5-1-2006

The Needs of Patients in a Rural/Frontier Setting with Renal Insufficiency

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THE NEEDS OF PATIENTS IN A RURAL/FRONTIER SETTING WITH RENAL INSUFFICIENCY

by

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A Thesis
Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Science

Grand Forks, North Dakota
May
2006

This thesis, submitted by Nancy Carda in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Signature Nancy Carda

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ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to Dr. Bette Ide my advisor and thesis chairman, Dr. Ginny Guido, and Dr. Richard Vari committee members for their expert advice and guidance in the completion of this project.

A special thanks to First Care Health Center and The Doctors Clinic for granting me permission to do this study.

I am deeply indebted to my family, friends, and co-workers for their constant encouragement and support during my time in graduate school.

ABSTRACT

The purpose of this study was to identify any needs patients with renal insufficiency living in a rural/frontier setting may have. A chart review was conducted in a rural health care facility of all patients with diagnostic code 593.9. The following questions were asked: What are the characteristics of the patients in this rural/frontier setting? What is the difference in their levels of renal insufficiency? What risk factors are related to the level of renal insufficiency? In what ways do their risk factors compare with those identified in literature? The results of this study were compared to what is stated in literature about the cause of renal insufficiency. After reviewing the data collected it was found that females were older, more likely to have congestive heart failure, and had higher glomelular filtration rates (GFR) than males at all four time periods. There was a significant decrease in systolic and diastolic blood pressure and GFR over time. The significant predictors of GFR at Time 1 were younger age, higher systolic blood pressure, lower diastolic blood pressure, and more miles from the clinic. The results demonstrate the need for more aggressive management of hypertension by providers.

CHAPTER I

INTRODUCTION

Chronic Kidney disease affects more than 20 million Americans or one in nine adults, and most don't know it. There are at least another 20 million people who are at "increased risk" for developing the disease (National Kidney Foundation, 2003). Americans have an above average chance of developing the disease due to the changing numbers in the ethnic and aging populations. The causes of kidney disease, or renal insufficiency, have been well documented: (1) diabetes; (2) high blood pressure (hypertension); (3) family history of chronic kidney disease; and (4) older age. It has also been documented that there is increased risk for renal failure in African Americans, Hispanics, Asian or Pacific Islanders and American Indians. Research by the National Kidney Foundation (2002) has determined that 40% of kidney disease is caused by diabetes, 30% by hypertension, and 30% by other causes.

This study explored the prevalence of renal insufficiency in a small rural area of northeastern North Dakota. The population of the study community is 1400. The U.S. Bureau of Census defines rural as a population of 2500 or less. The facility in this study, though small, serves several outlying communities (within a 60 mile radius) whose population is much less.

Significance of the Study

It is unclear whether patients in rural areas are seeking and receiving the care that they need and how these patients compare to urban populations in regard to the risks for renal insufficiency. Diabetes is the only risk factor for renal insufficiency that has been studied in North Dakota. This study addressed the role of previously documented factors and how they relate to renal insufficiency. Once these data are evaluated and compared with results from national studies, one can identify the next steps toward determining possible educational needs of rural-dwelling patients diagnosed with renal insufficiency.

Purpose of the Study

The purpose of this study was to identify characteristics of persons with the diagnosis of renal insufficiency who live in a rural/frontier setting.

Conceptual/Theoretical Framework

A physiological framework of renal insufficiency was used for this study. Renal insufficiency and kidney failure are used interchangeably. Kidney failure is characterized by the failure of the kidney to remove all waste products. According to Dudley (2003), when kidney function decreases, there is a build up of waste products in the blood. If the build up is mild, no symptoms appear. If the failure continues, symptoms appear; this may take weeks or years. Renal failure is considered either acute or chronic. Acute renal failure occurs over days, week, and months, while chronic renal failure occurs slowly over years. People with uncontrolled hypertension and diabetes have been found to be at risk for developing kidney disease. Family history of diabetes and or hypertension is considered a risk for developing renal insufficiency. These concepts are more fully discussed in Chapter II.

CHAPTER II

REVIEW OF LITERATURE

The topics covered in the literature review are those that comprise the conceptual framework: physiologic factors that affect the kidney, leading to the renal insufficiency, and the factors related to renal insufficiency.

