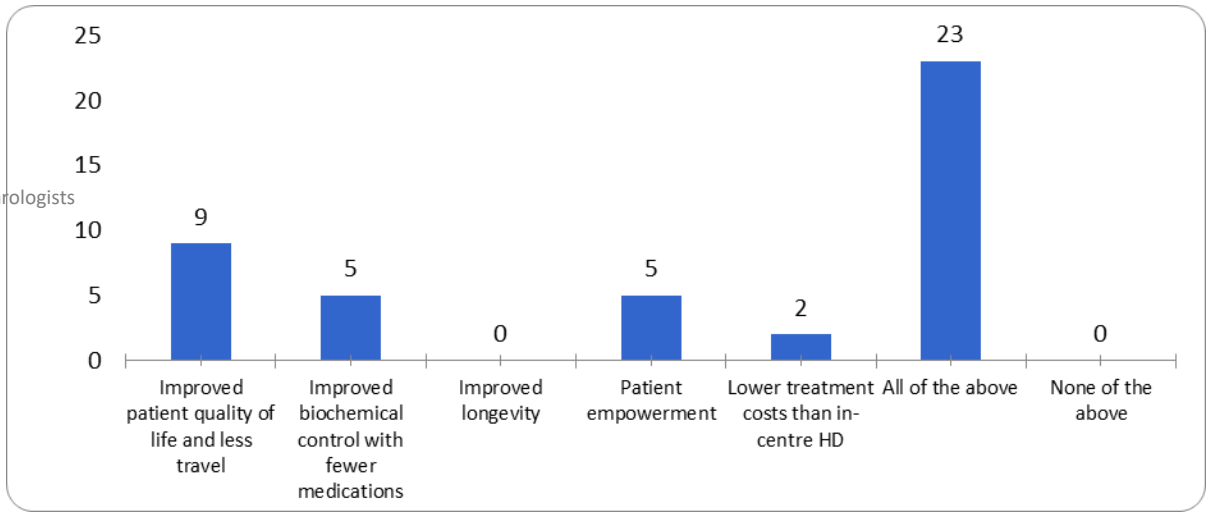


Table 6: Best Patient Outcomes (Total Population)

	Frequency	Percent
Which alternative HD practice do you believe would combine the best patient outcomes with cost efficiency When compared to in-center conventional HD (3 per week)? [Note: cost-effectiveness = patient benefit + cost benefit]		
a. Centre based HDF (x3 per week)	1	3%
b. Centre based HD with extended schedules (>5hrs, >4 sessions per week)	8	25%
c. Minimal care, community-based HD offering extended schedules	0	0
d. HHD (x3-4 per week)	6	19%
e. HHD offering extended schedules (>5hrs, >4 sessions per week)	17	53%
f. HDF offering extended schedules (>5hrs, >4 sessions per week)	0	0

Barriers to HHD consisted of assessing patient barriers as well as organizational barriers. Patient barriers to HHD included: patient complexity and comorbidity, fear of self-cannulation, fear of isolation and lack of support, lack of space within patients' homes, all of the above, none of the above. Twenty nephrologists stated all of the above patient barriers were most important to consider (Table 7). These results remained consistent with those nephrologists practicing in

urban and suburban settings as 10 nephrologists in both cohorts reported all of the above patient barriers are important provisions to consider for HHD (Table 8). (Figure 4). These results remained the same when assessing the urban and suburban nephrologists' point of view of organizational barriers for HHD (Table 9).

Table 7: Barriers to HHD (Total Population)

	Frequency	**Percent**
Which of the following are the most important patient barriers to provision of HHD?		
a. Patient complexity and comorbidity	3	9%
b. Fear of self-cannulation	6	19%
c. Fear of isolation and lack of support	3	9%
d. Lack of space within patients' homes	0	0%
e. All of the above	20	63%
f. None of the above	0	0

Table 8: Barriers to HHD (Urban vs Suburban)

	Urban Frequency	**Suburban Frequency**
Which of the following are the most important patient barriers to provision of HHD?		
a. Patient complexity and comorbidity	3	0
b. Fear of self-cannulation	5	1
c. Fear of isolation and lack of support	3	0
d. Lack of space within patients' homes	0	0
e. All of the above	10	10
f. None of the above	0	0

Figure 4: What are the most important organizational barriers to expansion of services HHD services in your unit? Tick all that apply (Total Population)

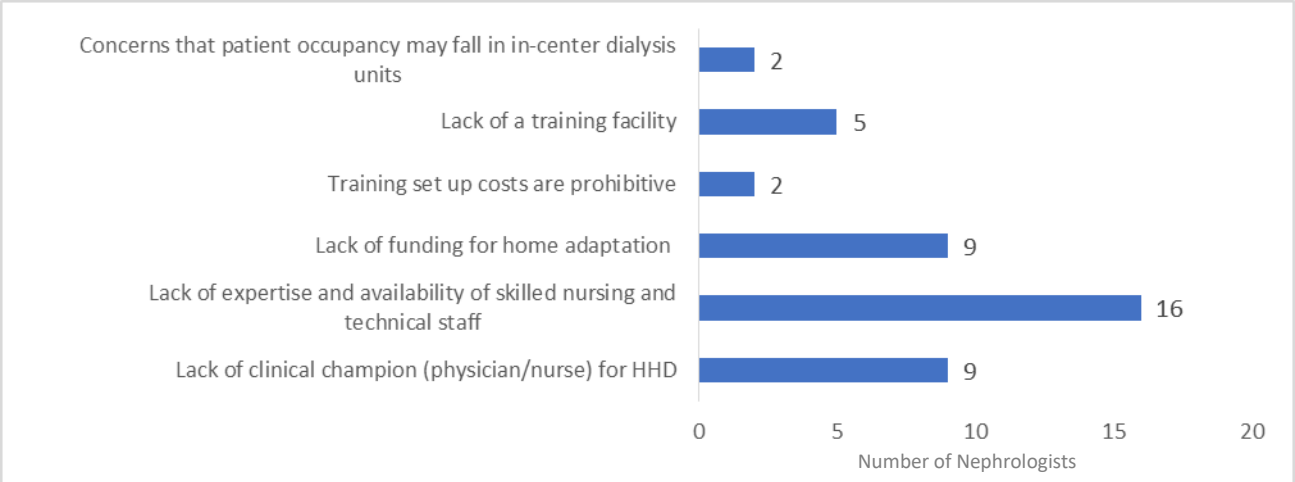
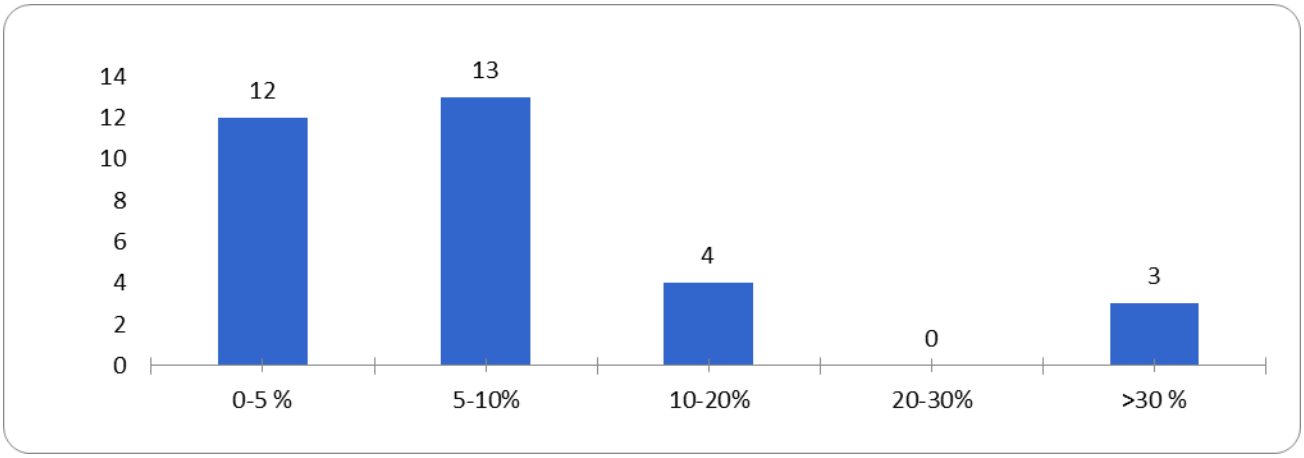


