Managing Chronic Kidney Disease in Northern Manitoba: An Innovative Model of Care Using Telehealth and a Northern-Based Nurse Clinician

by

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A Thesis Submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirement of the degree of

MASTER OF SCIENCE

Department of Community Health Science

University of Manitoba

Winnipeg

ACKNOWLEDGMENTS

I would like to thank Dr. Sharon Bruce and Dr. James Zacharias for their support over the years. This has been a long journey. I would also like to thank Dr. Alan Katz and Ms. Jan Schneider for their participation on my committee. Thank-you Ms. Bonnie Grandbois. This is your project.

I started thinking about going back to school 8 years ago after working as a nurse with the Northern Medical Unit at the University of Manitoba. This work changed my life. Thank you Dr. Bruce Martin for encouraging me to pursue further studies.

To Christopher and Frances Bourque: thank-you for all the love and encouragement. You always believe in me even when I do not.

Thank-you Ken Van Ameyde and Lindy Lee; I am dedicating my thesis to you both. Lindy, 7 years ago I was so excited to tell you all of my stories and discuss everything I was learning. I think you would be proud of me now. Ken, you have spent countless hours answering my questions, guiding me away from terrible ideas and providing moral support. I look forward to the future when we can drink coffee without talking about my ongoing thesis.

Jennifer Kornelson—you are wonderful. Thank-you for being my compass and explaining things to me as I tried to navigate my way through graduate school without actually being on campus. You are brilliant.

I owe all of this to Ross MacDonald, Peter MacDonald and Daphne Macdonald. I've given so much time over the years to this project. Thank you for loving me.

ABSTRACT

Chronic kidney disease (CKD) and its care are not evenly distributed across Canada, and individuals living in rural and remote locations across the country do not receive the same quality of care that is available in larger urban centres. Increasingly, technology is being used to assist with provision of care for those with chronic conditions in remote regions of the country.

This study describes a pilot project that used Telehealth and a nurse clinician to provide care for individuals living with CKD in Northern Manitoba. Patients could visit the nurse close to their home community and link with specialty nephrology services in Winnipeg instead of travelling for CKD care.

Descriptive statistics were compiled for patient demographic variables, health status variables and clinical indicator variables. Clinical indicator variables were compared at baseline and after one year in the program. The numbers of adverse clinical outcomes and nursing interventions was also compiled. This study looked at N=117 patients who entered the program and received care from the nurse clinician in Northern Manitoba between March 2010, and March 2014. The mean age of study participants was 57.2 years. The proportion of individuals with diabetes was 70.1%. Those with diabetes were older and more likely to have advanced kidney disease than those without diabetes.

The results of this study indicate that this pilot project successfully provided care for a cohort of individuals who arguably need care closer to home. There are no obvious adverse outcomes such as death as a result of decreased travel to Winnipeg for nephrology care.

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CHAPTER ONE: INTRODUCTION

Summary

Chronic kidney Disease (CKD) is a complex illness that is responsible for considerable morbidity and mortality in Canada. Those living far from a nephrologist are more likely to experience adverse outcomes than their urban counterparts (Miller, et al., 2014; Bello, et al., 2012; Rucker et al., 2011). This may be partially due to the fact that care for those with kidney disease is complex and requires frequent contact with a team of specialized health care professionals who can provide both clinical care and education regarding the nature of the illness. To obtain this care, patients living in rural and remote communities in Canada have traditionally had to travel long distances at a high cost. Attempts have been made in recent years to develop different models of care that can accommodate patients with kidney disease and other chronic health conditions closer to their homes, and increasingly, Telehealth is being used in Canada to provide care to those with kidney disease living in remote areas. In Manitoba, a nurse-led clinic provides care for some individuals with CKD living in Thompson, Manitoba and surrounding First Nations communities.

Nurse-Led Telehealth Renal Health Clinic Project Description

Thompson is located 759 km north of Winnipeg, and travel to Winnipeg involves either an airplane, an 8-hour drive by car or a 10-hour bus ride. The city of nearly 13,000 people (Statistics Canada, 2012) is located in the province's Northern Health Region. More than two thirds of the population in the Northern Health Region self-identify as

Aboriginal, and half of residents live in First Nations communities (Northern Health Region, 2016).

The "Thompson Nurse-Led Telehealth Renal Health Clinic" was established as a pilot project to care for individuals 18 years and older with all stages of CKD living in Thompson Manitoba and surrounding communities (within a two-hour drive). The first patient was seen in March, 2010. A specially trained nurse clinician provides care, education and community outreach for individuals with CKD living in the catchment area. Telehealth is used to connect patients to their Winnipeg based nephrology team instead of requiring the usual time and travel to Winnipeg for renal care. Thompson was chosen because of its size and willingness to participate in the pilot project. The area also has a high burden of renal disease (Bernstein et al., 2010) and associated comorbidities such as diabetes. Some Winnipeg based nephrologists noted a cohort of northern patients (many of whom live in isolated FN communities) who were forced to travel to Winnipeg for CKD care. Due in part to travel, the nephrologists believed that "no show" rates in their clinics were high, and that there were associated complications and comorbidities related to inconsistent care.

Rationale

There is little research looking into models of care that use Telehealth to connect remotely located patients living with CKD with their heath care providers. A recent publication looking at Telehealth programs caring for individuals with chronic health conditions summarized systematic reviews and meta-analyses available in the literature. Twenty-four reviews were identified. Not a single one looked at CKD (Kitsou et al., 2013). Published literature on models of care that do involve both Telehealth and kidney

disease tend to focus on those already receiving renal replacement therapy (Jhaveri et al., 2015; Bernstein et al., 2010). To date, only one Canadian study has looked at the use of a nurse-led CKD clinic for those living in rural communities via Telehealth (Campbell et al., 2012). Campbell's study focuses mainly on patient satisfaction surveys. This thesis adds to a very small body of literature that combines the use of nurse-led clinics with Telehealth to care for those with CKD.

Purpose

This study looks at the Thompson Nurse-Led Telehealth Renal Health Clinic that uses Telehealth to connect with an interdisciplinary nephrology team in Winnipeg, Manitoba. The purpose of this study is to (1) describe project implementation and progression, including interventions provided and baseline patient health status, and (2) to examine quality of care and disease progression by comparing clinical indicators at the time of enrolment in the program and after one year, and to document adverse events that occur over one year.

Objectives

1. To describe a) program start-up and implementation, b) nursing interventions both qualitatively and quantitatively, and c) the distribution of demographic and health status variables (e.g. presence or absence of diabetes, obesity and smoking) for the study population;
2. To determine if there are any differences in clinical indicator variables (e.g. blood pressure, haemoglobin A1c) after one year in the program;
3. To determine if there are any differences between clinical indicator variables between patients with and without diabetes;

4. To calculate the change in eGFR and serum creatinine per patient per year to reflect “days at risk”;
5. To outline at the number of adverse events (e.g. deaths, initiation of hemodialysis without a mature AVF and number of hospitalizations); and
6. To look at the proportion of missed appointments before and after program implementation.

CHAPTER TWO: REVIEW OF THE LITERATURE

Chronic Kidney Disease

Chronic kidney disease (CKD) is defined by as "abnormalities of kidney structure or function for > 3 months, with implications for health" (KDIGO, 2013 p.5). CKD is a heterogeneous disease with numerous causes, presentations, and rates of progression and is believed to affect up to 12.5% of Canadian adults (Arora et al., 2013). CKD is often associated with other chronic conditions such as: hypertension (both a cause and outcome of the disease) and diabetes mellitus (Levin et al., 2008). In early stages of CKD, there are frequently no physical symptoms.

The kidneys are responsible for filtering blood and removing waste. As kidney function declines, excess fluid and waste accumulate in the body causing high blood pressure (or worsening pre-existing blood pressure), anemia, mineral bone disorder and increased risk of heart attack or other vascular diseases (Fink et al., 2012; Levin et al., 2008). Although CKD can progress to End Stage Kidney Disease (ESKD) requiring a form of Renal Replacement Therapy (RRT), most people with the condition will die from diabetic or cardiovascular complications prior to RRT initiation. The focus of caring for those with CKD should be to manage complications and prevent progression of kidney damage (Levin et al., 2008).

Glomerular Filtration Rate

Predicting an individual's trajectory from mild CKD to ESKD is complex. Typically, glomerular filtration rate (GFR), measured in mL/min/1.73m^2 is determined for those with CKD. This measure is then used to categorize a patient's kidney disease into one of five stages. As kidney function declines, so does GFR (Table 2.1).

Table 2.1: Stages of Chronic Kidney Disease

Stage	Description	GFR (mL/min/1.73m^2)
1	Kidney damage with normal or increased GFR	≥ 90
2	Kidney damage with mild decreased GFR	60-89
3	Moderately decreased GFR	30-59
4	Severely decreased GFR	15-29
5	Kidney Failure	<15 (or dialysis)

Adapted from (Levin, et al., 2008)

Determining GFR is not simple however. One method is to look at Creatinine clearance (CCr) which involves a 24-hour urine collection and a blood test. Creatinine is a byproduct of creatine derived from diet and skeletal muscle breakdown. Creatinine's levels in both blood and urine are used to obtain an estimated GFR. Problems with this method involve incomplete urine collection and accuracy (Levey et al, 1999). Over the years, different formulas that use blood tests alone have been used to estimate GFR (Cockcroft and Gault, 1976; Gates, 1985).

In 1999, a new model to calculate estimated glomerular filtration rate (eGFR) was developed. The ongoing Modification of Diet in Renal Disease (MDRD) Study was a controlled, multicenter trial that looked at protein restriction and blood pressure to control the progression of renal failure (Klahr et al., 1994; Peterson et al., 1995). Participants in the study group had GFR and a number of other blood and urine tests calculated, and the MDRD study results were then used to derive an equation for determining eGFR (Levey et al.,1999). The authors suggested using demographic (age and sex), and serum (creatinine, albumin and urea) levels to determine eGFR. The MDRD equation has since

been validated in a number of studies (Vervoort et al., 2002; Assay, 2004; Hallan et al., 2004) and in 2010, Diagnostic Services of Manitoba (DSM) began automatically reporting eGFR on all adult serum creatinine values ordered using the newer 4 variable MDRD equation (Levey et al., 2006). Determination of eGFR divides those with CKD into different groups based on severity of kidney decline; it does not predict who will progress to ESKD.

End Stage Kidney Disease

As previously stated, if kidney function declines to End Stage Kidney Disease (ESKD), a form of Renal Replacement Therapy (RRT) or palliative care must be selected. Choices of RRT available include hemodialysis, peritoneal dialysis and kidney transplant. In Canada, hemodialysis usually involves travel to a hospital or clinic three times or more per week to have one's blood filtered by a machine or dialyzer (Kidney Foundation of Canada). Ideally, the dialyzer attaches to a surgically created arteriovenous fistula (AVF) that allows vascular access. AVF creation involves the surgical anastamosis between a vein and an artery (usually in the forearm). It takes between 4 and 6 weeks to mature before it can be used for hemodialysis. When an AVF is not available, an external vascular catheter must be used to connect to the dialyzer. An AVF is an ideal route for hemodialysis as it is associated with fewer infections and hospitalizations, and a lower mortality rate (Weber and Djurdjev, 2009). Home hemodialysis is also an option but is infrequently used, requires much training and is not available in all areas of the country. There is however increasing interest in implementing home hemodialysis as a modality (Zacharias J. , 2017). In Canada, the annual cost of hemodialysis per patient per year is estimated to be between $95,000 and

$107,000 (Klarenbach et al., 2014). The cost of dialysis in isolated, remote communities has been estimated to be over $200,000 per year (Ferguson et al., 2015).

Peritoneal dialysis involves the instillation of dialysis fluid into the peritoneum—a vascular layer of tissue that lines the abdomen and its organs—via a surgically implanted catheter. Treatments are typically done at home and the fluid is exchanged three to six times per day or continuously overnight. It is less costly than hemodialysis, at approximately $56,000 per year (Klarenbach et al., 2014), and requires fewer dietary restrictions and medications .Peritoneal dialysis does however increase the chance of infection to the peritoneum and people must be physically and mentally able to perfrom their own dialysis (National Kidney Foundation, 2006)

Kidney transplant is considered the ideal treatment for ESKD (KDIGO, 2009). The two ways of obtaining a kidney transplant are from a live or recently deceased donor. Transplant allows one to live a more "normal" life than either peritoneal dialysis or hemodialysis.

Multidisciplinary Care Models

In order to prevent progression of kidney disease, and to prepare for potential ESKD if needed, Kidney Disease International Working Group's (KDIGO) 2013 guidelines suggest that those with progressive CKD should be managed in a multidisciplinary care setting with "access to dietary counselling, education and counselling about different RRT modalities, transplant option, vascular access surgery, and ethical, psychological and social care" (KDIGO p.115, 2013). The specifics of how to staff and run a multidisciplinary care setting however are vague.

A review of CKD models of care by Johns et al., in 2015 looked at the KDIGO guidelines and made note of the fact that there is no set definition of interdisciplinary care (IDC). The authors define IDC as "a coordinated, patient-centered approach that integrates separate disciplines to achieve common management goals" (Johns et al., 2015 p.1) and do not differentiate between IDC and multidisciplinary care. They go on to suggest that IDC should be patient-centered, provide meaningful CKD education and "improve morbidity and mortality" (Johns et al., 2015 p.3).

Early research into the topic was done by Binik et al., on psychoeducational interventions for individuals with CKD (1993). The authors noted that patients who received educational interventions that focused on kidney function, kidney disease, diet, renal replacement therapy and transplant options had delayed progression of CKD in a randomized controlled study (Binik et al., 1993). Binik's study looked at a group of patients from 1983-1988 who had deteriorating kidney function. Individuals in the study were randomly assigned to a control group that received standard nephrology care or an "enhanced education program" (Binik et al., 1993 p.373). Standard nephrology care at the time consisted of education from the nephrologist, written materials, and/or referral to a nurse clinician. The authors note that standard care provided likely varied greatly depending on the patient, hospital and care provider. The enhanced program "consisted of an individually administered slide-lecture presentation" (Binik et al., 1993 p.373) that covered kidney disease and its management. Patients were also provided with a booklet summarizing the presentation; the sessions lasted about 75 minutes and were administered by specially trained research assistant.