Defining Renal Insufficiency

To define renal insufficiency, the literature was reviewed for physiological aspects. Hansen (1998) explained that the urinary system is divided into the upper urinary tract, consisting of the kidneys, and the lower urinary tract consisting of the ureters, bladder, and urethra.

Inside each kidney there are 1 million nephrons. Each nephron has a glomerulus, capillaries and tubules. It is known as the functional unit of the kidney. It is damage to this functional unit (nephropathy) that determines the level of renal insufficiency (Hanson, 1998).

Each day the kidneys process about 200 quarts of blood. Of this, two quarts are filtered out as waste and extra water; this becomes urine. It is the glomerulus that does the filtering; each glomerulus is connected to a tubule which receives waste and chemicals, returning what can be used back to the body and sending the rest to the bladder as waste. The kidneys return sodium, potassium, glucose, bicarbonate and phosphorous back into the blood so it can return to the body. The kidneys also have

another function: they release three hormones to assist in continued whole body homeostasis. The hormones released are: (1) erythropoietin (EPO) which stimulates bone marrow to make red blood cells; (2) rennin , which regulates blood pressure; and (3) vitamin D, which helps maintain calcium balance.

Manifestations of Renal Insufficiency

> The symptoms associated with the renal insufficiency may be insidious. The symptoms of renal insufficiency are as follows; fatigue with decreased mental acuity, muscle cramps or twitching, anorexia, nausea, vomiting, and or an unpleasant taste in the patient's mouth, and finally the patient's skin may appear yellow or gray secondary to retention of urinary pigments. (Hanson, 1998, p. 540)

These patients may also experience anemia, acidosis, and lipid abnormalities as well as malnutrition. The malnutrition and anemia are due to the restriction of protein. The importance of diet cannot be expressed enough in some cases. Diet needs to be modified to reduce the intake of protein, sodium, potassium, fluids, and phosphate. There should be an addition of a water soluble multivitamin supplement to replace vitamins lost (Sloan, 2002).

The fatigue the patient feels is most likely due to the depletion of iron stores due to the decreased hormone erythropoietin production by the kidneys. This should be closely monitored, and anemia treated only when the Hematocrit falls below 18. Fatigue was the biggest and most frequently expressed complaint by patients. Anemia becomes more of a factor in chronic renal insufficiency due to shortened red blood cell survival with patients receiving hemodialysis; in these cases, Epoetin is given. Studies show, however, that this should be started long before the patient is in chronic failure (Onyekachi et al., 2001).

The diagnosis of renal insufficiency is made by monitoring of several lab values. These lab values can be monitored if a complete blood panel is done. The following labs

are monitored: Serum creatinine is a product of muscle metabolism; a rise in this value indicates a decrease in kidney function. Blood urea nitrogen (BUN) is a reflection of renal excretion of urea which is a product of protein metabolism. BUN may begin to rise with decrease in glomerular filtration rate. Urine creatinine measures the amount of creatinine excreted in the urine. Hematocrit and hemoglobin are both affected by the release of the hormone erythropoietin (EPO) from the kidney. Erythropoietin affects the body's ability to produce the red blood cells which carry oxygen to the rest of circulatory system. Potassium is a mineral which is freely filtered by the glomerulus; it is responsible for the resting membrane potential in muscle and cardiac cells. An increase or decrease in potassium level can cause irregular heart rhythm. Blood pressure is partially regulated by the hormone renin, which is synthesized by the kidney. In the blood stream, renin activates the protein angiotensin I. Angiotensin I circulates through the body and is converted to angiotensin II by angiotensin converting enzyme (ACE) in the lungs. Angiotensin II increases vasoconstriction and therefore reduces renal blood flow. Angiotensin II also stimulates the adrenal cortex to release aldosterone which promotes sodium and water reabsorption and ultimately blood pressure increases (Hansen, 1999). To prevent kidney damage, blood pressure needs to be maintained at a safe level between systolic 120-139 mmHg and diastolic 80-89 mmHg. as per The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7).