Table 9: Organizational Barriers (Urban vs Suburban)

	Urban Frequency	Suburban Frequency
What are the most important organizational barriers to expansion of services HHD services in your unit? Tick all that apply		
a. Lack of clinical champion (physician/nurse) for HHD	7	2
b. Lack of expertise and availability of skilled nursing and technical staff	11	5
c. Lack of funding for home adaptation	4	5
d. Training set up costs are prohibitive	1	1
e. Lack of a training facility	3	2
f. Concerns that patient occupancy may fall in in-center dialysis units	2	0

Of the total nephrologists that participated in the survey, nearly 41% stated that 5-10% of their total dialysis patients could be treated by HHD (Figure 5).

Figure 5: In your opinion, what percentage of your total dialysis patients (PD + HD) could be treated by HHD? (Total Population)



Results: Mann-Whitney U Test

The Mann-Whitney U test was conducted to test the null hypothesis (Table 10). The null hypothesis was: there is not a significant difference in the facilitators/barriers of HHD between the urban and suburban physicians. Based on the results, the null hypothesis should be accepted for all survey questions (8a through 22) except question 20 (i.e., most important patient barriers to provisions of HHD). By rejecting the null hypothesis, the conclusion of this should be there is a significant difference in the patient barriers of HHD between the urban and suburban nephrologists.

Table 10 Mann-Whitney U Test

Null Hypothesis: There is NOT a significant difference in the facilitators/barriers of HHD between the urban and suburban physicians

Question # on NDT-E survey	Group	N	Mean Rank	Total Mann-Whitney U	Z score	Decision
8a	**Suburban**	11	17.818	528	-0.5753	**Accept**
	Urban	21	15.809			
8b	**Suburban**	11	13.363	528	-1.3688	**Accept**
	Urban	21	18.142			
10	**Suburban**	11	16.5	528	0	**Accept**
	Urban	21	16.5			
11	**Suburban**	11	16.59	528	-0.03967	**Accept**
	Urban	21	16.45			
12	**Suburban**	11	18.95	528	-1.0712	**Accept**
	Urban	21	15.21			
13	**Suburban**	11	16.45	528	-0.0198	**Accept**
	Urban	21	16.52			
14	**Suburban**	11	17.77	528	-0.5554	**Accept**
	Urban	21	15.83			
15	**Suburban**	11	15.54	528	-0.4165	**Accept**
	Urban	21	17			
16	**Suburban**	11	15.59	528	-0.3967	**Accept**
	Urban	21	16.97			
17	**Suburban**	11	14.9	528	-0.6943	**Accept**
	Urban	21	17.33			
18	**Suburban**	11	14.5	528	-0.8728	**Accept**
	Urban	21	17.54			
19	**Suburban**	11	18.54	528	-0.8927	**Accept**
	Urban	21	15.42			
20	**Suburban**	11	21.04	528	-1.9037	**Reject**
	Urban	21	14.11			
21	**Suburban**	11	19.72	528	-1.4084	**Accept**
	Urban	21	14.8			
22	**Suburban**	11	15.95	528	-0.238	**Accept**
	Urban	21	16.78			

Recommendation and Discussion

Discussion

The aim of this study was to identify barriers and facilitators from the nephrologists' perspective of transitioning ESRD patients to HHD by utilizing a previously validated survey instrument. The NDT-E survey comprised of 6 site-specific questions about the setup/provision

for HHD and 12 opinion-based responses relating to the beliefs and attitudes for various aspects of hemodialysis therapy, along with the Background Screener, which included four additional criteria questions.

Prescribing HHD for patients with ESRD may be an alternative option for some patients. Studies have demonstrated that 'believe in the current evidence of intensive hemodialysis (Jayanti et al., 2014; Ludlow et al., 2011). The results demonstrate that majority of the nephrologists that participated in this survey do feel that there is sufficient scientific evidence to demonstrate that longer and/or more frequent hemodialysis may offer patients better clinical outcomes. Furthermore, nephrologists believe the best treatment modality for overall patient outcomes is frequent nocturnal hemodialysis (5-6 nights per week). This does not come as a surprise as the more frequent the dialysis treatment, the better the clinical outcomes (Blair, 2008). Ludlow et al. (2011) study found 83% of respondents agreed HHD with frequent sessions and/or long hours was clinically advantageous to the patient. Nocturnal hemodialysis also offers patients a better treatment option as it not only removes greater amounts of waste and fluids from the body, but it is also more tolerable and gentle for the patient. This in turn can lead to better health outcomes and improve QoL, as the patient is not bound to a machine throughout their day (National Kidney Foundation, 2015-4).

Despite the lack of utility of HHD in the real world, the benefits of HHD, this study demonstrated similar results to the Jayanti et al. study as majority of the nephrologists (72%) felt the patient's home was the best place for extended hemodialysis. The literature establishes that many nephrologists do in fact favor HHD (Fluck et al., 2014; Jayanti et al., 2014; Ludlow et al., 2011). Additionally, the present study reported that 13 nephrologists (41%) believe that 5-10% of their entire dialysis patient population, including those on hemodialysis and peritoneal dialysis

can be treated with HHD. This shift of transitioning 5-10% of the patient population can have tremendous impact to the healthcare system and patient's overall wellbeing.