Multidisciplinary Care Models in Canada

Typically in Canada, care for those with declining kidney function is provided by a multidisciplinary team (Levin et al., 2014), with the goal to both delay progression of kidney disease and manage associated comorbidities. Blood and urine samples must be collected on a regular basis to monitor anemia, mineral metabolism, diabetes control (if present), and progression of renal failure. Medications targeting the renin/angiotensin system (eg. ACEI or ARB) and other anti-hypertensives are prescribed to delay progression of renal disease, and ideally blood pressure is kept below 130/80 mmHg (Levin et al., 2008). Patients typically receive education about kidney disease, dietary restrictions and lifestyle. If and when a patient is deemed to be close to ESKD, further education and care is provided in order to prepare for a form of RRT.

Canadian models of care for CKD vary across province and region (Levin, 2014). While most clinics offer multidisciplinary care, there is no national standard for the constitution of these clinics. Staffing ratios vary greatly and there is little evidence to show which model or models work best at slowing progression of renal failure and controlling potential comorbidities (Levin et al., 2014).

In light of these variations in care, some attempts have been made recently in Canada to study models of CKD care and clinical outcomes. One randomized pilot study looked at care for people living with stages 3 & 4 CKD. Participants for the study were identified in five different urban centres across Canada based on elevated serum creatinine levels. The family physicians caring for individuals with elevated creatinine were contacted and asked if they would refer their patient to the study. After referral to the study, all patients received regular care from their family physician and were assessed as part of the study every four months. During these assessments, participants had blood

drawn, and a physical health assessment was performed. A randomly assigned group of patients also received extra care after these assessments from a specially trained study nurse who worked closely with a nephrologist to provide individualized education and care supported by medical protocols and best practice guidelines. Participants who did not receive care from the study nurse were followed by their family physicians who were able to consult with speciality services if they thought it was necessary. The authors hypothesized that the care provided by the nurse would be superior to regular care from a family physician with occasional nephrologist consultation. No major differences were found between the control and treatment groups however (Barrett et al., 2011).

Another study done in Alberta found that patients age 66 and over with CKD stages IV-V showed a 50% reduction in risk of death during the study period when care was provided by multidisciplinary team versus those who received usual care from a nephrologist alone (Hemmelgarn et al., 2007). In the multidisciplinary clinics described in this study, education sessions are provided by a nurse clinician, a dietician, and a social worker. Topics addressed with the patients included causes, complications and progression of CKD, dietary restrictions, blood pressure monitoring, medications and lifestyle recommendations. Comparison was made with a matched cohort that was identified through a laboratory database. Referrals to multidisciplinary clinics were made by a nephrologist.

Kidney Disease Across Canada

Because Chronic Kidney Disease is often silent and goes undiagnosed or unreported, accurate estimates of prevalence are difficult to ascertain. The Canadian Institute for Health Information (CIHI) tracks ESKD in Canada via the Canadian Organ

Replacement Register (CORR). In 2014, the number of prevalent ESKD patients in Canada was 35,281 (Quebec excluded). This number includes both people who have previoulsy received a kidney transplant or who are currently receiving some form of RRT. The prevalence of individuals in the CORR registry went from 599 per 1,000,000 in 1995 to 1291 per 1,000,000 in 2014. Manitoba is consistently among the provinces with the highest prevalence of ESKD with 1627 individuals per million recorded in 2014. (Canadian Institute for Health Information, 2016).

As previously stated, the prevalence of CKD across Canada is estimated to be about 12.5%. This number is based on analysis of the Canadian Health Measures Survey by Statistics Canada that took place between 2007 and 2009. A multistage cluster sampling design was used in order to "represent 96.3% of the population" (Arora et al., 2013, p. 418). The study consisted of an in home questionnaire, and attendance at a mobile clinic at a later date where blood and urine were collected. Of the households surveyed, there was a 51.7% response rate. A limitation of the study was that residents of First Nations communities, crown lands, remote regions and members of the Canadian Armed Forces were not included .

In Manitoba, estimated prevalence of CKD in adults across the province was recently determined in a study that used both administrative and laboratory data to identify disease presence (Chartier et al., 2015). The authors noted that CKD prevalence for the province was 7.4% based on administrative data (two or more physician visits for CKD within a three year period, one CKD-related hospitalization, or the use of medication prescribed specifically for CKD), and 10% based on laboratory data that consisted of two or more eGFR values less than 60 ml/min/1.73m^2 at least three months

apart (Chartier et al., 2015). The authors speculate that both estimates are low since CKD often goes un-noticed in early stages, and physicians may not necessarily bill for a CKD related condition when there are numerous comorbidities related to one clinic or hospital visit (Chartier et al., 2015).

Prevalence estimates for CKD in this same study were significantly higher for northern and remote communities however. The age and sex adjusted prevalence of CKD in the Northern Health Region of Manitoba using laboratory data showed a prevalence of 15% compared to the provincial average of 10%. Remote communities (almost all remote communities were located in Manitoba's Northern Health Region) were noted to have a prevalence of 25% . This study defines remote as "communities in Northern Manitoba with limited access to a major health facility (only by plane, train or winter roads) and communities that have all-season roads but are sparsely populated and include First Nations populations" (Chartier et al., 2015 p.5).

CKD in First Nations Peoples

Prevalence of CKD in First Nations communities across Canada is not known. While the incidence of ESKD among FN is higher than the rest of Canada (Canadian Institute for Health Information, 2013), less is known about CKD prior to the need for RRT. However, "risk factors for CKD, such as diabetes and metabolic syndrome" are more prevalent among Indigenous people (Komenda et al., 2016), and some recent regional attempts have been made to look specifically at CKD in FN communities.

An Alberta study looked at presence of CKD among FN and non FN individulas. In total, 676,660 adults from six different regional health authorities in the province were included in a study that looked at outpatient serum creatinine levels drawn over one year.

The age and sex adjusted prevalence of CKD in this study was 67.5 per 1000 people for non-First Nations individuals in Alberta versus 59.5 among First Nations individuals. When CKD was broken down by stage however, First Nations individuals were more likely to have severe CKD (Stages 4 and 5). First Nations individuals in this study were also more likley to live in rural communities, and more likely to live in the live in poverty (Gao et al, 2007).

A few studies have been conducted in Manitoba in recent years that look at CKD or its precursors in First Nations communities. In 2012, a Manitoba based study reported on the presence of microalbuminuria in a First Nations community in Manitoba (Zacharias et al., 2012). Of the 1356 adults able to participate in the screening program from which the data was compiled, 483 community members were screened. Complete data was collected on 468 adults, and albuminuria was found in 20% of participants (15% microalbuminuria and 5% proteinuria). Notable findings from this study include a statistically significant increase risk of albuminuria in those that have any history of smoking, those with a higher body mass index, and those with poor blood pressure control. Also, 29% of the individuals who participated in this study had a diagnosis of diabetes (Zacharias et al., 2012).

In Manitoba, the Diabetes Integration Project and the Manitoba Renal Program collaborated to implement the First Nations Community Based Screening to Improve Kidney Health and Prevent Dialysis (FINISHED) project. After engaging with individual First Nations communities and meeting with stakeholders, 11 of Manitoba's 64 FN communities were selected for mass screening of CKD and its complications over 260 days in 2014 (Lavallee et al., 2015). In all, 1,346 adults were screened and 343

individuals were found to have CKD as defined by an elevated urine albumin creatinine ratio (UACR), or eGFR <60 ml/min/m2. The crude prevalence was 25.5% of study participants, but when broken down into communities, prevalence varied from 17.6% for First Nations residents with road access to Winnipeg and 34.4% without year round roads (residents rely on airplane to get in and out of the community except for a short period of time in the winter when ice roads connect them with the rest of the province). Along with increased prevalence of CKD, residents of fly-in communities without roads had statistically significantly higher UACR and were at higher risk of progressing to ESKD than those with road access.

CKD Care in Rural Canada

In Alberta, researchers with the Alberta Kidney Disease Network have conducted two extensive population based research studies on CKD epidemiology, quality of care, and geography. One study looked at 31 337 adults with both diabetes and CKD stage III-IV (eGFR between 15-59 mg/ml 1.73 m2) (Bello et al., 2012). The authors found that residents of Alberta living greater than 50 km from a nephrologist were less likely to visit a nephrologist, less likely to have the recommended tests performed on a regular basis and less likely to receive medications such as an angiotensin-converting enzyme (ACE) inhibitor or Statin. Use of medications like ACE inhibitors have been found to reduce the risk of progression of CKD (Fink et al., 2012). The same study also noted that rural residents had higher mortality than their urban counterparts (Bello et al., 2012).

Similar findings were noted in an observational study that looked at 31,452 adults age 18 and over living in Alberta with an estimated glomerular filtration rate (eGFR) less than 45 ml/min per 1.73m2. The authors found that those living greater than 50 km from

a nephrologist have higher morbidity and mortality rates than urban dwellers, are less likely to have recommended lab tests done on a regular basis (ie: hemoglobin A1c and urine albumin) and less likely to receive the recommended renal protective medications such as an ACE or ARB (Rucker et al., 2011). While those living far from a nephrologist and a multidisciplinary care clinic may have had access to primary care, the authors theorize that the difficulties accessing specialty CKD care by the nephrologist and team contribute to poorer care overall.

Interestingly, these findings are not necessarily consistent across the country. Although small, a recent study compared the quality of care for CKD patients with diabetes between Cree residents of the James Bay Region in Northwestern Quebec, and people living in Montreal. Despite hypothesizing that quality of care indicators would be inferior, no major differences were found. In fact, despite some demographic differences (Cree residents with both DM and CKD were younger and more likely to be obese), residents of the James Bay region were *more likely* to be prescribed an ACE or ARB than non-Cree residents of Montreal (Patapas et al., 2012). Healthcare services in the 9 James Bay Cree communities are governed by the Cree Board of Health and Social Services of James Bay (CBHSSJB). The CBHSSJB works closely with McGill University's Reseau Universitaire Integre du Sante (RUIS), a program that pairs isolated communities with one of four faculties of medicine in the province. The goal of RUIS is "to facilitate specialized care, medical education, and medical research throughout the province's many regions" (RUIS McGill, 2017). The results of this study may speak more about the care available in these select James Bay communities and should not be interpreted as

proof that First Nations individuals living in remote communities receive better care for CKD than their urban counterparts.

Another Canadian observational study looked at incident hemodialysis starts in Canada from 2000 to 2009. The authors noted that Canadians living >200 km from a dialysis centre had poorer hemoglobin and albumin levels, were less likely to receive pre-dialysis care and were more likley to start hemodialysis with a central venous catheter instead of a a mature arteriovenous fistula (Miller et al., 2014). A similar Canadian study looked at the percentage of hemodialysis patients starting with a centreal venous catheter (CVC), and further broke the numbers down to determine whether a tunneled or non-tunneled hemodialysis catheter (NTHC) was used (Clark et al., 2016). It found that patients with a NTHC were more likely to live further away from a dialysis centre than those who start with a tunneled catheter. Non-tunneled hemodialysis catheter (NTHC) use is considered the least ideal option for vascular access and is associated with the more complications than tunneled catheters (Vats, 2012).

Kidney disease is a complex illness that affects a considerable number of Canadians. Recommendations for care suggest multidisciplinary clinics with a focus on education in hopes of delaying progreession of CKD. Unfortunately, neither kidney disease distribution, nor its care are evenly spread across the country. First Nations peoples are known to have more risk factors for developing CKD than non-FN individuals (Komenda et al., 2016), they tend to develop CKD at a younger age, and progress to more severe stages of CKD than non-FN individuals (Gao et al., 2007). FN peoples are certainly over-represented in ESKD prevalence (Canadian Institute for Health Information, 2013). First Nations individuals also frequently live in rural and remote

areas of Canada where access to care for CKD can be limited, and the same standard of care enjoyed in urban centres is not always received.

Attempts to Reduce Inequities

In order to reduce some of the disparities seen in kidney disease (both chronic and end-stage), a number of attempts have been made to develop care models that accommodate remotely located patients closer to home. One Canadian pilot study looked at patients in Toronto who chose to dialzye at home instead of at a hospital or dialysis centre (Schachter et al, 2014). Eligibility for the study included those already performing home dialysis (either PD or HD) who were recently discharged from hospital, underwent a medical procedure, were treated with antibiotics or had recently completed home dialysis training. Patients received a phone call one to three times per week from a physician or nurse. A standardized assessment tool was used to guide the conversation that covered the purpose of the phone call and study, reviewed the individual's dialysis prescription, patient history, medications, and current symptoms. The goal of the pilot project was to enhance care and fill any gaps that may be missed since those who choose home hemodialysis do not have the same "access" to the nephrology team that hospital based hemodialysis patients do (Schachter et al., 2014). Findings from the pilot study of 35 individuals showed that such a model of care is both practical and feasible, and that "a larger multi-center prospective clinical trial is justified to identify if (such a model) can prevent adverse events among home dialysis patients" (Raphael et al., 2015, p.7).

Other stragegies specifically focus on First Nationspeople. As previoulsy mentioned, in Manitoba, members of the Diabetes Integration Project (DIP), and the Manitoba Renal Program collaborated to screen members of 11 First Nations

communities for CKD using point of care testing and Indigenous health care professionals (Lavallee et al., 2015; Komenda et al., 2016). After screening, treatment recommendations (if warranted) were sent to the primary care provider responsible for the individual. Referrals to nephrology were initiated by the team based on pre existing algorithms that calculated the risk of kidney failure within the next 5 years. (Lavallee et al., 2015; Komenda et al., 2016).

While the mass screening program is complete, the DIP team continues to provide care to individuals with Diabetes living in select FN communities. The DIP operates as "a mobile diabetes screening program that uses specially trained nurses for "finger stick" blood testing of patients for hemoglobin A1c, lipids (total cholesterol, HDL cholesterol, triglycerides and calculated LDL cholesterol),glucose and the testing of urine for the determination of the microalbumin:creatinine ratio" (First Nations Health and Social Secretariat of Manitoba, 2017). If individuals are noted to have CKD, or be at risk for CKD, primary care providers are notified (if they exist) and referrals are still made to nephrologists in Winnipeg if necessary.

Satellite-centre based hemodialysis is provided in many remote communities that do not have access to nephrology services. Treatments are administered by local nurses and physicians with support from nephrology services in larger cities. Communication between remote dialysis units and larger centres takes place via telephone (Bernstein et al., 2010) or Telehealth (Sicotte et al., 2011). Many of the communities that offer remote hemodialysis offer this care directly in FN communities, or for a large proportion of FN patients.

Telehealth consists of a "high speed, secure video link" that connects patients and care providers. Patients can access a variety of services including specialist care for chronic diseases without the previously required travel (MBtelehealth, 2014). Individuals at both ends of the videoconference can see and speak with each other. Telehealth is used extensively in Manitoba and across Canada to connect those who live far from a specific health care service to services in an urban centre. The technology is also used to connect rural health-care professionals with education opportunities not available in their home communities.