The glomelular filtration rate (GFR) indicates renal function. The measurement is done by using blood creatinine, age, ideal body weight, and gender. The GFR helps to determine the stage of renal insufficiency. The following numbers are entered into what is called the Cockroft-Gault equation (140-age) X (ideal body weight, IBW) divided by creatinine x 72 x (0.85 if female) = creatinine clearance (McCullough, 2003).

The creatinine clearance reflects the GFR and gives an indication of the adequacy of kidney function. To perform this measurement, a 24 hour urine is collected and at midpoint of this collection a plasma creatinine is obtained. The following formula is used: Ccr=Ucr (urine creatinine) x Uv (urine volume/per time) divided by Pcr (plasma creatinine) (Preisig et al., 1998).

The stages of kidney disease are:

- In Stage 1, there is kidney damage but a normal GFR(> 90 ml/min.);
- In Stage 2, there is kidney damage and a mild decrease in GFR (60-89 ml/min.);
- In Stage 3, there is a moderate decrease in GFR;
- (30-59 ml/min.);
- In Stage 4, there is a severe decrease in GFR (15-29 ml/min.);
- In Stage 5, kidney failure GFR (< 15 ml/min.).

To determine who is at risk for kidney disease, there is a short self test which any one over the age of 18 can take. It is called the Kidney Early Evaluation Program (KEEP) test. The test consists of five simple questions: (1) Do you have high blood pressure? (2) Do you have diabetes? (3) Do you have a parent, grandparent, brother or sister with high blood pressure? (4) Do you have a parent, grandparent, brother or sister with diabetes? (5) Do you have a parent, grandparent, brother, or sister with chronic kidney failure? A yes answer to any of these questions places one at risk for kidney disease (National Kidney Foundation, 2004).

Research Studies

The following studies show that the most frequent factors found to be related to renal disease are diabetes, hypertension, and/or family history of renal insufficiency. Fadem (1999) conducted a 2-year longitudinal study (1997-1999) for the Nephron Information Center. The findings revealed that approximately 16 million Americans have

diabetes and, of those, 10 million have early renal insufficiency. The data also revealed that, in the 10 years prior to 1999, the incidence of diabetes induced renal insufficiency rose sharply. As a result of this study, published guidelines were developed for early interventions in diabetic patients with renal insufficiency. The author suggested that the patient provider should start working with the patient when the serum creatinine is greater than 1.5mg/dl (women) and 2.0mg/dl (men) and when the urine albumin/creatinine ratio is > 30.

Young et al. (2002) conducted a study which addressed systolic hypertension in older adults. The study looked at the relationship between baseline blood pressure and the incidence of decline in kidney function. The decline in kidney function is defined as an increase in serum creatinine equal to or greater than 0.4mg/dl over a five year follow up (Young et al., 2002 p. 2776). The study began by recruiting 4736 men and women over the age of 65. Participants with creatinine levels >2.0mg/dl were excluded, leaving 4425 participants. To determine the risk of decline in kidney function associated with blood pressure in older men and women, 2181 participants were selected for the randomized placebo group. Participants were evaluated by doing four sets of blood pressures; an average was then used for baseline. Exclusion criteria included anyone with past history of myocardial infarction, stroke, cancer, alcoholic liver disease, insulin dependent diabetes, depression and kidney failure. Serum creatinine levels were then assessed. A baseline serum creatinine was established and a yearly outcome of 0.4mg/dl was chosen as a point of significance. Patients who were currently taking anti-hypertensive drugs stopped these medications for two weeks before their serum creatinine levels were assessed; if their level was 2.0 mg/dl, they were excluded. It was concluded that participants with higher systolic blood pressure tended to be older, were more often women, and had lower diastolic blood pressures .This study also concluded that systolic

blood pressure is a strong independent risk factor for the decline in kidney function (Young et al., 2002).