There are clinical benefits of HHD over in-clinic hemodialysis. The results of this study are in line with clinical research indicating that patients experience a "reduction in blood pressure, improvement in left ventricular mass index, phosphate level control, improvements in QoL and quality of sleep, and a reduction in restless leg syndrome" (Tennankore et al., 2013) when they are receiving hemodialysis at home. This study demonstrated that majority of the nephrologists (72%) felt that the combination of improvements in QoL, biochemical control and longevity, while also reducing the overall treatment costs and empowering the patient were all deemed to be benefits of HHD over in-clinic hemodialysis.

Despite the many benefits, HHD still has many hurdles to overcome on the infrastructure and patient end. Current literature states that there were concerns for patient safety, lack of knowledge, capable training facilities, social isolation, and family burden (Diaz-Buxo et al., 2015) on transitioning to HHD. For the current study, we looked at financial, patient, and organizational barriers that nephrologists identified on patients transitioning from in-clinic dialysis to HHD. These barriers may have contributed to the significant decrease in HHD throughout the past few decades. In the 1960s nearly 40% of the patients with ESRD utilized HHD, while in 2011, only 1.4% of patients with ESRD utilized HHD (Diaz-Buxo et al., 2015).

From an organizational barrier perspective in setting up training for HHD, we anticipated majority of the nephrologists would state that HHD is not available or offered in their practice because it requires a lot more clinical savviness from the patient along with technical support that their clinic may not provide around the clock for their patients. The current study indicated,

that 16 respondents offered training in their unit and 13 respondents (41%) stated that training was offered to their patients through another unit. Only one nephrologist from the suburban setting stated that they do not offer training for HHD to patients with ESRD. Furthermore, majority (63%) of the nephrologists indicated that there is a training policy/protocol exists followed by having a support system in place (44%) for the patients. The data suggests that, contrary to popular belief, training and support for HHD is offered at many clinics.

The survey also assessed other organizational barriers to the expansion of HHD services in their specific unit. Nearly half of the nephrologists believed that a lack of expertise and availability of skilled nursing and technical staff was the number one organizational barrier to HHD followed by 28% of nephrologists who stated that a lack of a clinical champion (physician/nurse) for HHD and lack of funding for home adaptation. Surprisingly, 2 nephrologists from the urban setting stated that organizational barrier concerns consisted of a reduction in patient occupancy within the in-clinic dialysis units.

Another barrier in the lack of HHD utilization is due to patient barriers. The current study assessed the possible patient barriers to provision of HHD from the nephrologist perspective. Patient barriers included the following: patient complexity and comorbidity fear of self-cannulation fear of isolation, lack of support, and lack of space within the patient's home. Twenty nephrologists (63%) selected all of the above as patient barriers to provision of HHD. This response was identified by an even distribution from the nephrologists practicing in suburban and urban settings. Furthermore, three nephrologists practicing in an urban setting selected patient complexity and comorbidity and another three nephrologists identified patient complexity and comorbidity as the only patient barriers. A study conducted by Cafazzo et al. (2009), assessed patient-perceived barriers to the adoption of nocturnal HHD. Participants that

were on conventional hemodialysis (CHD) identified barriers including a lack of self-confidence in self-cannulation, lack of self- efficacy in performing nocturnal HHD, and perceived lack of quality care (Cafazzo et al., 2009). Participants in the study had addressed other concerns including: family burden, lack of self-confidence, and fear of a catastrophic event (Cafazzo et al., 2009). When comparing patient barriers from Cafazo et al. (2009) study with the current study, nephrologists seem to have the correct perception of patient barriers. Fear of self-cannulation due to the need for clinical savviness and lack of support including medical support were common themes in both studies. The data from this study may suggest that patients with complexity and comorbidity in the suburban setting may have the resources available to better manage their care (i.e., able to afford their medications, compliance) or readily have access to their doctors (i.e., transportation), whereas patients in the urban setting may not have the resources (i.e., financial, transportation) to meet with their doctors on a regular basis to address their concerns.

The current study asked nephrologists, based on the current cost model, would the unit suffer a financial disadvantage if more patients opted for HHD. A Canadian study by Hornberger & Hirth (2012) reported that HHD resulted in lower net revenue than in-clinic hemodialysis (Hornberger & Hirth, 2012). Most of the nephrologists (63%) in this study stated that their dialysis unit would not suffer a financial disadvantage; however, nearly a third of the nephrologists stated that they were not sure if their dialysis unit would suffer any financial disadvantage if patients transitioned from in-clinic to HHD.

Implications

Clinical Practice

The study demonstrated that nephrologists identified the best place to provide intensive hemodialysis is at the patient's home. Patients that are provided hemodialysis in a home setting can benefit from improved QoL as well as better clinical outcomes as long hours for the treatment is clinically advantageous. There must be routine discussion of transitioning in-clinic dialysis patients to HHD during patient-provider interactions for qualified patients. By having the open communication, patients will be able to assess their situation to see whether they are ready to make the move to HHD. It will also allow nephrologists to be more aware of their patients' needs rather than assuming that patients are not interested in a certain treatment plan after the first visit.

Organizationally, dialysis clinics should include whether patient is interested in learning about HHD at every visit rather than just the initial consultation. This can be part of the intake form for new patients setting up in the dialysis clinic and/or should also be part of the on-going quarterly discussions for established patients. Doing this will ensure that the option of HHD for qualified patients is available and the healthcare provider is being proactive in providing optimal patient care.

Healthcare Policy

On a national level, policies for patients on dialysis need to change. There can be considerable cost savings for Medicare if patients are provided alternative treatment modalities to hemodialysis. Furthermore, providing patients with governmental financial assistance may be a way to not only incentivize those utilizing the HHD service, but it will also be a way to help

reduce the national healthcare spending. The annual average cost of in-clinic dialysis treatment per individual is $89,000 (USRDS, 2013). This is a substantial burden on the healthcare system and particularly Medicare. Although cost to the healthcare system was not assessed in this study, conceptually, HHD is able to provide more treatment hours with better clinical outcomes that may help reduce the overall long-term economic burden for both the patients and healthcare system. Healthcare reforms for home hemodialysis can pave the way to have more patients on home hemodialysis, in addition help reduce length of stays in hospitals, reduce the need for extra medications and treatments, and reduce the financial burden on Medicare.