While most of the research using Telehealth and kidney disease focuses on ESKD, one small Canadian study has attempted to look at its use for CKD. The program links a remotely located nurse and patient with nephrology services in Ottawa, Ontario. The nurse assesses the patient prior to the telehealth appointment. Clinical outcomes have not yet been examined, but the study did report that both physicians and patients are supportive of the use of telemedicine instead of travelling long distances to see a nephrologist for ongoing care (Campbell et al., 2012).

Summary

Chronic kidney disease is a growing problem both across the world and within Canada. Care for those with CKD is complex, and should involve a multidisciplinary team of health care providers in order to delay progression of the illness and manage associated comorbidities.

There is evidence that within Canada, those who live far from a multidisciplinary nephrology clinic do not enjoy the same quality of health care as those living in urban centres. More than one large scale, population based study has shown that individuals

with CKD who live in remote regions of the country are be less likely to receive recommended laboratory tests on a regular basis, less likely to receive a referral to a nephrologist, and less likely to receive medications that have been shown to delay progression of CKD. Remotely located Canadians who initiate hemodialysis are also more likely to start treatments with the use of a CVC instead of an AVF.

In Manitoba, there are large discrepancies in prevalence of CKD between urban and remote regions of the province. First Nations peoples in Canada are known to have a higher incidence of ESKD than non First Nations, and in northern Manitoba, FN individuals make up more than two-thirds of the population.

Increasingly, health care administrators and policy makers have been looking at using technology to assist with the delivery of good quality care for those living far from medical specialists. The use of Telehealth now allows patients to access care from a team of health care providers much closer to their own home. This study builds on existing literature about CKD inequities in Canada.

CHAPTER THREE: METHODS

Design

This is a mixed methods study consisting of 1) a retrospective secondary analysis of Manitoba Renal Program CKD Pilot Project data, and 2) an interview with the nurse from the pilot project to add context to the data. Specifically, the nurse was asked to elaborate on program implementation and patient data. The interview with the nurse clinician took place after the collection and analysis of administrative and patient related data.

One hundred seventeen (n=117) patients were seen by the nurse clinician for care in Thompson between March 2010 and March 2014. Eligible patients were referred to the program by renal clinic nursing staff at the Health Sciences Centre in Winnipeg. All participants lived in Thompson, Manitoba or surrounding communities and were over the age of 18 years.

Program Description

The process of planning and implementation of the Thompson pilot project was described using existing administrative documents. These documents consist of working group meeting minutes, policies and procedures, clinic and nursing processes, financial statements, and project charters made between the Project Management Office, the Winnipeg Regional Health Authority, and the Manitoba Renal Program. All administrative documents are stored at the Health Sciences Centre in the office of Dr. James Zacharias. If details were unclear regarding certain steps involved in any clinic or nursing process, the nurse clinician and developers of the Telehealth program (specifically Dr. James Zacharias) were contacted to clarify as needed. Patient level

information was not involved with this portion of the study. Program implementation, educational interventions, assessments, and referrals delivered by the nurse clinician are described.

Patient Characteristics and Outcomes

Descriptive patient related quantitative data for this study were generated from two separate sources of data. Most data came from a "multiuse rolling record form" (Appendix A) that is kept and updated regularly by the nurse clinician in Thompson, Manitoba. Patient data are entered into the rolling record as soon as he or she is referred to the Thompson Telehealth project. Patient referrals typically occur in Winnipeg at the HSC Renal Clinic. This referral date is referred to as "baseline" in Table 3.1. A copy of the rolling record is kept in both Thompson and in Winnipeg.

Patient charts kept in the Renal Health Clinic at Health Sciences Centre were also used as sources of data for this study The HSC charts include more information than the "rolling record", and detailed patient histories can be found here. A mirrored copy of the HSC Renal Clinic chart also exists in Thompson for use by the nurse clinician.

Demographic variables collected from the rolling record for analysis include date of birth, sex (male or female) and the date of a patient's 1st appointment at the HSC Renal Health Clinic in Winnipeg, and at the Thompson Telehealth program.[1]

Health status variables were collected via chart review (charts were reviewed from the baseline patient visit at HSC in Winnipeg), and include presence or absence of diabetes (based on a diagnosis in the patient's chart), body mass index (BMI) measured as kg/m^2, smoking (based on documentation of smoking status as noted in a patient's

[1] Table 3.1 found below lists all variables collected in this study

chart), and CKD stage at time of initial telehealth visit. Diabetes status was documented as either yes or no. If a patient was not diagnosed as having diabetes but he or she had a documented hemoglobin A1c of 6.5% or greater, the patient was listed as having diabetes. The Canadian Diabetes Association considers an A1c of 6.5% or greater to be diagnostic for diabetes (Canadian Diabetes Association, 2016). Smoking was documented as never, current or previous. Patients were listed as having CKD in stages I-V.

Clinical indicator variables were also collected in this study. Variables included were hemoglobin A1c (%), serum creatinine (μmol/L), estimated glomerular filtration rate (eGFR in mL/min/1.73m^2), and systolic blood pressure and diastolic blood pressure (both measured in mmHg).

The first three clinical indicator variables (hemoglobin $A1_c$, serum creatinine and eGFR) were collected via routine blood work prior to each appointment at either the HSC Renal Health Clinic or with the nurse clinician in Thompson. A number of eGFR values were missing from the rolling record. Missing eGFR values are likley due to the fact that Diagnostic Services of Manitoba (DSM) only initiated automatic eGFR calculation and reporting in October 2010. Prior to this, it was common for only serum creatinine values to exist in a patient's chart. This study follows individuals from March 2010 until March 2014. Missing eGFR values were calculated using the four variable Modification of Diet in Renal Disease (MDRD) equation (Levey et al., 2006) that is also used by DSM. It requires a patient's age, sex, race and serum creatinine to determine.

A patient's blood pressure was taken by a nurse in Winnipeg or by the nurse clinician in Thompson as part of the patient assessment. Two blood pressures are taken

using an automated blood pressure cuff after the patient has been resting for about 5 minutes. The average of the two blood pressure values is then recorded. The processes and type of equipment used for obtaining blood pressure measurement are the same in both Thompson and in Winnipeg (Baldwin, 2016).

Adverse outcomes and history of missed appointments were also recorded as part of this study. Adverse events included were: deaths, hospital admissions, and hemodialysis initiation without a mature arteriovenous fistula. A patient's history of missed visits or "no shows" was documented as part of his or her ongoing care as a patient of the Health Sciences Centre Renal Clinic and as a patient in the telehealth program. The number of missed appointments was accounted for over the course of his or her first year participating in the telehealth program.

Care delivery was examined by the number of nurse initiated referrals (e.g. diabetes educator, retinal screening, foot care and social work) along with referrals to vascular surgery and for peritoneal dialysis.

Table 3.1: Measures used in analysis

Type of Data	Data Source	Time of Data Collection
Demographic • **Sex (M/F)** • **DOB (DD/MM/YYYY)** • **Date of 1st visit to RHC (DD/MM/YYYY)** • **Date of 1st referral to Thompson Pilot Project (DD/MM/YYYY)**	Rolling Record	Baseline
Health Status Variables • **Diabetes (yes/no)** • **Smoking (yes/no/history of)** • **BMI (kg/m^2)** • **CKD Stage (Stages I-V)**	Rolling Record & Chart Review	Baseline
Clinical Indicator Variables • **Haemoglobin $A1_c$ (%)** • **Serum Creatinine (µmol/L)** • **eGFR ($mL/min/1.73m^2$)** • **Systolic Blood Pressure (mmHg)** • **Diastolic Blood Pressure (mmHg)**	Rolling Record	Baseline & 1 year
Adverse Outcomes • **Deaths** • **Emergent Hemodialysis** • **Hospital Admissions**	Rolling Record	Over the course of 1 year
Referrals • **Nurse Initiated Referrals** • **Peritoneal Dialysis Referrals** • **Vascular Referrals**	Rolling Record	Over the course of 1 year

Statistical Analysis

Demographic and health status variables were calculated as means (e.g. age) or proportions (e.g. gender). Clinical indicator variables are provided as means with standard deviation, or medians with ranges. The proportion of patients who achieved blood pressure target levels of < 130 mmHg systolic and <80 mmHg diastolic at baseline and after one year was also calculated. The change in a patient's serum creatinine and eGFR was calculated from the time of the first visit to the one year follow-up visit. Very few follow up visits occurred exactly one year after the first however, so the change in creatinine and eGFR was then calculated per 365 days (one year) to reflect "days at risk". Descriptive statistics were generated for the changes in serum Creatinine and eGFR (mean and standard deviation).

Differences in clinical indicators from baseline to 1-year in the program were compared by either chi-square, t-tests or paired t-tests to look at change in systolic blood pressure, diastolic blood pressure, serum creatinine and eGFR. The change in A1c values for patients with diabetes was not calculated because baseline A1c values were missing for many of the participants. Nephrologists tend not to order this as routine bloodwork, and diabetes control is usually monitored by a primary care provider. The nurse clinician was responsible for ordering A1c values on patients at follow up because the values were needed for referral to a local diabetes educator.

Independent samples t-tests or chi-square tests were then performed to look for differences in demographic, health status and clinical indicator variables between patients with and without diabetes at baseline and after one year.

Adverse outcomes and the number of nursing, peritoneal and dialysis referrals were presented as numbers in a table.

Finally, the number of missed appointments was counted before and after initiation of telehealth visits in Thompson. The HSC Renal Clinic has records of a patient's attended and missed appointments. This history is included in the telehealth rolling record. After a patient's referral or baseline visit in Winnipeg, visits to the nurse clinician in Thompson were counted. Any missed appointments were documented and added to the rolling record. All patient visits were counted (including patients who initiated hemodialysis or were transferred to another renal team to start peritoneal dialysis prior to the end of one year). No statistical tests were done to compare the number of missed appointments prior to and after referral to the nurse clinician in Thompson. This decision was made because the history of "no shows" recorded for the HSC Renal Clinic always reflect a physician visit (with or without participation of the allied health team) and the length of time a patient was followed varied substantially before he or she was referred to the nurse-led clinic in Thompson. The Thompson "no show" numbers reflect missed appointments with the Nephrologist via Telehealth and nurse only visits that were for follow up without Teleheatlh. The numbers can therefore not be compared.

Ethical Considerations

This study was a retrospective analysis of an existing dataset and no interventions were administered to the study population. All potentially identifying information was kept in a locked secure room at Health Sciences Centre. De-identified data was collected for the purposes of this study and kept on a password-protected computer. This study received ethics approval from the University of Manitoba Health Research Ethics Board (HREB) (Appendix B).

CHAPTER FOUR: RESULTS

Program Start-Up

In 2007, Manitoba Health and the Manitoba Renal Program chose to develop renal health outreach programs in rural/remote areas of the province. A proposal for nurse-run clinics associated with remote dialysis centres was put forward with the idea that a nurse trained in dialysis could run a clinic with local physician support if needed, and specialist nephrology involvement from Winnipeg. The reason for the development of this model of care was to address the growing prevalence of CKD and lack of renal services in rural and remote areas of the province. In early 2010, the Manitoba Renal Program partnered with the Winnipeg Regional Health Authority, and the Burntwood Regional Health Authority (now the Northern Health Region) to initiate the first such clinic out of Thompson Manitoba (Manitoba Renal Program, 2011)[2].

The Health Sciences Centre Renal Health Program began the nurse-led Telehealth program with support from the the Project Management Office (PMO) at the Winnipeg Regional Health Authority (WHRA). Four stages for the development of the pilot project were identified: 1) Discovery, 2) Design, 3) Implementation and 4) Evaluation.
The discovery portion of the project involved travel to Thompson, and connecting with community stakeholders (specifically First Nations communities, the Northern Patient Transport Program, First Nations and Inuit Health) in order to identify and define the project catchment area. Research into similar models was also conducted. A Renal Health Clinic Model Working Group was established and an initial patient list was

[2] Unless otherwise specified, all information in Program Start-up section comes from Manitoba Renal Program administrative data from 2011

developed. Potential problems with the model of care were identified during the discovery phase and revisions to the model proposal were made as needed.

During the design phase of the project, metrics were created for a "Plan, Do, Study, Act" PDSA cycle and one patient was seen. Both patient and staff satisfaction surveys were conducted. Standard operating procedures and orientation packages were developed for the nurse clinician and his or her support clerk in Thompson. A two-week orientation and training program took place in Winnipeg for the Thompson based nurse clinician. Performance metrics were further developed and the nurse received training.

The Implementation phase of the project involved hiring the nurse clinician and the necessary orientation and training needed for the job. The nurse travelled to Winnipeg. Staff were trained to use Telehealth's video conferencing equipment, and the HSC Renal Clinic's "I-Scheduler program". Resources were identified for future support of the program, referrals systems were developed for new clients (patients were identified by HSC Renal Clinic nursing staff based on residence in catchment area) and the project was implemented. Portions of the four stages for development for the pilot project overlapped. For example, the nurse clinician was hired prior to program implementation (Personal Communication, (Grandbois, 2017).

The evaluation phase of the project is ongoing and includes this thesis.

Clinic Process

Processes for the nurse-led clinic in Thompson were based on the HSC Renal Clinic model. At the HSC Renal Clinic in Winnipeg, after a patient is seen by the nephrologist, he or she indicates when follow up should occur. An appointment is scheduled prior to the patient leaving the clinic and laboratory requisitions are given to

the patient (he or she is instructed to have labs drawn two weeks prior to the next appt). At HSC, a volunteer calls all patients a few days prior to their scheduled appointment to confirm attendance. Travel to Winnipeg is arranged by either the patient, the Northern Patient Transport Program (NPTP) or by Non-Insured Health Benefits (NIHB) for First Nations patients who are registered as "Status Indians" with the Government of Canada. The NPTP is accessible to residents living north of the 53rd parallel on the west side of Lake Winnipeg, or north of the 51st parallel on the east side of Lake Winnipeg. A travel subsidy funded by Manitoba Health, Seniors and Active Living is available for those who qualify. Manitoba residents with other potential sources of medical travel coverage do not quality for this subsidy (Manitoba Health, Seniors and Active Living). For example, First Nations individuals living on reserve lands have their travel costs covered by NIHB (Health Canada, 2016).

When a patient arrives at the HSC Renal Clinic, he or she is seated in a clinic room and asked to sit quietly. After resting for 5 minutes, a nurse will take the patient's blood pressure and document the results in the patient's chart. Medications are then reviewed by either a nurse or pharmacist, a physical assessment is done by the nurse and other disciplines will visit the patient as deemed necessary (ie: social work, dietician). Finally, the nephrologist comes in to see and assess the patient. Follow-up teaching is then done by interdisciplinary staff if necessary.