Mann et al. (2001) reported the results of the HOPE (Heart Outcomes and Prevention Evaluation) study. This was a randomized, double blind study involving 980 patients with renal insufficiency and 8,307 patients with normal renal function. The primary purpose of the study was to measure the incidence of cardiovascular death, myocardial infarction, and/or stroke in clients with renal insufficiency. The study included men and women over the age of 55 who had at least one cardiovascular disease. In addition, a serum creatinine of at least 1.4mg/dl identified which patients had renal insufficiency. This study concluded that if patients had a vascular disease or diabetes combined with another cardiovascular risk factor and mild renal insufficiency, they were at twice the risk of more cardiovascular events and or mortality. The authors further concluded that even mild renal insufficiency should be seriously considered as a cardiovascular risk factor. They noted that Angiotensin-converting enzyme (ACE) inhibitors decreased the risk of cardiovascular disease in patients with renal insufficiency and should not be discontinued because there may be an increase in serum creatinine (Mann et al., 2001).

Mann et al. (2000) also studied the effects of ACE inhibitors and progression of renal insufficiency. When ACE inhibitors were used in trials with animals, there was a significant slowing of the progression of renal insufficiency. Men and women were recruited between the ages of 18 and 70, with creatinine levels 1.5-4.0 mg/dl. During this trial, blood pressure was treated to maintain diastolic levels less than 90 mm/hg. Insulin dependent diabetics were excluded. The sample consisted of a drug group and a placebo group. Several subjects dropped out of the study for various reasons and there was a higher mortality rate among the drug group. It was concluded that more study needs to be done with ACE inhibitors in patients with renal insufficiency. Mann suggested that

perhaps this classification of drug was harmful to participants who had renal problems. They stated that:

> cumulative incidence of primary outcome (myocardial infarction, cardiovascular death and all death for patients with a serum creatinine concentration less than 1.4 mg/dl or at least 1.4 mg/dl) was higher in patients with renal insufficiency than in those without. Patients with renal insufficiency had a substantially increased risk for cardiovascular death and increased total mortality rate. The ACE inhibitor, Ramipril, reduced the incidence of primary outcomes in patients with and those without renal insufficiency. Mortality and heart failure was greater in patients with renal insufficiency than those without. (Mann et al., 2001, p.4)

A study conducted in Japan used a meta-analysis to study the effect of ACE – inhibitors on outcomes in patients with renal insufficiency. This analysis compared 15 other studies that had been conducted on the use of ACE inhibitors. All 15 studies concluded that: "ace-inhibitors are effective in controlling the progression of renal disease not only in patients with elevated serum creatinine above 3.0mg/dl but also in patients with serum creatinine below 3.0mg/dl. Future research will be conducted to clarify the risks and benefits" Terajima, 2003).

The following findings were reported by Knobler (2004) from a study of the reduction in glomelular filtration rate in diabetic patients. Seventy seven patients had a reduced GFR < 60ml/min compared to 177 patient with GFR >60ml/min; the reduced GFR group was older and had a longer duration of diabetes and a significant two-fold increase in cardiac events. The study concluded that a reduced GFR was common in asymptomatic diabetic patients. The results of the multivariate analysis showed the reduced GFR to be the independent variable that predicts cardiac events.

The Prospective Cohort Study of Chronic Renal Insufficiency (CRIC) is currently in progress. It is a longitudinal cohort study of 300 persons ages 21 to 74 with mild to

moderate chronic renal insufficiency. The cohort is racially and ethnically diverse (40% white, 40% African American, and 20% other), and approximately half of the participants have a diagnosis of diabetes mellitus. This is a seven year study to develop a perspective of the racial, ethnic and gender composition of persons with End Stage Renal Disease (ESRD). This study also makes a statement about previous and current studies: "all have had important shortcomings, small sample size, short term follow up, use of select populations, lack of ethnic and racial diversity, low rate of female participants, limited assessment of potential risk factors, and inclusion of select causes of renal disease" Feldman (2003).

Research Questions

The following questions were addressed in the current study:

1. What are the characteristics of adults in a rural/frontier area with renal insufficiency in relation to:

   Demographics

   Co-morbidities

   Medications

   Lab values

   Health care use (clinic visits and hospitalizations)

   Support systems
2. What differences are there in the levels of renal insufficiency?
3. What risk factors are related to the level of renal insufficiency?
4. In what ways do their risk factors compare with those identified in the literature?

Definitions

Rural/frontier: population density of this area served ranges anywhere from 3.2 to 9.7 persons per square mile as stated by North Dakota Bureau of Census.

Renal Insufficiency: is determined by the glomelular filtration rate (GFR). The stages are defined on page six.