Quality and Safety

When setting up patients with HHD, it is very important to ensure that the patient can understand the complexities of transitioning to HHD. To provide quality service, reduce patient anxiety, and have desired health outcomes, it is important to ensure the patient not only understands the ins and outs of their treatment modality, but they also have a hotline they can call in case they have questions. This will not only help patients reduce their anxiety but will also give them the perception that they are being cared for even if they do not come to the clinic on a routine basis. The overall goal of transitioning patients from in-clinic hemodialysis to HHD is to ensure that the patients not only have high satisfaction with their treatment plan but also have low discomfort with their new treatment plan. By allowing the patient to take control of their health, HHD will allow them to have a sense of self-achievement while also improving their QoL.

Education

Educating new and current nephrologists through in-services on best practices for dialysis may be avenues to have more nephrologists inform their patients on HHD. By conveying the importance of HHD on not only the clinical aspect but also in terms of providing optimal patient care and potentially reducing healthcare costs may be a great way to educate healthcare professionals. On a patient level, having a dedicated team member that can provide additional education and triage questions to the appropriate people and/or services when the healthcare provider is not available is vital for the success of transitioning patients from in-clinic to HHD. By having open lines of communication and assistance can help reduce anxiety that patients may have when they are overwhelmed of the new treatment modality.

Sustainability

For this project, nephrologists will ensure sustainability by asking their patients at various clinic visits if they are interested in HHD. By doing this, the nephrologists are keeping the conversation going at the visits that there is always an option for transitioning to HHD. This allows the patient to assess their needs and QoL on a more frequent basis, rather than just at the start of the treatment. Furthermore, sustainability of this project can also be ensured once the dialysis clinics update their intake forms to reflect a single question: *Are you interested in learning more about HHD?* By having the patient check the yes or no on the intake form can have tremendous impact, as it is a way to ensure the conversation on HHD continues throughout the dialysis treatment. Lastly, another way sustainability can be ensured for this project is through having a dedicated HHD team lead that can serve as the point person for all patients undergoing in-clinic dialysis. This dedicated team member can help guide the patients as they

transition as well as answer and/or triage all of their questions to the appropriate people and/or service(s).

Translation

Through presentations at Rutgers University and national kidney conferences, broader groups will become aware of the project background, study details and results/outcomes. This study can be translated to neighboring counties and other states with similar patient demographics. By expanding the study, there is also a possibility of policy changes that can occur on a state and national levels to help patients manage their renal disease while also potentially reducing the economic burden to the healthcare system.

Dissemination

Results of the present study will be made available to the study participants through various means. The PI will fax a document to the participants' offices informing them of the study results. Disseminating the results to the participants will allow them to gain insights on the barriers and facilitators of translating patients from in-clinic to HHD. The PI will also fax the poster presentation to each clinic to disseminate the results and inform the participants of the study outcomes and implications. In all documents, the PI will provide a contact phone number where the participants can reach out to him if they have any questions or would like to discuss more about the study outcomes. Another means to disseminate the results will be through a successful presentation at Rutgers University, School of Nursing. The study results will be disseminated to the wider medical community to change the hemodialysis landscape and prescribing patterns of nephrologists.

Professional Reporting

To share the results of this current project with the professional community, the PI will present the study details through a poster presentation and DNP project presentation at Rutgers University. In addition, the PI will report the results of the data at a future nephrology conference.

Future Scholarship

The first step of scholarship is to submit the abstract to a conference. Since this study was on the perceptions of nephrologists, it would be important to submit the abstract to a nephrology congress. The *American Nephrology Nurse Association* will announce a call for abstracts for the April 2020 annual meeting in Orlando, FL Once the abstract has been accepted to the congress, the poster development will take place. The second step will include publishing the findings of this study in a journal. Prior to submitting the manuscript, a letter will be drafted to the editors in chief of various journals to inquiry whether they will be interested publishing the manuscript. Picking an appropriate journal to publish this study will be important as it is an avenue of disseminating the study results to the public.

Limitations

This survey has many limitations. The survey did not assess questions on treatment modalities for peritoneal dialysis. Since this is another form of dialysis for patients with ESRD when kidney transplant is not possible (Sinnakirouchenan & Holley, 2011), the results of the survey may not apply to the entire patient population on dialysis. Although the study had

produced some interesting results; however, it did not highlight which treatment modality the nephrologist felt offered the best overall clinical outcomes for patients with ESRD when kidney transplant is not an option. Another limitation of this study is that it may not be generalizable to the entire US population. This study focused on only one county in the state of New Jersey. Due to this, the responses from the nephrologists may broadly vary throughout the US and may not be applicable to practices outside of this region. Additionally, the sample size of 32 nephrologist for this population was relatively small and so generalizations may not be made in this study due to this. The small sample size can be attributed to the misinformation found online for the office location and phone number for nephrologists along with some nephrologists declining to take part in the survey due to their busy schedules and/or lack of interest in participating. Another limitation this study introduced was selection bias. By only including practicing nephrologists and no other healthcare providers such as nurse practitioners and physician assistants, this study is limited in that it does not provide a holistic view from a healthcare provider perspective, but rather from one niche group of providers. Furthermore, the patients' perspective on HHD was not assessed this study. Obtaining the patient's perspective can help provide insights into the true barriers and facilitators of transitioning to HHD rather than taking the assumptions of these factors from a nephrologist. Obtaining the patient's perspective on HHD may offer additional insights that can be gained on transitioning from in-clinic hemodialysis to HHD while also laying the groundwork for a more robust study to asses another population affected by HHD. And finally, as most of the analysis is descriptive, this study cannot conclusively establish a relationship between the nephrologists' perspective and barriers and facilitators of transitioning to HHD. Future research is needed to confirm this association after controlling for potential confounders.

Conclusion

The findings of this study demonstrate that there is a disconnect between the belief of HHD benefits and the practice of transitioning patients to HHD as a majority of nephrologists state that they prefer patients to receive extended hemodialysis in a home setting; however, only 5-10% of their patients may qualify for transitioning from in-clinic to HHD. Furthermore, the findings from this study can help to provide support and inform future policies of transitioning patients from in-clinic to HHD.