After the clinic visit, a patient can be referred to the nurse clinician in Thompson for follow-up if he or she lives in the catchment area, and if Telehealth is considered appropriate. The physician may want to see the patient in Winnipeg due to severity of illness; the patient can also refuse to follow up via Telehealth. If the patient is deemed

eligible and consents to the program, a follow-up appointment is then scheduled and the necessary rooms and equipment are booked for future use. The nephrologist in Winnipeg along with the patient will decide when the next appointment in Winnipeg must take place. Until the next Winnipeg appointment, follow-up visits can take place in Thompson with the nurse-clinician. When the visit is scheduled, the clerk in Winnipeg specifies what is needed on the Clinical Booking Form (CBF) (Appendix C). Items may include a stethoscope, camera or dressing tray. Pre-clinic bloodwork and urine are also specified by the nephrologist at this time.

The patient in Thompson, Manitoba does not receive a telephone call from a volunteer reminding him or her of the appointment a few days prior. This is done directly by the nurse clinician in Thompson. Two weeks prior to a patient's booked appointment, the patient goes to a laboratory to have blood and urine samples drawn. One week later, if the results are not yet back, the nurse calls the patient again as a second reminder. (Grandbois, 2017)

On the day of the Telehealth visit, individuals will arrive one hour prior to their scheduled appointment and register at Thompson Hospital. The nurse clinician then sees and assesses the patient, and fills out the Interdisciplinary Renal Health Clinic Record (Appendix D). This form is faxed to the HSC Renal Clinic prior to the Telehealth portion of the patient visit. The patient is then seen by the nephrologist and/or allied helath providers at the HSC Renal clinic. Clinic documentation in Winnipeg occurs in a patient's paper chart as it would normally, and a copy of the clinic notes is faxed to the nurse clinician for the patient's "shadow chart" in Thompson.

Role of the Renal Nurse Clinician

There are a number of duties that are unique to the Thompson Renal Health Outreach nurse that differentiates her from standard nursing clinic roles in Winnipeg. During a telephone discussion with the nurse clinician in the role during the study period, a number of questions were asked in order to clarify questions that arose during data analysis and review of program docments. This interview took place in February, 2017 and is the sole source of information in this section (Grandbois, 2017).

The nurse did not frequently communicate directly with a patient's primary care provider. Communication with an individual's primary care provider continued as it previoulsy had, through the nephrology specialist. The referring clinician from Thompson or surrounding area would receive a follow-up letter with suggestions from the nephrologist after each appointment. The nurse did on occasion receive direct phone calls from patients asking for her assistance with issues that did not need the services of their nephrologist . For example, a patient might call complaining of symptoms of a urinary tract infection (UTI). Treating a UTI is beyond the scope of practice of the nurse clinician, but in this situation, the nurse would call the primary care provider or nursing station and speak with somebody who could assess and treat the condition if necessary. In situations such as these, the primary care provider usually notified the nurse clinician of the patient's course of treatment. The nurse would occasionally call the attending Nephrologist in Winnipeg for assistance in the matter if the medication prescribed was contraindicated based on a patient's renal function.

The nurse clinician also followed closely patients with elevated blood pressure. For example, when a patient presented to clinic for a telehealth appointment, at times his

or her blood pressure would be elevated. Repeat appointments would be booked to visit the nurse alone without the use of Telehealth. Blood pressure would be monitored over a period of time and if it remained elevated, the nurse clinician would speak with the patient's Nephrologist in Winnipeg, and a decision would be made to titrate blood pressure medications to better control blood pressure. At times, when patients lived a few hours away in a First Nations community, the nurse clinician would ask the staff at the nursing station to repeat a patient's blood pressure a few times over the course of one week. According to the nurse however this "did not go well" and results were seldom faxed back to Thompson for the nurse to review and intervene as necessary.

Not all visits were recorded. Sometimes patients would drop by and chat informally. No physical assessment took place and since no appointnment was booked, these "check-in" visits were never entered into the rolling record.

The nurse also engaged in renal health outreach activities in the community and at times in remote First Nations communities. Over the course of the study period, the nurse clinician visited Wabowden and Cross Lake First Nation (during the Cross Lake renal health outreach visit, a couple of patient visits were also incorporated into the trip and Telehealth was used from Cross Lake to connect with a nephrologist at HSC in Winnipeg. This only happened a few times however, and appointments almost always took place in at Thompson General Hospital).

The nurse originally received all educational materials for teaching the Thompson patients about kidney disease and dialysis modalities from Winnipeg's Renal Clinic. After a short period of time however, the nurse used the educational materials as a

guideline and adapted educational interventions to the patient and his or her needs and interests.

Nursing Interventions : Referrals

The nurse initiated many referrals, the majority of which were for diabetes education. These referrals did not require physician involvement and were done independently by the nurse (Table 4.1).

Table 4.1 Nurse Initiated Referrals For Individuals During First Year in Telehealth Program

Referrals	Number
Diabetes Education	52
Foot Care Nurse	2
Social Work	1
Dietician	2
RetinalScreening or Optometry	2
Emergency	1

Referrals made between March 2010 and March 2014

Referrals for diabetes education were initiated for all individuals with diabetes. Some patients had already been referred to the local diabetes educator however, and the number of referrals for this service is less than the number of patients with diabetes in the dataset. After the first clinic visit, the nurse clinician in Thompson would call the diabetes educator to determine if the patient was already being followed. If not, the nurse clinician would fax the referral form with recent lab work included to the diabetes educator and follow up would be arranged (Appendix E).

Referrals for foot care, retinal screening and dietician services in Thompson were usually made by the diabetes educator instead of the nurse clinician, and referrals for foot

care and retinal screening recorded in this dataset were for special services available in a northern First Nations community provided by the University of Manitoba.

When a referral to either vascular surgery or peritoneal dialysis was suggested by the nephrologist in Winnipeg, he or she was responsible for writing the consult to the receiving specialist. The nurse clinician in Thompson would ensure that the necessary tests and labs were collected and faxed as requested for the referral. For example, when referring to vascular surgery for fistula creation, it is expected that an EKG, recent bloodwork, chest x-ray and case summary be faxed into the receiving vascular surgeon. This was all taken care of in Thompson without any extra trips to Winnipeg for the patient (Grandbois, 2017).

Demographic and Health Status Variables

From March 2010 until March 2014, 117 patients received care from the renal nurse clinician in Thompson, Manitoba. The demographic and health status variables of the group are presented in table 4.2. The group consists of 70 men (59.8%) and 47 women (40.2%). Date of birth was available for 115 of the 117 patients and ages ranged from 18 years old to 80 years at the time of enrollement in the Telehealth program (mean 57.2 years; SD ±13.79 years). Eighty-two of the participants had diabetes (70.1%). Diabetes status was not available for one individual in this study. The length of time each person had been a patient of the Renal Health Clinic at Health Sciences Centre varied considerably from no prior involvement to 15.2 years and was not normally distributed (median 3.2 years; IQR 1.2-5.4 years). The first referrals to the nurse clinician in Thompson were for longstanding patients, but as the program progressed and expanded, participants were referred immediately after their first visit to a Nephrologist

in Winnipeg. Thirty-one (26.5%) of the patients were referred to the Thompson Telehealth program at the time of their first visit to the HSC renal clinic. There is no "first date" appointment for one of the 117 patients because this one person never attended an appointment at the HSC Renal Clinic. This participant's involvement with the nurse clinician in Thompson occurred after a brief hospitalization at the Thompson General Hospital. The participant saw the nurse clinican a few times for education and a referral to the peritoneal dialysis program at another hospital was arranged (Grandbois, 2017).

Thirty-three of 117 patients were current smokers (28.2%), 29 (24.8%) had a recorded history of smoking but did not currently smoke, and 38 (32.5%) patients did not smoke. Documentation of smoking history was missing for 17 (14.5%) patients. Body mass index was available for 104 of 117 patients with an average BMI of 33.47 kg/m^2 (SD ±7.575; Range 17.6-64.2 kg/m^2), and was normally distributed. The average BMI for men was 33.95 kg/m^2 while the average BMI for women was 32.8 kg/m^2. There differences in BMI between the sexes was not statistically significant. Seventy-three patients (62.4%) had a recorded BMI greater than 30 mg/kg^2. Patients in the program were being followed for all stages of chronic kidney disease. Eighty-five patients (72.6%) had CKD stages III-V.

Table 4.2: Demographic and Health Status Variables at Baseline
(Collected from March 2010-March 2014)

Variable	Categories	Measure	Value
Gender N=117	Male	Number (%)	70 (59.8)
	Female	Number (%)	47 (40.2)
Age N=115		Mean (±SD)	57.2 (±13.79)
		Median (Range)	60 (18-80)
Years in Program N=85*		Mean (±SD)	3.34 (±2.63)
		Median (Range)	3.19 (.08-15.19)
		IQR	(1.3-5.6)
Diabetes N=116	Yes	Number (%)	82 (70.1)
	No	Number (%)	34 (29.1)
Smoking Status N=117	Current	Number (%)	33 (28.2)
	Never	Number (%)	38 (32.5)
	Previous	Number (%)	29 (24.8)
	Not Available	Number (%)	17 (14.5)
BMI N=104	Both sexes	Mean (±SD)	33.5 (±7.6)
		Median (Range)	33.5 (17.6-64.2)
	Male N=61	Mean (±SD)	34.0 (±6.9)
		Median (Range)	33.7 (18.3-52.3)
	Female N=43	Mean (±SD)	32.8 (±8.4)
		Median (Range)	32.3 (17.6-64.2)
CKD Stage N=117	Stage I	Number (%)	24 (20.5)
	Stage II	Number (%)	8 (6.8)
	Stage III	Number (%)	46 (39.3)
	Stage IV	Number (%)	29 (24.8)
	Stage V	Number (%)	10 (8.5)

*Patients that were referred to the Telehealth program without previous HSC Renal Clinic involvement were excluded

Clinical Indicator Variables

Blood pressure was recorded for 113 of 117 patients during their baseline Telehealth visit. Mean systolic blood pressure at baseline was 132.95mmHg (SD ± 21.82mmHg, range 63mmHg-195mmHg. Just over 42% of individuals had a systolic blood pressure < 130 mmHg at baseline. Mean diastolic blood pressure at baseline was 74.21mmHg (SD ±11.11 mmHg; range 53mmHg-105mmHg). The proportion of individuals with a diastolic blood pressure < 80 mmHg at baseline was 70.8% Distribution of both systolic and diastolic blood pressure at baseline was normal. Glycated hemoglobin level was available for 29 patients at baseline. Six of the patients with available A1c values did not have diabetes. Of the 23 patients with diabetes that had a recorded A1c value at baseline—only 28% of those with diabetes had a recorded A1c at baseline— the mean value was 8.8% (SD ±1.89%) with a range of 6.2% to 12.9%. Thirteen of the 23 patients with diabetes had an A1c greater than 8.0%. Initial serum Creatinine values were available for 113 of patients seen at baseline. Mean serum Creatinine value was 178.92 μmol/L (SD ±131.2) with a median value of 142 μmol/L (range 35μmol/L -805μmol/L). There were 114 recorded eGFR values at baseline with a mean value of 48.11 mL/min/1.73m^2 (SD ±32.37) and a median of 39 mL/min/1.73m^2 (range 6 mL/min/1.73m^2 - 147 mL/min/1.73m^2).

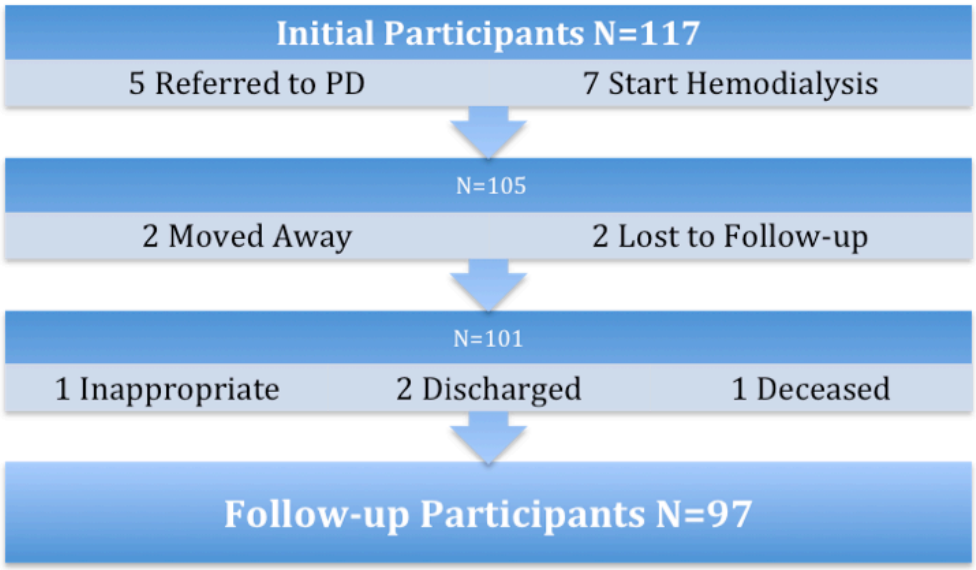
Table 4.3 Clinical Indicator Variables at Baseline
(Collected from March 2010-March 2014)

Variable	Measure	Value
Systolic Blood Pressure (mmHg) **N=113**	Mean (±SD) Median (Range) <130 mmHg (%)	132.95 (±21.82) 134 (63,195) 42.5
Diastolic Blood Pressure (mmHg) **N=113**	Mean (±SD) Median (Range) <80 mmHg (%)	74.21 (±11.11) 73 (53-105) 70.8
$A1_c$ (%) **N=23* (Only patients with diabetes)**	Mean (±SD) Median Range	8.76 (±1.89) 8.6 (7.36, 10.16)
Creatinine (µmol/L) **N=113**	Mean (±SD) Median (Range)	178.92 (±131.3) 142 (35-805)
eGFR (L/min/1.73m^2) **N=114**	Mean (±SD) Median (Range)	48.11 (±32.37) 39 (6-147)

Patient Follow-up After One Year

Patient follow up at one year was available for 97 of the original 117 patients. Of the 20 patients that were no longer being followed after one year, five patients were referred to another nephrology clinic for peritoneal dialysis. Seven patients began hemodialysis, one patient died due to non-renal related issues, two moved away from the Thompson area, two were discharged from the clinic to be followed by their primary care provider, and one patient was discharged from the clinic because he came to his appointments inebriated. Two patients were lost to follow up (Figure 4.1)