Demographics:

Distance from clinic: the miles the participants have to travel from their home to health care center.

Age: year they are in life cycle

Sex: male or female

Co-morbidities: include other diseases such as: diabetes; hypertension; congestive heart failure (CHF); and coronary artery disease (CAD).

Medications: medications for diabetes and/or hypertension since these are the primary cause of renal insufficiency.

Lab values: there are many that are monitored and these are listed in the literature. Values reflecting the frequency and progression of disease as listed on pages five and six were included in this study.

Support system: the status of family members, whether they lived alone and who served as primary care givers.

Family risk factors: as listed in literature as family history of renal insufficiency, diabetes, and/or hypertension

CHAPTER III

STUDY DESIGN

This chapter will explain the design of this study and the variables which were looked at for this study. The study design is that of a chart review of patients with the diagnostic code 593.9 in a rural health care facility. The chart review examined several variables: age, sex, diagnosis, frequency of exams, lab values, medications, distance from the facility, and social support. The study site was a 14 bed Critical Access Hospital and a Rural Health Clinic which has two Family Practice Physicians, and one Physician Assistant. There was also a doctor's clinic which employs one part time surgeon.

Population and Sample

The population was all patients with the diagnosis of renal insufficiency within 60 miles of study facility who had been hospitalized or treated in this small rural hospital/clinic setting during a one year period. The areas where these patients live are all highly rural and the area is considered low income. The patients included for this study had the diagnosis of renal insufficiency, which is identified by the International Classification of Diseases 593.9. The data were collected for four times over a one year period for more accurate comparison and validity. The following measures were collected: 1. Age, 2. Sex, 3. Diabetes or history of, 4. Hgb. A1c, 5. Medications for diabetes, 6. Hypertension or history of, 7. Blood pressure medications, 8. Anemia, 9. GFR, 10. BUN, 11. Serum Creatinine, 12. Hgb., 13. Hct. 14. Other co-morbidities, 15.

Distance from the clinic/hospital, 16. A positive family history for diabetes, hypertension, and renal problems or insufficiency. All charts with complete date were included resulting in a sample size of 85. In one case only one value required for calculation of the GFR was missing for Time 2 and Time 3. This case was not included, in data analysis related to the GFR for those time periods. Random numbers were assigned to medical record numbers to protect privacy.

Human Subjects

Prior to data collection, permission for this study was granted by the Institutional Review Board (IRB) at the University of North Dakota and the facility administration, with the assurance that the patient's privacy would be protected according to HIPPA guidelines with oversight of the facility health information director. The data collection form is presented in Appendix A. Random numbers were assigned to medical record numbers to protect privacy. The number was used by the reviewer for reference. Permission from IRB was sought and given under the condition that the data would be kept in a double locked system with the only access by this researcher and the head of Health Information Services in the facility in which the data was collected. These records will remain locked for a three year period and then destroyed. As stated earlier, each chart number was given a dummy number to be used only by the researcher if needed to recheck any data. No names or other information which could identify the patient or their chart were collected.

Statistical Analysis

The first research question asked about the characteristics of rural/frontier adults with renal insufficiency. It was addressed using descriptive statistics, frequencies, and

cross-tabulations by gender. To answer the second research question, involving changes in the level of renal insufficiency, mean levels of renal insufficiency as measured by the GFR were plotted at four points over the year. This was done by using the four visits for health care over a one year period. The third research question asked what risk factors are related to renal insufficiency. A multiple regression analysis was used to answer this question. The dependent variable was the GFR at time one. The independent variables, or predictors, were: age, ACE inhibitor, systolic B/P, diastolic B/P, number of miles from the clinic, diabetes, and family history of hypertension and diabetes. These variables were measured as dichotomous (0= no, 1= yes) variables. Creatinine level and sex were not included as independent variables because they are involved in calculation of the GFR. The analysis looked at the beta values, each of which shows the degree of change in the dependent variable (GFR) with all of the other independent variables kept constant. To answer the fourth research question, results from major studies of risk factors related to renal insufficiency were compared with the results from this study.