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Appendix 1 Table of Evidence

PICO: Nephrologists' perspective on barriers and facilitators of transitioning ESRD patients from clinic to HHD

Article #	Author & Date	Evidence Type	Sample, Sample Size, Setting	Study findings that help answer the EBP Question	Limitations	Evidence Level & Quality
1	Fluck et al. (2014)	Quantitative survey	Sample consists of 324 nephrologists working in hospitals and private practice from Europe (n=128), Canada (n=46), and the US (n=150). The certified nephrologists were sent the survey electronically.	Majority of the nephrologists (~61%) favored HHD as it provides better QoL. They also favored dialysis performed at night than in clinic and indicated that increasing the frequency of dialysis results in better outcomes for the patients; however, most of their patients did not have HHD as they tended to prescribe in clinic hemodialysis (90%).	The study participants had to have been in practice for 2-35 years and this can be a limitation as this does not include all nephrologists (i.e., those with <2 years practice); one third of the clinics where the nephrologists worked did not offer HHD and so the results may be a bit biased. The sample size was a bit small in certain countries, it did not include countries in the East, and so the results may not be generalizable to the rest of the world.	This is a level 3 Qualitative study. Good quality: The quality of the study is good because the results are reasonably consistent and enough sample size. The purpose of the study was clearly presented as well as the conclusions.
2	Schiller et al.	Qualitative 10 question	Sample consists of	50% of MDs chose HHD (short daily or nocturnal) as	Limitations included sample	This is a level 3

	(2010)	Questionnaire	323individuals. nephrologists (n=44), nurses (n=101), dieticians and social workers (n=61), patient care technicians (n=20), and administrative employees (n=94), and three did not disclose their job classification Setting: Survey monkey tool sent via email to company distribution list consisting on in center and home facilities	their choice of renal replacement therapy (RRT) while they themselves were waiting for a transplant, and only 5% of MDs would start in the conventional clinic. If transplant was not an option, 66% of MDs stated that they would chose Home HD as their RRT 62% of MDs estimated only 10-30% were able to perform home HD	size, of the 323 individuals, only 44 MDs participated. This is less than 25% of respondents. The study used other HCPs that generally do not have the ability to prescribe one type of dialysis over another. These HCPs generally provide care for the patient undergoing dialysis and by including them in the survey meant that the results were not based solely on the provider input. In addition, the study was based off nephrologists and their perceptions of renal replacement therapies and what they would do if they had to get dialysis rather than it being from the patient perspective.	Qualitative study. Good to Poor quality: The quality of the study is between good and poor because the study was based off the study lacked sample size as less than 25% respondents answered the survey and most sources were beyond 5 years old; however, the conclusions that could be drawn from the results are accurate.

3	Ludlow et al. (2011)	76 questionnaires developed by the Health Australia Home Dialysis Advisory Group	Sample: the study had a total of 71 responses; Heads of Units (n=44), nephrologists (n=44) The study took place in Australia. The majority of nephrologists practiced in eastern states of Australia, mostly in metropolitan public hospitals.	47% of nephrologist cited the most common barrier to increasing the uptake of home HD was a perception that home HD patients suffer personal financial disadvantage compared with in clinic institutions. 38% of respondents cited a lack of physical infrastructure was a barrier to home HD expansion 83% of respondents agreed home HD with frequent sessions and/or long hours was an advantage to the patient. Other limitations to the uptake of home HD included patient issues: demography, geography, motivation, and education. System barriers included funding, training opportunities, psychological outreach, and home dialysis machinery. If these impediments were overcome, majority of nephrologist would recommend home HD to a greater portion of patients (72%). Suggested initiatives to increase home HD: reimbursement for out of	This may not be generalizable top the U.S. population The study could not accurately capture all practicing nephrologists (some may be general physicians with a component of nephrology) Limitations included geography; most of the study was conducted in eastern states of Australia. There was a low response rate from the Nephrologists; most likely, due to the fact, the questionnaire was time consuming (76 questions), hence there is major bias from non-response in this survey.	This is a level 3 Qualitative study. The study is of Good quality. The study produced fair and definitive conclusions from the nephrologist perspective. Financial and system barriers were key reasons for the low uptake of home HD.

				pocket costs, access to care givers payments for dialysis support people, and Medicare reimbursement		
4	Yau et al. (2016)	Quantitative online survey. Two surveys were conducted, one patient survey and one nephrologist survey	Patient sample: 250 patients responded to the email invitation. The average age 46 years (18-99 years). Those above the age of 50 (n=128), those above the age of 65 (n=23), and those that were female (n=122). nephrologist survey: 51 MDs response to the survey. Those in urban areas (41%), suburban (43%), and rural (16%) practice settings	nephrologists believed patients are capable dialysis relevant task such as weighing themselves (98%), wiping down the chair and machines (84%), clearing alarms during treatment (53%), taking vital signs (46%), and cannulating (41%), **but** in terms of ***willing*** percentages fell to 69%, 34%, 31%, 29%, and 16%. The study revealed a "capability-willingness gap". The two reasons nephrologists believe patients are hesitant (1) process is intimidating or scary [75%] (2) seems like too much work [55%]. The patient survey findings showed 69% patients were likely or very likely to consider home HD, if proper training was provided. Patients reported their top three benefits of self-care home HD (1) feeling in control (2) health benefits (3) no more waiting for dialysis to begin	nephrologist respondents were geographically diverse by age and clinical experience; hence, results may not be generalizable to all patients receiving in center hemodialysis, including those who are poor, homeless, and poorly educated.	This is a level 2 quasi experimental The purpose of the study was clearly presented. Key words were clearly stated. The literature review was current with most sources dating to the last 5 years. Limitations to the study were clearly identified.

			The study was conducted in California, USA.			
5	Jayanti et al. (2014)	Qualitative survey 2 sections: 6 site specific questions on setting up home hd 12 opinion-based responses	Sample size: 439 healthcare professionals, those that completed the survey (n=272) Samples came from Europe (61.4%), Middle East (9.6%), Asia (8.8%), and North America (7.7%) 93.4% were practicing nephrologists and 48.5% worked in a general setting and 43.8% worked in a dialysis setting	Discussions of HHD took place when patients are CKD 4/5 in the clinic; however, 48.1% the choice of HHD was not available or not offered as an option. 69.1% of MDs did believe in in current evidence of intensive HD and 54.4% believe the best location for HHD location is at home 50.8% of MDs believed lack of funding for home adaptation was an organizational barrier to HHD Complex patients (20.9%), self-cannulation fears (5.1%), isolation (5%), and no space (1.1%) made up a total 32.1% of patient barriers to HHD as perceived by the MDs	The observed findings could have been exposed to bias because of preferential findings. Most non-responders were from Europe and do not reflect the broader worldview of other parts of the world.	Level 3 qualitative study The quality of the study is good to high The research study presents the clearly in graph format, conclusions were based on the results, and limitations were addressed.