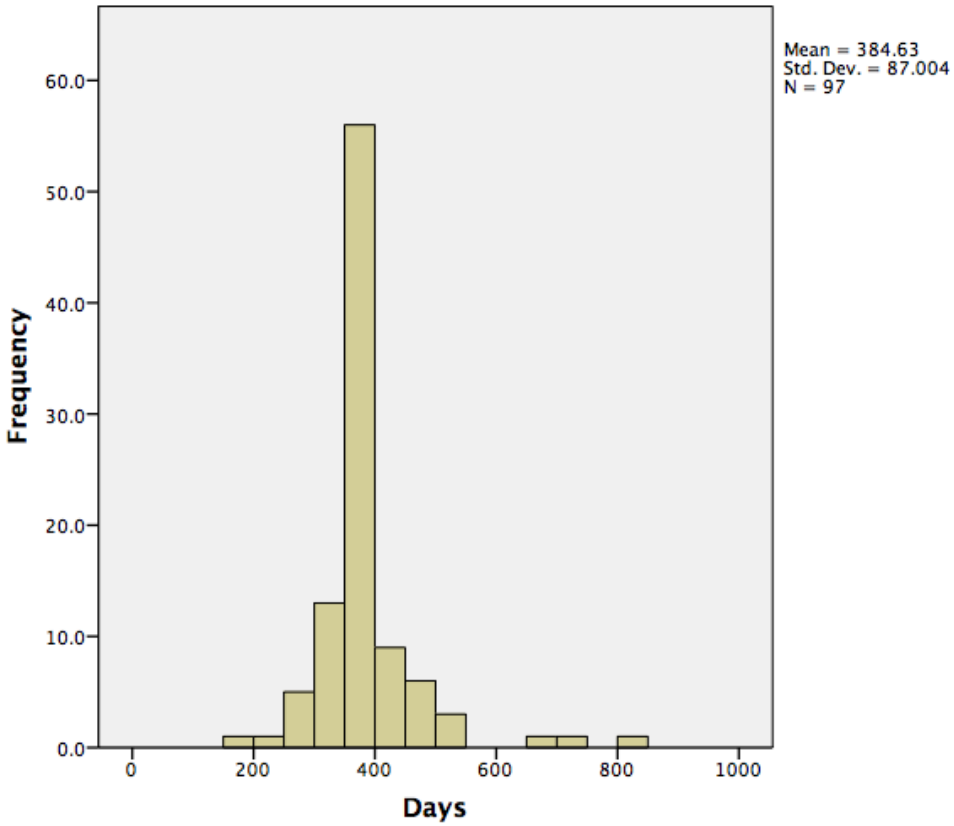
Figure 4.1 Reasons for Patient Loss During First Year



The patients that were transferred to peritoneal dialysis within one year ranged in age from 46-65 years. Four of the five PD transfers were male and one was female. Every single PD transfer patient had diabetes. The seven patients who began hemodialysis over the course of their initial year in the program ranged in age from 46-67 years. Four of the patients who chose HD as a modality were women and three were men. Again, every single patient who started hemodialysis within the year had diabetes.

Telehealth follow-up dates for patients varied considerably with a range of 161 days to 847 days from the date that they were first referred to the Telehealth program. Despite the varied time of follow up, the mean number of days was 386 (SD ±86.06) with a median of 366 (IQR 352-399 days). Only 12 of the 97 patients had a follow up visit date that was greater than +/- 3 months or 90 days of one year (Figure 4.2)

Figure 4.2 Number of days from Referral to Thompson Follow-up



Clinical Indicator Variables at Follow-up

Of the 97 patients seen after one year, blood pressure value was available for 95 individuals (two patients missed the one year follow up but they did have their bloodwork taken as the requisitions were given out prior). Table 4.4 presents clinical indicator variables at follow-up. Mean systolic blood pressure at one year was 139.56 mmHg (SD ±22.19, range 99-203). Mean diastolic blood pressure was 76.41 mmHg (SD ±9.69, range 58-96mmHg). The proportion of individuals who achieved a sytolic blood pressure <130 mmHg at one year was 31.6%. The proportion of individuals who achieved a diastolic blood pressure <80 mmHg at one year was 70.5%. Hemoglobin A1c was available for 55 of the 97 patients. There were 82 individuals with diabetes in the study group after one year. Of those individuals, 47 (57%) had an A1c available in the rolling record. Twenty-five (53%) of individuals with diabetes had an A1c less than 8% at follow-up. The mean A1c for patients with diabetes (n=47) was 8.26% (SD ±1.7%) and ranged from 5.7% to 14.0% . Serum creatinine (n=97) average was 167.49μmol/L (SD ±101.24 μmol/L), with a median value of 146 μmol/L (range 45 μmol/L) -597 μmol/L). Estimated glomerular filtration rate after one year had a mean value of 47.48 (SD ±30.47 mL/min/1.73m^2) with a median value of 40 mL/min/1.73m^2, (range 9 mL/min/1.73m^2 - 142 mL/min/1.73m^2).

Table 4.4 Clinical Indicator Variables at Follow-up

(Collected during follow-up visit closest to one year after baseline visit)

Variable	Measure	Value
Systolic Blood Pressure (mmHg)	Mean (SD)	139.56 (22.19)
N=95	Median (Range)	137 (99-203)
	<130 mmHg (%)	31.6
Diastolic Blood Pressure (mmHg)	Mean (SD)	76.41 (7.69)
N=95	Median (Range)	74 (58-96)
	<80 mmHg (%)	70.5
$A1_c$ (%)	Mean (SD)	8.26 (1.7)
N=47 (Individuals without DM excluded)	Median (Range)	7.9 (6.65-9.15)
Creatinine (μmol/L)	Mean (SD)	167.49 (102.24)
N=97	Median (Range)	146 (45-597)
eGFR (L/min/1.73m^2)	Mean (SD)	47.48
N=97	Median (Range)	40 (9-142)

A series of paired t tests shown in Table 4.5 indicates that there were statistically significant increases in systolic blood pressure (p <.001), diastolic blood pressure (p=.005 DF 90), and serum Creatinine (p=.004) from baseline to follow-up. Estimated glomerular filtration rate decreased (p<.001). The number of *paired* blood pressure, creatinine and eGFR values is less than the number of *follow-up* blood pressure, creatinine and eGFR values because of missing data either at baseline and at follow-up.

Table 4.5 Follow-up Clinical Indicator Variable Paired t-tests

Paired Variables	Mean (SD)	P value
• **SBP Initial**	130.60 (19.72)	**<.001**
• **SBP One Year**	139.09 (21.87)	
N=91		
• **DBP Initial**	73.44 (10.82)	**.005**
• **DBP One Year**	76.49 (9.52)	
N=91		
• **Cr Initial**	150.63 (88.51)	**.004**
• **Cr One Year**	166.46 (101.45)	
N=94		
• **eGFR Initial**	52.75 (32.51)	**<.001**
• **eGFR One Year**	47.44 (30.49)	
N=93		

The change in both eGFR and serum Creatinine over the year was calculated per person per 365 days. The mean change in eGFR was -4.52 mL/min/1.73m^2 per year (SD ±12.54 mL/min/1.73m^2). The mean change in serum creatinine per year was +16.56 μmol/L per year (SD ± 58.43 μmol/L). Both were normally distributed (Table 4.6).

Table 4.6 Change in Cr & eGFR/365 days

Variable	Measure	Value
Δ Creatinine/365 days	Mean (SD)	16.56 (±58.51)
N=94	Median (Range)	6.77 (-201, 270)
Δ eGFR/365 days	Mean (SD)	-4.52(±12.54)
N=93	Median (Range)	-2(-54.23, 27.67)

Differences Between Those With and Without Diabetes

Demographic and Health Status Variables

There were no significant differences between those with and without diabetes in terms of sex or BMI. However, patients with diabetes were significantly older with a mean age of 58.9 vs 52.9 (p=.031), and had more severe kidney disease compared to patients without diabetes (χ^2 6.121; p=.013). The proportion of patients with diabetes who had an eGFR <30 was 41.7% while the proportion of individuals without diabetes with an eGFR <30 was merely 17.6%. Table 4.2 presents demographic and health status variable differences between patients with and without diabetes.

Table 4.7: Demographic and Health Status Variables by Diabetes Status (Collected at Baseline from March 2010-March 2014)

	Diabetes	No-Diabetes	t-test	Chi Square
Age (mean)	58.9	52.9	**p=.031 (t-test)**	**n/a**
BMI (mean)	33.55	33.25	p=.859 (t-test)	n/a
eGFR < 30 N= 39	33	6		
eGFR > 30 N= 74	46	28	**n/a**	**p =.013** χ^2 **=6.121**
Totals N=113	79	34		
Male	46	23		
Female	36	11	n/a	p=.249 χ^2=1.330
Totals N=116	82	34		

Clinical Indicator Variables

At baseline, there were no statistically significant differences in clinical variables between patients with and without diabetes. The mean SBP for patients with diabetes was 135.01mmHg (SD ±20.71mmHg) and the mean SBP for patients without diabtetes was 126.82mmHg (SD ±22.91mmHg). Comparison of the two mean systolic blood

pressures was not significant (p.067). Mean DBP for patients with diabetes was 74.44 mmHg (SD ±11.31mmHg) compared to a mean DBP of 73.0 mmHg (SD ±10.31 mmHg) for those without diabetes (p=.547). Baseline differences between those with and without diabetes is presented in Table 4.8.

Table 4.8 Clinical Indicator Variables differences at Baseline between Individuals with and without Diabetes

Variable	With Dabetes	Without Diabetes	P value
Initial SBP (SD)	135.01 (±20.71) n=79	126.82 (±22.91) n=33	.067
Initial DBP (SD)	74.44 (±11.31) n=79	73.06 (±10.31) n=33	.547
Initial Serum Cr (SD)	184.01 (±124.02) n=79	147.76 (±97.61) n=33	.138
Initial eGFR (SD)	44.90 (±30.99) n=79	56.80 (±34.09) n=34	.072

At the time of follow-up, both patients with and without diabetes saw an increase in mean SBP and DBP. T-tests done to compare the differences in mean blood pressure values were again neither statistically significant for systolic blood pressure (p=.095), nor diastolic blood pressure (p=.656). There were no statistically significant differences in creatinine or eGFR between the two groups at follow-up. The rate of change in creatinine and eGFR per 365 days between those with and without diabetes was also not statistically significant (Table 4.9)

Table 4.9 Clinical Indicator Variables Differences After One Year Between Individuals With and Without Diabetes

Variable	With Diabetes	Without Diabetes	P value
One Year SBP (SD)	142.14 (22.215)	133.97 (21.436)	.095
One Year DBP (SD)	76.11 (9.5)	77.07 (10.22)	.656
One Year Creatinine (SD)	174.51 (107.35)	152.53 (86.53)	.321
One Year eGFR (SD)	44.77 (28.26)	53.26 (34.48)	.202
Δ Cr /365 Days	21.82	4.25	.172
Δ eGFR/365 Days	-5.1	-3.29	.518

Blood pressure values were quite variable however. One goal for treating those with kidney disease is to keep systolic blood pressure below 130 mmHg and diastolic blood pressure below 80 mmHg (Levin et al., 2008). The proportion of patients who achieved blood pressure values below the target level was calculated and chi-square tests were performed to look at any statistically significant differences between individuals with and without diabetes. At baseline, there were no statistically significant differences in blood pressure between the two groups when chi-square tests were used to compare proportions (Table 4.10)

Table 4.10 (a) Baseline Systolic Blood Pressure

	Diabetes Status		
	Yes	No	Total
SPB <130 mmHg	32 (40.5%)	16 (48.5%)	48
SBP ≥ 130mmHg	47 (59.5%)	17 (51.5%)	64
Total	79	33	112
Chi Square	.605		p=.437

Table 4.10(b) Baseline Diastolic Blood Pressure

	Diabetes Status		
	Yes	No	Total
DBP <80mmHg	55 (69%)	25 (31%)	80
DBP ≥80mmHg	24 (75%)	8 (25%)	32
Total	79	33	112
Chi Square	0.430		p=.512

Chi-square tests were performed to determine if there were any differences between the proportion of individuals with and without diabetes who achieved target blood pressure values after one year. Interestingly, after one year, there was a statistically significant difference in the proportion of patients with diabetes vs. those without diabetes who achieved a systolic blood pressure < 130 mmHg ($\chi 2=4.619$; p=.032). (Table 4.11)

Table 4.11(a) Follow-up Systolic Blood Pressure

	Diabetes Status		
	Yes	No	Total
SBP <130mmHg	16 (53.3%)	14 (46.7%)	30
SBP ≥130mmHg	49 (75.4%)	16 (24.6%)	65
Total	65	30	95
Chi Square	4.619		**p=.032**

Table 4.11(b) Follow-up Diastolic Blood Pressure

	Diabetes Status		
	Yes	No	Total
DBP <80mmHg	46 (70.8%)	21 (70%)	67
DBP ≥80mmHg	19 (29.2%)	9 (30%)	28
Total	65	30	95
Chi Square	.006		p=.939

Clinical Outcomes

Over the course of the year, 13 individual patients were hospitalized a total of 20 times.

As previously mentioned, 12 individuals either started hemodialysis (n=7) or were transferred to another nephrology team to prepare for PD (n=5). Six patients were referred for peritoneal dialysis, but only 5 were deemed appropriate. Six of the seven patients that started hemodialysis did so with a central line. One individual had a mature AVF for his or her first dialysis treatment.

Four of the 7 patients who began hemodialysis were referrerd to vascular surgery prior to dialysis initiation. Three of these four individuals already had an AVF created by a vascular surgeon, but the anastamosis was not sufficiently healed before HD was required. One patient was referred to vascular surgery after the initiation of hemodialysis; this individual had been referred for peritoneal dialysis but was not deemed

a suitable candidate. One individual began hemodialysis without referral to either a peritoneal dialysis team, or vascular surgery.