CHAPTER IV

RESULTS

The purpose of this study was to identify possible needs of persons with the diagnosis of renal insufficiency in a rural frontier area. To achieve this, a chart review was conducted in a small rural healthcare facility in northeastern North Dakota. The data collection instrument included not only demographic information but information that would answer the four research questions as they refer to persons in a rural/frontier area with the diagnosis of renal insufficiency. The time period over which data were collected was four visits over one year.

Research Question Number One: What are the characteristics of adults in a rural/ frontier area with renal insufficiency in relation to: Demographics, Co-morbidities, Medications, Lab Values, Health Care Use and Support Systems? Tables 1 through 7 show frequencies and percentages that compare males and females by age groups, diagnosis, family history of disease, distance from clinic, systolic and diastolic blood pressures at times one and GFR at all four times for the total sample. There were only four patients who did not have any type of support system (percentages may total greater than 100% due to rounding).

The number of males versus females in this study was almost equal with 42 males and 43 females. Males dominated the 70-79 year age group (35.7%) and females dominated the 80-89 year age group (53.5%). The predominant diagnosis was

hypertension (41.2%).A larger percent of the females than the males had hypertension (46.5% females versus 35.7% males), although the reverse was true for a diagnosis of diabetes. Nearly a quarter (23.3%) of the females had a diagnosis of CHF, while a larger percent of the males had CAD (19.6%).

Table 1. Age Group.

	Male		Female		Total	
Age	#	%	#	%	#	%
35-39 Years	3	7.1	0		3	3.5
60-69 Years	4	9.5	4	9.3	8	9.4
70-79 Years	15	35.7	8	18.6	23	27.1
80-89 Years	13	31.0	23	53.5	36	42.4
90 + Years	7	16.7	8	18.6	15	17.6
Total	42	100	43	100	85	100

Table 2. Diagnosis of Disease.

	Male		Female		Total	
Diagnosis	#	%	#	%	#	%
Hypertension	15	35.7	20	46.5	35	41.2
Diabetes	5	11.9	7	16.3	12	14.1
Hypertension./Diabetes	8	19.0	3	7.0	11	12.9
CHF	4	9.5	10	23.3	14	16.5
CAD	8	19.0	3	7.0	11	12.9
Cancer	2	4.8	0	0	2	2.4
Total	42	49.4	43	50.6	85	100

Table 3. Family History of Disease.

Disease	Male #	Male %	Female #	Female %	Total #	Total %
Hypertension	24	58.5	18	41.9	42	50.0
Diabetes	6	14.6	10	23.3	16	19.0
Hypertension./Diabetes	4	9.8	6	14.0	10	11.9
Renal Problems	4	9.8	7	16.3	11	13.1
Renal /Hypertension.	2	4.9	2	4.7	4	4.8
Renal/Diabetes	2	2.4	0	0	2	1.2
Total	42	48.8	43	51.2	85	100

Family history of disease also varied between males and females. Males were more likely to have a family history of hypertension and females one of diabetes.

More than half of the patients lived within 10 miles of clinic. Males were more likely than females to live more than 10 miles from the clinic (50.4% versus 44.1%).

Table 4. Distance From Clinic.

Miles from Diagnosis	Male #	Male %	Female #	Female %	Total #	Total %
1-10 Miles	21	50.1	24	55.8	45	52.9
11-20 Miles	7	16.8	10	23.2	17	20.0
21-30 Miles	6	14.4	4	9.3	10	11.8
31-40 Miles	4	9.6	1	2.3	5	5.9
41-55 Miles	4	9.6	4	9.3	8	9.4
Total	42	100%	43	100%	85	100

Systolic and diastolic blood pressure at Time 1 were examined (see Tables 5 and 6). A larger percentage of females (76.8%versus 66.7% for males) had a systolic blood pressure exceeding 120mm/Hg., but males had a higher percentage (39.4% versus 24.3% for females) with a diastolic blood pressure of 80mm/Hg or more.

Table 5. Systolic Blood Pressure at Time 1.

Systolic Blood Pressure x 1	Male		Female		Total	
	#	%	#	%	#	%
90-120 mm Hg	14	33.3	10	23.3	24	28.2
121-139 mm Hg	13	31.0	14	32.6	27	31.8
140 + mm Hg	15	35.7	19	44.2	34	40
Total	42	100	43	100	85	100

Table 6. Diastolic Blood Pressure at Time 1.