6	Walker et al. (2017)	Comprehensive review	Sample: 102 articles were assessed. 61 studies were included in this review	Patient considerations: When it comes to QoL, normal activities, freedom and flexibility, fatigue, patients found Homed HD could offer the opportunity to thrive Patient barriers included lack of self confidence in the beginning. With peer support and trust from MDs, home HD was the superior choice. Financial barriers: Home HD is not fully covered by insurance, and out of pocket, cost reimbursements were inadequate. Patients choosing home HD had upfront financial losses, one reason being the time for undergoing training. A majority of home HD required a care partner, who were unpaid family members Home HD was associated with lower cost and better outcomes compared to in-center HD	No limitations for a comprehensive review. Any articles outside of the English language are not considered	Level three Systematic review level of evidence High Quality: the purpose of the systematic review was clearly stated, reports were, and multiple databases were searched and identified.
7	Ledebo et al. (2008)	Qualitative Questionnaire	Sample: 7042 completed questionnaires were collected. 7000 nephrologist	50% have an active self-care dialysis program and 20% were planning to start a self-dialysis program Important stakeholders could influence the implementation of self-dialysis. Stakeholders were healthcare and	Limitations include the representation of worldviews. North America and Asia were under represented in the study.	Level 3 qualitative study The quality of the study is good. The study revealed

			s were among the international survey The questionnaire was distributed over at 5 international meetings taking place in 2006	reimbursement, nurses and physicians, and patients and families. The strongest driver to choosing self-dialysis was increasing motivation for patient and families (50%).		patient motivation is the biggest driver to self-dialysis. The response rate to the questionnaire was >25%s

Appendix 2 Theoretical Model

Stage 1 Awareness and Identify

- Recognize the problem
- More than 90% of dialysis is given as in-clinic hemodialysis
- Clinical trial show positive clinical outcomes for home hemodialysis vs in-clinic hemodialysis
- Lack of utility of home hemodialysis
- Assess barriers of home hemodialysis from Nephrologists' perspective

Stage 2 Assess and Implement

- Review literature to help identify a validated qualitative questionnaire
- Assess the geographic regions that can be utilized for the survey (i.e., urban, suburban, rural
- Execute qualitative survey to Nephrologists to better understand their perspective on barriers and facilitators of home hemodialysis
- Perform statistical analysis of survey results
- Evaluate Nephrologists' feedback and compare results based on geographic regions

Stage 3 Acceptance and Integration

- Disseminate study findings to Nephrologists, patients, medical and hospital administration staff by providing/emailing a brochure highlighting study results
- Provide in-service of best practice guidelines to address the status quo
- Address the transition of dialysis treatment (i.e., finances, QoL, isolation)
- Integrate into daily practice to inform new ESRD patients and in-clinic ESRD patients of home hemodialysis
- Consider implementing continuing education or in-services at various clinical sites to improve utility of home hemodialysis

Adapted from: The change Curve model adapted from Kubler-Ross (1969)

Appendix 3 NDT-E Survey

GENERAL INFORMATION

Q1. Your region is:

a. Europe
b. Middle East
c. Asia
d. North America
e. Central and South America
f. Oceania
g. Africa

Q2. Your age is:

a. <35 yrs
b. 35-44 yrs
c. 45-54 yrs
d. 55-64 yrs
e. >65 yrs

Q3. Your main activity field is:

a. Clinical Nephrology
b. Dialysis
c. Transplantation
d. Research
e. Administration

Q4. The type of your centre is:

a. Academic department
b. Hospital
c. Free-standing dialysis unit
d. Other

Q5. What is your role in patient management?

a. Physician
b. Trainee
c. Nurse
d. Other

Q6. How many patients in your overall dialysis (PD + HD) program? ----------

Q7. How many patients do home haemodialysis in your organisation? .....

Q8a. In your program, who mainly discusses dialysis modality options with patients?

a. Myself
b. A dedicated education team
c. Other staff
d. All of above
e. None of above

Q8b. When is the choice of Home HD offered to your patients?

a. Routinely in CKD 4 & 5 clinics
b. Routinely in ESRD patients on haemodialysis
c. On patients requests only
d. At all above stages
e. Choice not offered/available to patients in my unit

Q9. What is the set up for providing home haemodialysis in your unit (patient pathway)? Tick all that apply

a. Presence of a clinical lead for Home HD
b. Patient pathway is well defined
c. Training policy/protocol exists
d. Have a support system for patients on HHD
e. None of the above

Q10. What is the set up for training home HD patients?

a. Training offered in my unit
b. Training offered to my patients through another unit
c. Do not offer home HD training to ESRD patients
d. Not sure or not applicable

Q11. Based on your current financial model, would the unit suffer financial disadvantage, if there were more patients who opted for HHD?

a. Yes
b. No
c. Not sure

Q12. Generally, in the organization you work in, is there a continual search for ways to improve operations and patient services?

a. Yes, new ideas are greeted with enthusiasm

b. No, there is generally a strong resistance to changing already established ways of doing things

c. No, rules and procedures limit scope for consideration of new possibilities

Q13. As regards your own practice, do you place patient's choice of modality above everything else, in the context of kidney replacement therapy?

a. Always

b. Sometimes

c. Never, as they are not knowledgeable

Q14. Do you try and persuade your patients to choose dialysis modality that offers best outcomes, even if they are nervous about trying it?

a. Never

b. Sometimes

c. Always

Q15. Do you believe that there is sufficient evidence in the current literature, in favor of longer or more frequent HD schedules, to offer it to your patients?

a. Yes

b. No

c. Not sure

Q16. Which hemodialysis modality do you believe offers the best overall patient outcomes, in any setting? Choose one

a. Frequent Nocturnal HD (5-6 nights per week)
b. Nocturnal HD (3-4 nights per week)
c. Short daily (2-3 hrs. 5-6 per week)
d. Alternate day HD (4hrs, 3-4 times per week)
e. Hemodiafiltration 3 times per week
f. Conventional standard HD (3 times per week)
g. Not sure

Q17. Where do you believe is the most suitable location to deliver more frequent or extended hemodialysis?

a. Patient's own home (self-managed)

b. Self- care / Minimal care community HD facilities

c. Hospital based dialysis facilities

d. Satellite HD community facilities

e. All of above

Q18. The benefits of HHD over in-center HD is/are mainly due to:

a. Improved patient quality of life and less travel

b. Improved biochemical control with fewer medications
c. Improved longevity
d. Patient empowerment
e. Lower treatment costs than in-center HD
f. All of the above
g. None of the above

Q19. Which alternative HD practice do you believe would combine the best patient outcomes with cost efficiency when compared to in-center conventional HD (3 per week)? [Note: cost-effectiveness = patient benefit + cost benefit]

a. Centre based HDF (x3 per week)
b. Centre based HD with extended schedules (>5hrs, >4 sessions per week)
c. Minimal care, community-based HD offering extended schedules
d. HHD (x3-4 per week)
e. HHD offering extended schedules (>5hrs, >4 sessions per week)
f. HDF offering extended schedules (>5hrs, >4 sessions per week)

Q20. Which of the following are the most important patient barriers to provision of Home Hemodialysis?

a. Patient complexity and comorbidity
b. Fear of self-cannulation
c. Fear of isolation and lack of support
d. Lack of space within patients' homes
e. All of the above
f. None of the above

Q21. What are the most important organizational barriers to expansion of services HHD services in your unit? Tick all that apply

a. Lack of clinical champion (physician/nurse) for HHD
b. Lack of expertise and availability of skilled nursing and technical staff
c. Lack of funding for home adaptation
d. Training set up costs are prohibitive
e. Lack of a training facility
f. Concerns that patient occupancy may fall in in-center dialysis units

Q22. In your opinion, what percentage of your total dialysis patients (PD + HD) could be treated by HHD? (Percentage = 100 X your expected number of patients who could be on HHD/total dialysis patients on (PD+HD)

a. 0-5 %
b. 5-10%
c. 10-20%

d. 20-30%
e. >30 %

Appendix 4 Background Screener

Is your practice located in Essex County of New Jersey?