Table 4.12 Breakdown of Clinical Outcomes

Clinical Outcome	# of Events	Notes
Hospital Admission	20	• 13 Individuals hospitalized on 20 separate occasions
Peritoneal Dialysis Transfers	5	• 6 PD referrals—1 patient not appropriate
Hemodialysis Starts	7	• 1 patient started with a mature AVF
Vascular Referrals	6	• 4 referrals prior to HD • 2 referrals after HD
Deaths	1	

Missed Appointments

Eighty-five patients patients previously attached to the HSC Renal Clinic were referred to the nurse-led renal clinic in Thompson Manitoba. The remaining 32 of the 117 participants were referred to the program at the time of their first clinic visit in Winnipeg, and a history of missed appointments was not available. These 85 patients had a total of 603 individual visits to Winnipeg to see a nephrologist and/or allied health professionals. There were 56 documented missed appointments distributed among 31 individuals. Had they attended all appointments, the total would have been 659 visits to Winnipeg. The baseline proportion of missed appointments for these northern patients was slightly less than 10% (8.5%). The reason for the missed appointments is not available in the rolling records. Appointment history and associated missed appointments vary greatly between individuals as does the length of time a patient was followed by the HSC Renal Clinic (range .08-15.19 years).

The 117 individuals who saw the nurse clinician in Thompson, Manitoba that were followed for one year had a total of 284 scheduled visits. There were 11 documented missed appointments divided among 10 individuals. The proportion of missed visits among this group of individuals was 3.9%. Both visits that used Telehealth to connect to the HSC Renal Clinic, and nurse only visits in Thompson are included. The number of visits ranged from 1 to 12 over the course of the year. At times, numerous visits were made over a short period of time to see the nurse clinician. The reasons for this varied. Some individuals came for extra 1:1 education, while others came for repeat blood pressure assessment or bloodwork review. Often, repeat visits were made to see the nurse along with the diabetes educator. Patients cannot receive financial compensation for transportation to see the diabetes educator, but if a follow up appointment is made with the renal nurse clinician, arrangements can be made for the diabetes educator to be present at the appointment.

CHAPTER FIVE: DISCUSSION

Demographic and Health Status Variables

Patients who received care from the nurse clinician in Thompson, Manitoba for CKD were young, with an average age of 57.2 years, and the proportion of individuals with diabetes was high as expected at over 70%.

While there is no national database following patients receiving care from a nephrologist, an ongoing study (CanPREDDICT) is a prospective, cross-Canada cohort study that aims to predict renal and cardiovascular morbidity in individuals with CKD (Levin et al., 2013). The study follows 2546 adult patients with CKD (eGFR values between 15 mL/min/1.73m^2 and 45 mL/min/1.73m^2) from 25 separate Canadian nephrology clinics. The average age of CanPREDDICT patients at baseline was 68.1 years, while 48% percent of participants had diabetes. In the Thompson Nurse-Led Telehealth Renal Health Clinic, those with an eGFR less than 45 mL/min/1.73m2 had an average age of 61.6 years, and 76% had diabetes. It appears as if this small group of patients located in and around Thompson is younger than the average Canadian CKD patient. Prevalence of diabetes is certainly higher.

The number of individuals with a history of smoking was high, with 57.3% of individuals recorded as current or previous smokers. Some data on smoking status was missing however, and the true proportion of those with a history of smoking is uncertain. The high proportion of individuals with a history smoking is notable given that previous research on kidney disease in Manitoba has noted that a history of *ever* smoking was associated with a statistically significant increased risk for albuminuria (Zacharias et al., 2012). The group also had a very high BMI (mean 33.5 mg/kg^2) which is notable given

that again, Zacharias et al., noted that those with higher BMI values were more likley to have albuminuria (2012).

Clinical Indicator Variables and Change in Kidney Function

Control of diastolic blood pressure values at baseline show that overall control is good, with mean diastolic blood pressure falling well below 80mmHg at 74.21mmHg. Mean systolic blood pressure for the group was slightly higher than the recommended threshold at 132.95mmHg. The proportion of individuals in this study whose SBP was below 130 mmHg at baseline was only 42.5%.

Of note, both systolic and diastolic blood pressure increased significantly by the time of follow-up. Caution must be taken when interpreting these results however. This study only reports on blood pressure and lab values for two visits (baseline and the visit in Thompson closest to one year after baseline). In reality, there were many more visits to the nurse clinician that are not reflected in these results. Patients with elevated blood pressure values as noted at their follow up visit would often be re-assessed by the nurse clinician a few days to one week following elevated blood pressure results. Changes to medications were made after consulting with the Nephrology team in Winnipeg. Subsequent visits often showed lower blood pressures, but this study does not reflect that. Another factor that must be considered when looking at reasons for increased blood pressure values over time include advancing CKD and age (Kovesdy et al., 2016).

It is not surprising that renal function declined as evidenced by increasing serum creatinine and decreasing eGFR. This is a study of individuals with chronic kidney disease. While the precise trajectory of the progression of CKD is highly variable, the

disease does tend to progress over time. Kidney function also declines as age increases (Kovesdy et al., 2016).

In order to make sense of the change in serum creatinine and eGFR, the average change of both per 365 days was calculated. The mean rate of eGFR change per 365 days was -4.52 mL/min/1.73m^2. Ideally, eGFR changes very slowly over time. A Canadian study recently showed that individuals (both with and without CKD) who experience either a rapid decrease or increase in eGFR values (± 5 mL/min/1.73m^2) were twice as likely to die from any cause than those with stable kidney function (Turin et al., 2013). This is concerning since the mean rate of eGFR change in this study group was - close to 5 mL/min/1.73m^2. The rate of eGFR decline is also concerning due to the mean age of individuals in this study (57 years), and the mean initial eGFR (48 mL/min/1.73m^2). An eGFR decrease of 4.5 mL/min/1.73m^2 per annum will lead to ESKD for many participants before the age of 65 years.

Haemoglobin A1c was only available for 23 of the 85 patients with diabetes at baseline. Typically, diabetes is generally monitored and managed by primary care providers and not a nephrologist. If A1c values were done, they simply were not available in the HSC Renal Clinic charts. The nurse clinician in Thompson ordered A1c values on all patients with diabetes as part of the referral to the diabetes educator. This reflected a drastic increase in the number of patients with diabetes with an available A1c (n=47) at time of follow-up compared to baseline. In order to compare the change in A1c in individuals with diabetes, paired t tests could be done to look for a difference. Paired t-tests would only result in 21 pairs for analysis however. Because of this discrepancy, no comparison was made. The increased number of individuals potentially receiving the

test, and being referred to local programs for education and care for diabetes is more notable than the A1c values in this study.

Differences Between Patients With and Without Diabetes

It was not surprising that those with diabetes were significantly older than those without, and that the group with diabetes had more severe CKD (stages IV and V) than the group without diabetes. Interestingly, there was almost no difference between the two groups mean BMI values. Both groups had very high mean BMI values of greater than 33 kg/m^2.

No significant differences in mean blood pressure value were found between those with and without diabetes. There was however a difference in the proportion of those with elevated systolic blood pressure at follow-up. Individuals with diabetes were less likely to achieve systolic blood pressure values below 130 mmHg ($p=.032$).

There were no other statistically significant differences between those with and without diabetes.

Clinical Outcomes and Missed Appointments

There were very few adverse clinical outcomes documented during a patient's first year participating in the Telehealth program. One person died and the cause of death was not related to renal issues. Seven individuals began hemodialysis over the year. However, only one of the seven had a mature AVF at the time dialysis was initiated. Initiation of hemodialysis prior to a mature AVF is considered an adverse event. Patients were referred to vascular surgery prior to initiation of dialysis, yet four people had to start HD after fistula surgery, but before the anastomosis had healed fully.

Of note however, is the number of people who were transferred to another clinic for peritoneal dialysis. Five out of 12 individuals were transferred to PD for RRT (42%). This is higher than the national average of roughly 20% (Canadian Institute for Health Information, 2016), and though the numbers are small, it is encouraging. Of note, 6 of the 12 individuals who had to start RRT chose to be referred to PD; unfortunately, one person was not an ideal candidate and had to select HD as a modality. This particular individual was one of the two that was referred to vascular surgery for fistula creation after dialysis initiation.

The number of missed appointments at the HSC Renal Clinic prior to initiation of the Telehealth project was actually not very high. Only 31 of 85 patients had any history of missed appointments, and the total number of missed appointments over the years was 56 out of 659 booked appointments (8.5%). Given the complexity in booking travel and weather related issues that can complicate an individual's ability to attend an appointment in Winnipeg, these missed appointments seem quite low.

When comparing missed appointments between Thompson follow-up visits and HSC Renal Clinic the numbers appear promising. Of 284 booked visits with the nurse clinician, there were only 11 missed appointments (3.8%). The rate of missed appointments cannot be compared however due to a number of factors. Missed appointments at the HSC Renal Clinic represent visits for individuals who were previously involved with the clinic from .08 to 15.19 years. The follow-up visit missed appointments was limited to one year only. Also, the reasons for the missed appointment is not available, and issues like cancelled flights and closed roads cannot be determined.

Limitations

The study is subject to some limitations. This was a small retrospective analysis of an existing dataset. The number of individuals followed is small, and one year is not a long time to follow individuals with a chronic disease.

There were some inconsistencies noted with the rolling record used in this study. At times, entire variables were missing from one person's record (i.e. CKD stage). Referrals were also recorded inconsistently in the rolling record, and documentation of missed appointments was difficult to determine. The baseline missed visits prior to seeing the nurse in Thompson was evident. Missed appointments sometimes show up as a missed date with an empty column in the record, but other times, the number of missed appointments with the nurse is updated in a row along the top of the record.

This study also includes eGFR values greater than 60 mL/min/1.73m2. Diagnostic Services of Manitoba does not report on values greater than 60 because the accuracy of the equation decreases as eGFR increases. This could have led to some numbers that skewed rate of eGFR change and average eGFR at baseline and at follow up.

Finally, the MDRD equation for estimating eGFR has not been validated in First Nations individuals. As previously mentioned, African-Canadians have a slightly different equation that is used. There have been no studies to look at whether a similar approach needs to be used with FN individuals in Canada.

Future Directions

The Thompson Nurse-Led Telehealth Renal Health Clinic provides care for individuals living with CKD closer to their homes. This care is vital because of the complexity of CKD, the need for frequent follow-up, and the time it takes for individuals

to travel back and forth from Winnipeg in order to seek care. Those living far from an urban nephrology team in Canada are also less likely to receive the same standard of care that is enjoyed in larger cities. For these reasons, this pilot project and others like it require further research and funding.

In its first year the proportion of missed appointments decreased for the 117 involved individuals involved in this pilot study. Linkages were made with community resources. The number of individuals being seen continues to increase, and it does not appear as if any negative clinical outcomes are attributable to a decreased number of visits to Winnipeg. These are major successes.

If attempts will be made in the future to determine the clinical "value" of remote nurse-led CKD clinics, research needs to explain the model of care and initial patient outcomes. Further studies can then be conducted to compare long-term clinical outcomes between those with access to remote nurse-led clinics with Telehealth and those who only have access to Telehealth.

This study also raises a number of important issues for further research and policy development in Manitoba. Much work has been done in Manitoba to look at the burden of Diabetes and CKD. While the cause of CKD was not collected as part of this study, the proportion of patients with diabetes was high. Patients with diabetes tended to have poorer control of systolic blood pressure than those without diabetes Over the course of one year, 12 individuals began a form of renal replacement therapy. Every single person who initiated dialysis during this time had diabetes. Essentially, programs like this must continue to serve the communities that need them.

Works Cited

Ajarmeh, S., Er, L., Brin, G., Djurdjev, O., & Dionne, J. (2012). The Effect of a Multidisciplinary Care Clinic on the Outcomes in Pediatric Chronic Kidney Disease. *Pediatric Nephrology* , 1921-1927.

Arora, P., Vasa, P., Brenner, D., Iglar, K., McFarlane, P., Morrison, H., et al. (2013). Prevalence Estimates of Chronic Kidney Disease in Canada: Results of a Nationally Representative Study. *Canadian Medical Association Journal , 185* (9), 417-413.

Assay, V. o. (2004). Hallan, Stein; Asberg, Arne; Lindberg, Morten; Johnsen, Harald. *American Journal of Kidney Disease , 44* (1), 84-93.

Baldwin, L. (2016, December 22). Telephone Interview. (K. Bourque, Interviewer)

Barrett, B. J., Garg, A. X., Goeree, R., Levin, A., Molzahn, A., Rigatto, C., et al. (2011). A Nurse-coordinated Model of Care versus Usual Care for Stage 3/4 Chronic Kidney Disease in the Community: A Randomized Controlled Trial. *Clin J Am Soc Nephrol , 6*, 1241-1247.

Bello, A., Hemmelgarn, B., Lin, M., Manns, B. K., & Thomson, S. (2012). Impact of Remote Location on Quality of Care Delivery and Relationships to Adverse Health Outcomes in Patients with Diabetes and Chronic Kidney DIsease. *Nephrol Dial Transplant* , 3849-3855.

Bernstein, K., Zacharias, J., Blanchar, J., Yu, N., & Shaw, S. (2010). Model for Equitable Care and Outcomes for Remote Full Care Hemodialysis Units. *Clinical Journal of the American Society of Nephrology* , 645-651.

Binik, Y. M., Devins, G. M., Barre, P. E., Guttmann, R. D., Hollomby, D. J., Mandin, H., et al. (1993). Live and Learn: Patient Education Delays the Need to Initiate Renal Replacement Therapy in End-Stage Renal Disease. *The Journal of Nervous and Mental Disease , 181* (6), 371-376.

Campbell, M., Akbari, A., Amos, S., & Keyes, C. (2012). Feasibility of Providing Nephrology Services to Remote Communities with Videoconferencing. *Journal of Telemedicine and Telecare* , 13-16.

Canadian Diabetes Association. (2016, November). *2013 Clinical Practice Guidelines Quick Reference Guide*. Retrieved December 20, 2016, from www.guidelines.diabetes.ca/cdacpg_resources/CPG_Quick_Reference_Guide_WEB.pdf

Canadian Institute for Health Information. (2016). *Canadian Organ Replacement Register 2016.* Retrieved March 26, 2017, from https://www.cihi.ca/en/canadian-organ-replacement-register-2016

Canadian Institute for Health Information. (2013). *End-Stage RenalDisease Among Aboriginal Peoples in Canada: Treatment and Outcomes.* CIHI.

Chartier, M., Dart, A., Tangri, N., Komenda, P., Walld, R., Bogdanovic, B., et al. (2015). *Care of Manitobans Living with Chronic Kidney Disease.* Winnipeg: Manitoba Centre for Health Policy.

Clark, E. G., Akbari, A., Hiebert, B., Hiremath, S., Komenda, P., Lok, C. E., et al. (2016). Geographic and Facility Variation in Initial Use of Non-Tunneled Catheters for Incident Maintenance Hemodialysis Patients. *BMC Nephrology , 17* (20).

Cockcroft, D., & Gault, M. (1976). Prediction of Creatinine Clearance from Serum Creatinine. *Nephron , 16* (1), 31-41.

Curtis, B. M., Ravani, P., Malberti, F., Kennett, F., Taylor, P. A., Djurdjev, O., et al. (2005). The Short and Long-Term Impact of Multi-Disciplinary Clinics in Addition to Standard Nephrology Care on Patient Outcomes. *Nephrology Dialysis Transplantation , 20*, 147-154.

Ferguson, T., Zacharias, J., Walker, S., Collister, D., Tangri, N., & Komenda, P. (2015). An Economic Assessment Model of Rural and Remote Satellite Hemodialysis Units. *PLoS ONE , 10* (8).

Fink, H. A., Ishani, A., Taylor, B. C., Greer, N. L., MacDonald, R., Rossini, D., et al. (2012). Screening for, Monitoring, and Treatment of Chronic Kidney Disease Stages 1 to 3: A Systematic Review for the U.S. Preventive Services Task Force and for an American College of Physicians Clinic Practice Guideline. *Annals of Internal Medicine , 156* (8), 570-581.

First Nations Health and Social Secretariat of Manitoba. (2017). *Diabetes Integration Project*. Retrieved May 14, 2017, from Nanaandawewigamig: www.fnhssm.com/index.php/policy-areas/diabetes-integration-project-dip

Gao, S., Manns, B., Culleton, B., Tomelli, M., Quan, H., & Crowshoe, L. (2007). Prevalence of Chronic Kidney Disease and Survival Among Aboriginal People. *Journal of the American Society of Nephrology* , 2953-2959.

Gates, G. (1985). Creatinine Clearance Estimation From Serum Creatinine Values: An Analysis of Three Mathematical Values of Glomerular Function. *Americal Journal of Kidney Disease , 5* (3), 199-205.

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the Public Health Impact of Health Promotion Interventions: The RE-AIM Framework. *American Journal of Public Health , 89* (9), 1322-1327.

Grandbois, B. (2017, February 1). Key Informant Interview. (K. Bourque, Interviewer)

Hallan, S., Asberg, A., Lindberg, M., & Johnsen, H. (2004). Validation of the Modification of Diet in Renal Disease Formula for Estimating GFR With Special Emphasis on Calibration of the Serum Creatinine Assay. *American Journal of Kidney Diseases , 44* (1), 84-93.

Health Canada. (2016, 04 02). *Health Systems and Services: Non-Insured Health Benefits for First Nations and Inuit*. Retrieved 03 30, 2017, from Government of Canada-Health Canada: https://www.canada.ca/en/health-canada/services/non-insured-health-benefits-first-nations-inuit/benefits-services-under-non-insured-health-benefits-program.html

Hemmelgarn, B., Manns, B., Zhang, J., Tonelli, M., Klarenbach, S., Walsh, M., et al. (2007). Association Between Multidisciplinary Care and Survival for Elderly Patients with Chronic Kidney Disease. *Journal of the American Society of Nephrology , 18*, 993-999.

Hughes, S. A., Mendelssohn, J. G., Tobe, S. W., McFarlane, P. A., & Mendelssohn, D. C. (2013). Factors associated with suboptimal initiation of dialysis despite early nephrologits referral. *Nephrol Dial Transplant , 28*, 392-397.

Hynes, D. M., Fischer, M. J., Schiffer, L. A., Rani, G., Chukwudozie, I. B., Porter, A., et al. (2017). Evaluating a Novel Health System Intervention for Chronic Kidney Disease Care Using the RE-AIM Framework: Insight After Two Years. *Contemporary Clinical Trials , 52*, 20-26.

Jhaveri, D., Larkins, S., & Sabesan, S. (2015). Telestroke, Tele-Oncology and Teledialysis: A Systematic Review to Analyse the Outcomes of Active Therapies Delivered with Telemedicine Support. *Journal of Telemedicine and Telecare , 21* (4), 181-188.

Johns, T. S., Yee, J., Smith-Jules, T., Campbell, R. C., & Bauer, C. (2015). Interdiesiplinary Care Clinics in Chronic Kidney Disease. *BMC Nephrology , 16* (161), 1-10.

Johns, T., Yee, J., Smith-Jules, T., Campbell, R., & Bauer, C. (2015). Interdisciplinary Care Clinics in Chronic Kidney Disease. *BMC Nephrology , 16* (161).

KDIGO. (2009). KDIGO Clinical Practice Guidelines for the Care of Kidney Transplant Patients. *American Journal of Transplantation , 9* (Supplement 3).

KDIGO. (2013). KDIGO Clinical Practice Guidelines for the Evaluation and Management of Chronic Kidney Disease. *Kidney International , 3* (1).

Kessler, R. S., Purcell, E. P., Glasgow, R. E., Klesges, L. M., Benkeser, R. M., & Peek, C. (2012). What Does It Meant to "Employ" the RE-AIM Model? *Evaluation & the Health Professions , 36* (1), 44-66.

Kidney Foundation of Canada. (n.d.). Retrieved June 16, 2016, from www.kidney.ca/hemodialysis

Kitsou, S., Pare, G., & Jaana, M. (2013). Systematic Reviews and Meta-Analyses of Home Telemonitoring Interventions for Patients With Chronic Diseases: A Critical Assessment of Their Methodological Quality. *Journal of Medical Internet Research , 15* (7), 1-23.

Klahr, S., AS, L., GJ, B., AW, C., Hunsicker, L., Kusek, J., et al. (1994). The Effects of Dietary Protein Restriction and Blood-Pressure Control on the Progression of Renal Disease. Modification of Diet in Renal Disease Study Group. *New England Journal of Medicine , 330*, 877-884.

Klarenbach, S. W., Tonelli, M., Chui, B., & Manns, B. J. (2014). Economic Evaluation of Dialysis Therapies. *Nat. Rev. Nephrol. , 10*, 644-652.

Komenda, P., Lavallee, B., Ferguson, T. W., Tangri, N., Chartrand, C., Lorraine, M., et al. (2016). The Prevalence of CKD in Rural Canadian Indigenous Peoples: Results From the First Nations Community Based Screening to Improve Health and Prevent Dialysis (Finished) Screen, Triage and Treat Program. *AM J Kidney Dis* , 1-9.

Kovesdy, C. P., Alrifai, A., Gosmanova, E. O., Lu, J. L., Canada, R. B., Wall, B. M., et al. (2016). Age and Outcomes Associated with BP in Patients with Incident CKD. *Clinical Journal for the American Society of Nephrology , 11*, 821-831.

Lavallee, B., Chartrand, C., McLeod, L., Rigatto, C., Tangri, N., Dart, A., et al. (2015). Mass Screening for Chronic Kidne Disease in Rural and Remote Canadian First Nations People: Methodology and Demographic Characteristics. *Canadian Journal of Kindey Health and Disease , 2* (9), 1-10.

Levey, A. S., Bosch, J. P., Lewis, J. B., Greene, T., Rogers, N., & Roth, D. (1999). A More Accurate Method to Estimate Glomerular Filtration Rate From Serum Creatinine: A New Prediction Equation. *Annals of Internal Medicine , 130* (6), 461-470.

Levey, A. S., Coresh, J., Greene, T., Stevens, L. A., Zhang, Y. (., Hendriksen, S., et al. (2006). Using Standardized Serum Creatinine Values in the Modification of Diet in Renal Disease Study Equation for Estimating Glomerular Filtration Rate. *Annals of Internal Medicine , 145* (4), 247-255.

Levey, A. S., de Jong, P. E., Coresh, J., El Nahas, M., Astor, B. C., Matsushita, K., et al. (2011). The Definition, Classification, and Prognosis of Chronic Kidney Disease: A KDIGO Controversies Conference Report. *Kidney International , 80*, 17-28.

Levin, A., Hemmelgarn, B., Culleton, B., Tobe, S., McPharlane, P., Ruzicka, M., et al. (2008). Guidelines for the Management of Chronic Kidney Disease. *Canadian Medical Association Journal , 179*, 1154-1162.

Levin, A., Rigatto, C., Barrett, B., Madore, F., Muirhead, N., Holmes, D., et al. (2013). Cohort Profile: Canadian Study of Prediction of Death, Dialysis and Interim Cardiovascular Events. *BMC Nephrology , 14* (121), 1-11.

Levin, A., Sokora, S., Allu, S., Au, F., Gil, S., & Manns, B. (2014). Canadian Chronic Kidney Disease Clinics: A National Survey of Structure, Function and Models of Care. *Canadian Journal of Kidney Health and Disease , 1* (29), 1-10.

Manitoba Health, Seniors and Active Living. (n.d.). *Manitoba Health, Seniors and Active Living-Emergency Medical Services*. Retrieved March 30, 2017, from Emergency Medical Services-Northern Patient Transport Program: www.gov.mb.ca/health/ems/nptp.html

Manitoba Renal Program. (n.d.). *Kidney Failure Risk Tools & Referral Pathways.* Retrieved March 04, 2017, from www.kidneyhealth.ca/wp/healthcare-professionals/egfr-referral-pathways/

Manitoba Renal Program. (2011). *Thompson Nurse-Led Telehealth Renal Health Clinic Project Files.* Winnipeg.

Mendelssohn, D. C., Curtis, B., Yeates, K., Langlois, S., MacRae, J. M., Semeniuk Lisa, M., et al. (2011). Suboptimal initition of dialysis with and without early referral to a nephrologist. *Nephrol Dial Transplant , 26*, 2959-2965.

Miller, L., Vercaigne, L., Moist, L., Lok, C., Tangri, N., & Komenda, P. (2014). The Association Between Geographic Proximity to a Dialysis Facility and Use of Dialysis Catheters. *BMC Nephrology , 15* (40), 8.

National Kidney Foundation. (2006). KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates: Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. *American Journal of Kidney Disease , 28*, S1-S322.

Northern Health Region. (2016). *Annual Report 2015/2016.* Retrieved March 27, 2017, from Northern Health Region: http://www.northernhealthregion.ca/data/1/rec_docs/3236_2015-16_Annual_Report.pdf

Patapas, J. M., Blanchard, A. C., Iqbal, S., Vasilevsky, M., & Dannenbaum, D. (2012). Management of Aboriginal and Nonaboriginal People with Chronic Kidney Disease in Quebec. *Canadian Family Physician , 58*, 107-112.

Peterson, J., Adler, S., Burkhart, J., T, G., Hebert, L., & al., K. A. (1995). Blood Pressure Control, Proteinuria and The Progression of Renal Disease. The Modification of Diet in Renal Disease Study. *Annals of Internal Medicine , 123*, 754-762.

Raphael, Michael J., Fredette-Nadeau, Annie, Tennakore, Karith et al., (2015) A Virtual Ward for Home Hemodialysis Patients: A Pilot Trial. *Canadian Journal of Kidney Health and Disease,* 2 (37).

Rucker, D., Hemmelgarn, B., Lin, M., Manns, B., Klarenbach, S., Ayyalasomayajula, B., et al. (2011). Quality of Care and Mortality are Worse in Chronic Kidney Disease Patients LIving in Remote Areas. *Kidney International , 79*, 210-217.

RUIS McGill. (2017). *What is RUIS?* Retrieved May 14, 2017, from Mcgill.CA/RUIS McGill: http://mcgill.ca/ruis/about-us-0

Schachter, M., Bargman, J., Copland, M., Hladunewich, M., Tennakore, K., & Levin, A. (2014). Rationale for a Home Dialysis Virtual Ward: Design and Implementation. *BMC Nephrology , 15* (33).

Sicotte, C., Moqadem, K., Vasilevsky, M., Desrochers, J., & St.Gelais, M. (2011). Use of Telemedicine for Haemodialysis in Very Remote Areas: The Canadian Fist Nations. *Journal of Telemedicine and Telecare , 17* (146).

Statistics Canada. (2017). *Census Profile, 2016 Census*. Retrieved May 25, 2017, from www.statcan.gc.ca/census-recensement/2016

Statistics Canada. (2012, October 24). *Focus on Geography Series, 2011 Census: Census Agglomeration of Thompson, Manitoba*. Retrieved March 30, 2017, from Statistics Canada Web Site: www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-cma-eng.cfm?LANG=Eng&GK=CMA&GC=

Tangri, N., Inker, L. A., Hiebert, B., Wong, J., Naimark, D., Kent, D., et al. (2016). A Dynamic Predictive Model for Progression of CKD. *American Journal of Kidney Disease* , 1-7.

Tangri, N., Stevens, L. A., Griffith, J., Tighouiart, H., Djurdjev, O., Naimark, D., et al. (2011). A Predictive Model for Progression of Chronic Kidney Disease to Kidney Failure. *JAMA , 305* (15), 1553-1559.

Turin, T. C., Coresh, J., Tonelli, M., Stevens, P. E., de Jong, P. E., Farmer, C. K., et al. (2013). Change in the Estimated Glomerular Filtration Rate OverTime and Risk of All-Cause Mortality. *Kidney International , 83*, 684-691.

University of Manitoba. (2017). *Max Rady College of Medicine: Community Health Sciences: Rady Faculty of Health Sciences.* Retrieved May 8, 2017, from Northern Health Programs:

umanitoba.ca/faculties/health_sciences/medicine/units/chs/depertmental_units/north_medical/program/programs.html

Vats, H. (2012). Complications of Catheters: Tunneled and Nontunneled. *Advances in Chronic Kidney Disease , 19* (3), 188-194.

Vervoort, G., Willems, H. L., & Wetzels, F. (2002). Assessment of Glomerular Filtration Rate in Health Subjects and Normoalbuminuric Diabetic Patients: Validity of a New (MDRD) Prediction Equation. *Nephrology Dialysis Transplantation , 17*, 1909-1913.

Weber, C., & Djurdjev, O. L. (2009). Outcomes of Vascular Access Creation Prior to Dialysis: Buliding the Case for Early Referral. *ASAIO Journal* , 355-360.

Zacharias, J. (2017, May 5). Interview. (K. Bourque, Interviewer)

Zacharias, J. M., Young, T. K., Riediger, N. D., Roulette, J., & Bruce, S. G. (2012). Prevalence, Risk Factors and Awareness of Albuminuria on a Canadian First Nation: A Community-Based Screening Study. *BMC Public Health , 12* (290), 1-8.