Yes____ No____

What demographic is the majority of your patients located in?

Suburban ____ Urban____

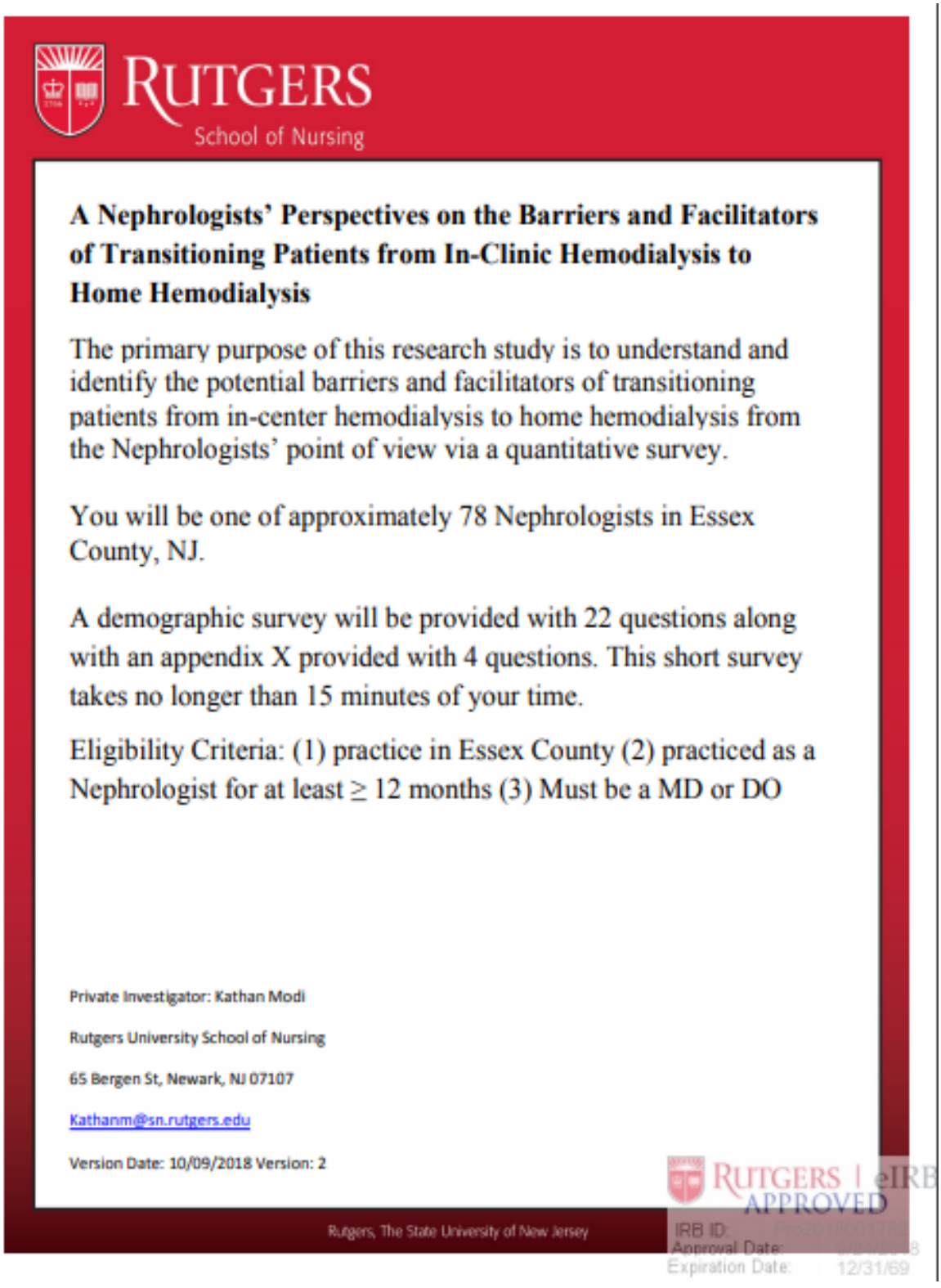
Are you a Board Certified Nephrologist?

Yes____ No_____

Have you practiced as a nephrologist for at least ≥ 12 months?

Yes_____ No_____

Appendix 5 Recruitment Flyer



RUTGERS
School of Nursing

A Nephrologists' Perspectives on the Barriers and Facilitators of Transitioning Patients from In-Clinic Hemodialysis to Home Hemodialysis

The primary purpose of this research study is to understand and identify the potential barriers and facilitators of transitioning patients from in-center hemodialysis to home hemodialysis from the Nephrologists' point of view via a quantitative survey.

You will be one of approximately 78 Nephrologists in Essex County, NJ.

A demographic survey will be provided with 22 questions along with an appendix X provided with 4 questions. This short survey takes no longer than 15 minutes of your time.

Eligibility Criteria: (1) practice in Essex County (2) practiced as a Nephrologist for at least ≥ 12 months (3) Must be a MD or DO

Private Investigator: Kathan Modi

Rutgers University School of Nursing

65 Bergen St, Newark, NJ 07107

Kathanm@sn.rutgers.edu

Version Date: 10/09/2018 Version: 2

Rutgers, The State University of New Jersey

Appendix 6 Consent Form

RUTGERS
School of Nursing

Consent

TITLE OF STUDY: Nephrologists' Perspectives on the Barriers and Facilitators of Transitioning Patients from In-Clinic Hemodialysis to Home Hemodialysis

Principle Investigator: Kathan Modi, BSN, RN

Hello, you are being asked to participate in a research study conducted by Kathan Modi, a DNP FNP- Primary Care student at Rutgers University.

Purpose Of The Study:

The primary purpose of this evidence-based practice project is to understand and identify the potential barriers and facilitators of transitioning patients from in-center hemodialysis to home hemodialysis from the Nephrologists' point of view via a quantitative survey.

You will be one of approximately 78 Nephrologists in Essex County, NJ.

What Will Be Done:

Once this consent is completed, a demographic survey will be provided with 22 questions along with an appendix X provided with 4 questions. The demographic survey is part of the NDT-E survey. Appendix has 4 additional question about practice location, board certification, and years of practice. This short survey takes no longer than 15 minutes of your time. All information will be coded to provide anonymity. Participation is voluntary. If you have any questions or concerns, please let me know. The only alternative to this study is not to participate.