APPENDIX A: Rolling Record

PATIENT #

Activity Codes:
TH=Telehealth Visit with MD (include minutes)
NV=Nurse visit @ Thompson site (include minutes)
PC=Phone call/follow-up

Front of Form (General Information)	
1st RHC Appointment (date) Wiinipeg	
PD Referals (yes;date/no)	
TX Referals (yes;date/no)	

Back of Form (Rolling Record)								
A) Attendance Profile		**Baseline**	**1**	**2**				
Number of appointments attended			EXAMPLE	EXAMPLE	EXAMPLE	EXAMPLE	EXAMPLE	
Number of No shows								
Appointment (date)								
Attendance (yes/no)								
B) Targets								
Weight (kg)								
Pulse (value)								
BP (value)								
Lab (value)	ACR							
Lab (value)	PCR							
Lab (value)	CR/Egfr							
Lab (value)	Stage							
Lab (value)	Cholesterol							
Lab (value)	Lipids (LDL)							
Lab (value)	Lipids (Ratio)							
Lab (value)	Anemia (Hemogobin)							
Lab (value)	Anemia (TSAT)							
Lab (value)	Anemia (Ferritin)							
Lab (value)	Mineral Metabolism (Ca)							
Lab (value)	Mineral Metabolism (Phos)							
Lab (value)	Mineral Metabolism (Albumin)							
Lab (value)	Mineral Metabolism (PTH)							
Lab (value)	Blood Sugar							
Lab (value)	A1C							
Vaccinations (yes/no)	Hep B							
C) Interventions								
Renal Education Given (yes;type/no)								
Referrals (yes;type/no)								
Arranged Vascular Access PD education given for Stage 4-5 patients (yes;date/no)								
Med Compliance to Treatment Plan (yes/no)								
D) Misc Outcomes								
Access for Dialysis/AVF Assesment (yes;type/no)								
Hospitalization to start Dialysis (days)								
Recent Hospital Admissions (yes;date/ no)								
Recent Hospital Admissions for Emergent Dialysis (yes;date/ no)								
Interim Telehelath visits between appointments (yes;number/ no)								
Pre clinic Labs done (yes/no)								
Isolation (yes;type)/no)								
E) Other Metrics								
Transportation method to Winnipeg (car, bus, van, air)								
Escort Required (yes/no)								
Previous State Cost (travel, lodging, meal); including escort ($)								
Current State Cost (travel, lodging, meal); including escort ($)								
Net Savings ($)								
Time for Telehealth portion of appointment (minutes) (**)			TH-20	NV-45	PC			
Total time of appointment (minutes) (*)								
F) Patient Satisfaction								
Survey Completed (yes;score/no)								
G) Staff Satisfaction								
Survey Completed-Nurse-Thompson (yes;score/no)								
Survey Completed-Nurse-Winnipeg (yes;score/no)								
Survey Completed-Pharmacist-Winnipeg (yes;score/no)								
Survey Completed-Dietitian-Winnipeg (yes;score/no)								
Survey Completed-Physican-Winnipeg (yes;score/no)								
Survey Completed-Social Worker-Winnipeg (yes;score/no)								

Revised_Blank_rolling_recordRolling Form

APPENDIX B: HREB Approval

UNIVERSITY OF MANITOBA | Research Ethics - Bannatyne
Office of the Vice-President (Research and International)

P126-770 Bannatyne Avenue
Winnipeg, Manitoba
Canada, R3E 0W3
Telephone : 204-789-3255
Fax: 204-789-3414

HEALTH RESEARCH ETHICS BOARD (HREB)
CERTIFICATE OF FINAL APPROVAL FOR NEW STUDIES
Delegated Review

PRINCIPAL INVESTIGATOR:	INSTITUTION/DEPARTMENT:	ETHICS #:
Kristen Bourque	U of M and HSC/Medicine/Community Health Sciences	HS20414 (H2017:011)
APPROVAL DATE: February 16, 2017	**EXPIRY DATE:** February 16, 2018	
STUDENT PRINCIPAL INVESTIGATOR SUPERVISOR (If applicable): Dr. Sharon Bruce		

PROTOCOL NUMBER:	PROJECT OR PROTOCOL TITLE:
N/A	Managing Chronic Kidney Disease in Northern Manitoba: An Innovative Model of Care Using Telehealth and a Northern Based Nurse Clinician (Linked to H2015:043)
SPONSORING AGENCIES AND/OR COORDINATING GROUPS: NA	

Submission Date of Investigator Documents:	HREB Receipt Date of Documents:
December 14, 2016 and February 5, 2017	December 21, 2016 and February 7, 2017

THE FOLLOWING ARE APPROVED FOR USE:

Document Name	Version(if applicable)	Date
Protocol: Protocol		submitted December 14, 2016
Clarification Letter dated February 5, 2017 Revised REB Submission Form dated February 7, 2017		
Consent and Assent Form(s):		
Other: Appendix A: Study Questionnaire Data Collection Form	V. 2	February 1, 2017 submitted December 16, 2016

CERTIFICATION
The above named research study/project has been reviewed in a ***delegated manner*** by the University of Manitoba (UM) Health Research Board (HREB) and was found to be acceptable on ethical grounds for research involving human participants. The study/project and documents listed above was granted final approval by the Chair or Acting Chair, UM HREB.

HREB ATTESTATION
The University of Manitoba (UM) Research Board (HREB) is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement 2, and the applicable laws and regulations of Manitoba. In respect to clinical trials, the HREB complies with the membership requirements for Research Ethics Boards defined in Division 5 of the Food and Drug Regulations of Canada and carries out its functions in a manner consistent with Good Clinical Practices.

QUALITY ASSURANCE
The University of Manitoba Research Quality Management Office may request to review research documentation from this research study/project to demonstrate compliance with this approved protocol and the University of Manitoba Policy on the Ethics of Research Involving Humans.

CONDITIONS OF APPROVAL:
1. The study is acceptable on scientific and ethical grounds for the ethics of human use only. ***For logistics of performing the study, approval must be sought from the relevant institution(s).***
2. This research study/project is to be conducted by the local principal investigator listed on this certificate of approval.
3. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to the research study/project, and for ensuring that the authorized research is carried out according to governing law.
4. **This approval is valid until the expiry date noted on this certificate of approval. A Bannatyne Campus Annual Study Status Report** must be submitted to the HREB within 15-30 days of this expiry date.
5. Any changes of the protocol (including recruitment procedures, etc.), informed consent form(s) or documents must be reported to the HREB for consideration in advance of implementation of such changes on the **Bannatyne Campus Research Amendment Form.**
6. Adverse events and unanticipated problems must be reported to the HREB as per Bannatyne Campus Research Boards Standard Operating procedures.
7. The UM HREB must be notified regarding discontinuation or study/project closure on the **Bannatyne Campus Final Study Status Report**.

Sincerely,

Chair, Health Research Ethics Board
Bannatyne Campus

Please quote the above Human Ethics Number on all correspondence.
Inquiries should be directed to the REB Secretary **Telephone**: (204) 789-3255/ **Fax:** (204) 789-3414

APPENDIX C: Clinical Booking Form

MBTelehealth
Bringing health care closer to home

CLINICAL BOOKING FORM

MBTelehealth Scheduler
Fax: 1-204-975-7787
Ph: 1-204-975-7714 or 1-866-667-9891 (Opt 2)

DO NOT EMAIL THIS FORM AS IT CONTAINS PERSONAL HEALTH INFORMATION

***** BOLDED FIELDS ARE REQUIRED *****

Is this for a Televisitation event? ○ Yes ○ No *If yes, ONLY complete Client Information and Televisitation sections.*

CONSULTANT INFORMATION

Consultant LAST Name | **Consultant FIRST Name** | **Specialty**

Consultant Telehealth Site | Room/Codec VCU#

Appointment Date | **Start Time (24hr)** | **End Time (24hr)**

Booking Contact Name | **Contact Phone #** | **Booking Contact Email** | **Booking Contact Fax**

CLIENT INFORMATION

Client LAST Name | **Client FIRST Name** | **PHIN #** | Provinical Health # or Other

DOB ○ Male ○ Female

Address (City/Town) | **Postal Code** | **Phone**

Client Telehealth Site *(If unsure - leave blank)* | Room/Codec VCU#

Additional Requirements (check all that apply) ☐ Otoscope ☐ Hand Held Camera | Body part to be visualized

Client Contact Person (if not client) | Phone | Relationship

NOTES AND COMMENTS

Notes/Additional Comments

TELEVISITATION REQUESTS "ONLY"

Televisitation is for clients receiving care away from home to visit family members in their home community. Must be requested by health-care professional.

Visitor LAST Name | Visitor FIRST Name | Visitor Location Site | Visitor Phone #

Preferred dates/times (Provide two possible dates/times)
Date #1 | Time (24hr) | Date #2 | Time (24hr) | # attending Visitor Site

Request by: LAST and FIRST Name | Program/Dept | Phone

(Health-care professional)

Print Form

APPENDIX D: Interdisciplinary Renal Health Clinic Record

Health Sciences Centre
Winnipeg

Interdisciplinary Renal Health Clinic Record
(ID: CKD Stages 1 -3)
Use IPN sheets if additional space required.

Date:_____

NURSE			**Completed by:**			
			Weight:	**kg (**	**kg since**	**)**
Blood Pressure/Pulse/Chest			**Assessment**			
BP#1:	BP#2:	BP Average:	Dyspnea:	**Y☐ N☐**	Edema:	**Y☐ N☐**
			Chest pain:	**Y☐ N☐**	Chest Clear:	**Y☐ N☐**
Pulse:			Urinary Symptoms:	**Y☐ N☐**	Other Physicians:	
CVD Risk Factors:						
Diabetes Control:		A1C:	FBS:		RBS:	
Smoking:		**Y☐ N☐**	Cholesterol Level:			
Comments:						
Physician			**Completed by:**			
Comments:						
Blood work /Other tests prior to next clinic:			**☐ NRB**	**☐ Iron Stores**	**☐ PTH**	**☐ Other**
Return to Clinic / Next Appointment			**☐ ID**	**☐ NID**	**Site:**	
☐ Letter Dictated		**☐ Case Summary Dictated**			**☐ Case Summary Updated**	

Health Sciences Centre Winnipeg

Interdisciplinary Renal Health Clinic Record
(ID: CKD Stages 4 -5)
Use IPN sheets if additional space required.

Date:_____

NURSE			**Completed by:**		
			Weight: **kg (** **kg since)**		
Blood Pressure/Pulse/Chest			**Assessment**		
BP#1:	BP#2:	BP Average:	Edema: **Y☐ N☐**	Fatigue: **Y☐ N☐**	Cramps: **Y☐ N☐**
			Chest Clear: **Y☐ N☐**	Poor sleep: **Y☐ N☐**	Anorexia: **Y☐ N☐**
Pulse:			Dyspnea: **Y☐ N☐**	Restless legs: **Y☐ N☐**	Nausea / Vomiting: **Y☐ N☐**
Other Physicians			Chest pain: **Y☐ N☐**	Itch: **Y☐ N☐**	Urinary Symptoms: **Y☐ N☐**
Education			**Hepatitis B vaccine**		
NKF Binder:		**Y☐ N☐**	☐ Needs serology checked	☐ Anti-HbsAg neg. (not immune)	
1-on-1 education		**Y☐ N☐**	☐ Anti-HbsAg pos. (immune)	☐ 1st series	☐ 2nd series ☐
Renal Ed Classes		**Y☐ N☐**	_____ Dose ____ of _____		
Renal Replacement Plan / Vascular Comment					
Date:			Conservative	**Y☐ N☐**	RRT discussed: **Y☐ N☐**
Vascular Consult		**Y☐ N☐**	AVF created	**Y☐ N☐**	Date Created:
PD Consult		**Y☐ N☐**	Vascular Comment		
Transplant consult		**Y☐ N☐**			
Comments:					

Diabetic; (if yes: FBS, RBS, A1C)	**Y☐ N☐**	FBS:	_____	RBS:	_____	A1C:	_____

Health Sciences Centre Winnipeg

Interdisciplinary Renal Health Clinic Record (ID: CKD Stages 4 -5)

Use IPN sheets if additional space required.

Date:_____

Dietitian	Weight change____ Urea _____ Creatinine ____ Potassium ____ Protein _____ Albumin_____ $Ca_{corrected}$_____ Phosphate____	Comments:	**Physician notes/New Orders/Follow-up Plans**
Pharmacist	**Mineral Metabolism**	**Physician Comments**	
	PTH Alk Phos	☐ Agree	
	Anemia	☐ Agree	
	Hemoglobin TSAT (%) Ferritin		

	Hypertension/CV	☐ Agree		
			Return to clinic:	☐ ID ☐ NID
	Miscellaneous	☐ Agree	Blood work / Other tests prior to next clinic: ☐ NRB ☐ Iron stores ☐ PTH ☐ Hepatitis serologies	
Completed by:		**Dietitian:**	**Pharmacist:**	**Physician:**
Page 2 of 2 (Rev: Draft 9.0)	**Next Appointment:**			☐ Letter Dictated ☐ Case Summary Dictated/Updated

APPENDIX E: Northern Regional Diabetes Program Referral

NORTHERN HEALTH REGION

867 Thompson Drive S., Thompson MB R8N 1Z4
Phone: 204-677-5333 Fax: 204-778-1534

NORTHERN REGIONAL DIABETES PROGRAM REFERRAL

Client Information:

Name: _____ Address: _____

DOB: _____ Sex: Male ☐ Female ☐

PHIN: _____ Phone: (H): _____

Client's Primary Physician: _____ (W): _____

Client's Preferred Language: _____ Room #: _____ Discharge date: _____

Type of Diabetes	Diagnosis Date
☐ Type 1	
☐ Type 2	
☐ Gestational (number of weeks)	
☐ Impaired Glucose Tolerance/ Impaired Fasting Glucose	
☐ Insulin Start	**Insulin regime** –
Insulin adjustment parameters -	
☐ Newly Diagnosed	Diagnosis Date:

BRDP Office Use Only

Urgent Referral: □Yes □ No

Case Manager: _____

Entered in Database: □Yes □

No Date/Initial: _____

All Medication (Name and Dose): _____

Source: (The 2008 CDA Clinical Practice Guidelines)

Lab Tests & Screens	Standard Values	Results	Date
Glycated Hemoglobin (3 months)	<7.0 %		
Triglycerides (annually)	<1.5 mmol/L		
Low Density Lipoprotein (annually)	<2.0 mmol/L		
High Density Lipoprotein (annually)	> 1.0 mmol/ L		
Total Cholesterol/High Density Lipoprotein Ratio (annually)	<4.0 ratio		
Albumin/Creatinine Ratio – random urine (annually) **note: nephropathy results can be recorded under Complications*	<2.0 mg/mmol		
eGFR	<60		

Comorbidity conditions: _____

Other pertinent information: _____

Name of person completing: _____ **Date:** _____

Location: TGH__ NCC __ Community __ BCHRC __

#001-1-71535-00

April 2013