Risk Or Discomforts:

There is no risk anticipated from taking part in this study. If you feel uncomfortable with a question, you can skip the question or withdraw from the study altogether. If you decide to quit at any time before you have finished the questionnaire, your answers will not be recorded.

Benefits Of This Study:

There is no direct benefit to you participating in this study. You will be contributing knowledge about home hemodialysis. After we finished the data collection, we will also provide you with more detailed information about the purposes of the study and the research findings (if applicable).

Confidentiality:

Your responses will be kept strictly confidential. The paper/digital data will be stored in secure computer and/or a hard copy will be stored in a locked filing cabinet after it is entered. The researcher will not see your individual survey responses and the results. We will not collect and personal identifying information about you and all answers will be confidential. Once the project is complete, the data will be destroyed according to Rutgers University policy.

Compensation:

There is no monetary compensation.

Withdrawal:

Participation is voluntary; you are free to withdraw your participation from this study at any time, you may turn in a blank survey. You also may choose to skip any questions that you do not wish to answer.

Application of results:

The results will be provided to Rutgers nursing faculty and administration in a presentation. The results might be published in an academic journal to further disseminate the information.

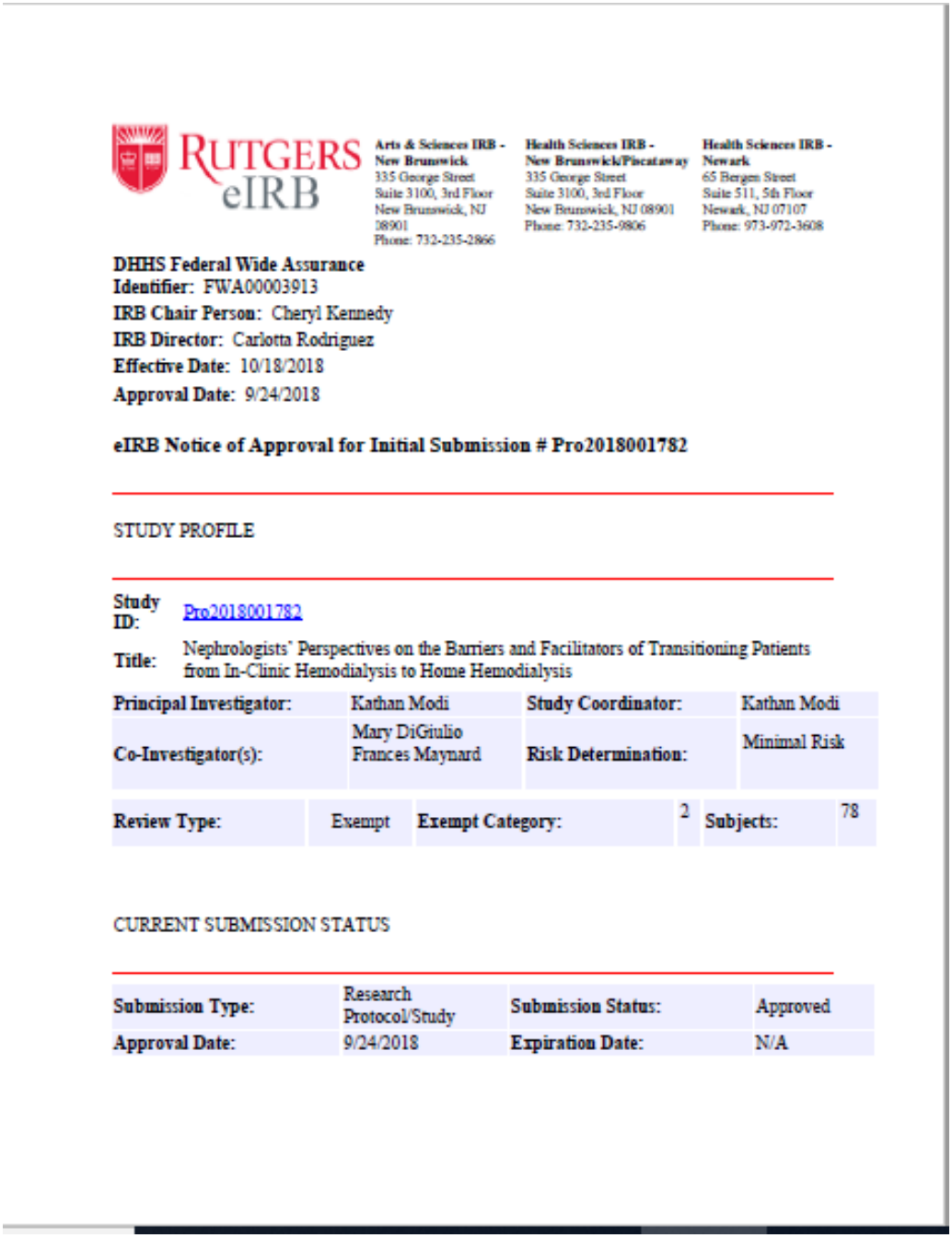
Contact Information:

If you have concerns or questions about the research study, please contact the Principal Investigator (PI) – Kathan Modi at kathanm@sn.rutgers.edu

If you have questions about your rights as a research subject, please contact the IRB Director at (973)-972-3608 Newark.

By beginning the survey, you acknowledge that you have read this information and agree to participate in this research, with the knowledge that you are free to withdraw your participation at any time without penalty.

Appendix 7 Rutgers University IRB Approval



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DHHS Federal Wide Assurance Identifier: FWA00003913
IRB Chair Person: Cheryl Kennedy
IRB Director: Carlotta Rodriguez
Effective Date: 10/18/2018
Approval Date: 9/24/2018

eIRB Notice of Approval for Initial Submission # Pro2018001782

STUDY PROFILE

Study ID: Pro2018001782

Title: Nephrologists' Perspectives on the Barriers and Facilitators of Transitioning Patients from In-Clinic Hemodialysis to Home Hemodialysis

Principal Investigator:	Kathan Modi	**Study Coordinator:**	Kathan Modi
Co-Investigator(s):	Mary DiGiulio Frances Maynard	**Risk Determination:**	Minimal Risk

Review Type:	Exempt	**Exempt Category:**	2	**Subjects:**	78

CURRENT SUBMISSION STATUS

Submission Type:	Research Protocol/Study	**Submission Status:**	Approved
Approval Date:	9/24/2018	**Expiration Date:**	N/A

Appendix 8 Timeline

Appendix 9 Budget

Item	**Budget**	**Actual Cost**
Printing of surveys, study recruitment flyers, and final results flyer	$250	$107.35
Fuel costs to various clinics	$150	$125.65
Total Cost	$400	$233