Diastolic Blood Pressure	Male		Female		Total	
	#	%	#	%	#	%
60-69 mm Hg	8	24.2	13	35.1	21	30.0
70-79 mm Hg	12	36.4	15	40.5	27	38.6
80-89 mm Hg	13	39.4%	9	24.3%	22	31.4%
Total	33	47.1%	37	52.9%	70	100%

Table 7 shows male and female differences in GFR at all four times. At all times the females had higher GFR's. At all times, higher percentage of females than males were at stages 3 and 4 of renal insufficiency.

Table 7. Glomelular Filtration Rate at Times 1-4 by Sex.

GFR x 1	Male #	Male %	Female #	Female %	Total #	Total %
>90 ml./min	14	33.3	5	11.6	19	22.4
60-89ml./min	15	35.7	10	23.3	25	29.4
30-59 ml./min	11	26.2	22	51.2	33	38.8
15-29 ml./min.	2	4.8	6	14.0	8	9.4
Total	42	100	43	100	85	100

GFR x 2	Male #	Male %	Female #	Female %	Total #	Total %
>90 ml./min.	11	26.8	6	14.0	17	20.2
60-89 ml./min.	13	31.7	5	11.6	18	21.4
30-59 ml./min.	14	34.1	24	55.8	38	45.2
15-29 ml./min.	3	7.3	8	18.6	11	13.1
Total	41	100	43	100	84	100

GFR x 3	Male #	Male %	Female #	Female %	Total #	Total %
>90ml./min.	10	24.4	4	9.3	14	16.7
60-89 ml./min.	14	34.1	12	27.9	26	31.0
30-59 ml./min.	13	31.7	16	37.2	29	34.5
15-29 ml./min.	4	9.8	11	25.6	15	17.9
Total	41	100	42	100	84	100

GFR x 4	Male #	Male %	Female #	Female %	Total #	Total %
>90 ml./min.	10	23.8	4	9.3	14	16.5
60-89 ml./min.	11	26.2	9	20.9	20	23.5
30-59 ml./min.	13	31.0	20	46.5	33	38.8
15-29ml./min.	8	19.0	10	23.3	18	21.2
Total	42	100	43	100	85	100

Research Question Number Two: What are the differences in levels of renal insufficiency? The Friedman analysis of variance by ranks tested the difference across time in systolic and diastolic blood pressure and GFR clearly answers this question. The Friedman analysis of variance by ranks is the non -parametric equivalent of the within subjects repeated measures ANOVA. The independent variable was time, which has four levels. The dependent variables are the systolic blood pressure and diastolic blood pressure and GFR. The results of the Friedman are shown in tables 8, 9, and 10. The Friedman Test results show statistically significant decreases in the systolic and diastolic blood pressure and the GFR from Time .One to Time Four. The largest decrease appears between Time 2 and Time 3 for blood pressures and between Time 3 and Time 4 for the GFR.

Table 8. Systolic Blood Pressure at Times 1-4, Friedman Test (N=85).

Time	Mean	Mean Rank	Chi-Square	Significance
Time 1	134.059	2.66	17.688	.001
Time 2	138.577	2.89		
Time 3	131.576	2.27		
Time 4	129.870	2.18		

Table 9. Diastolic Blood Pressure at Times 1-4, Friedman Test (N=85).

Time	Mean	Mean Rank	Chi-Square	Significance
Time 1	71.177	2.54	13.474	.004
Time 2	72.823	2.89		
Time 3	69.705	2.28		
Time 4	68.7529	2.28		

Table 10. Glomelular Filtration Rate at Times 1-4, Friedman Test.

Time	Mean	Mean Rank	Chi-Square	Significance
GFR 1	71.414	2.97	20.974	.000
GFR 2	67.119	2.52		
GFR 3	65.292	2.42		
GFR 4	62.013	2.08		

Research Question Number Three: What risk factors are related to the level of renal insufficiency? This question was addressed with a multiple regression analysis; dummy variables were created for diabetes, family history of diabetes, and family history of hypertension. Because systolic and diastolic blood pressure at Time 1 were included, a diagnosis of hypertension was not included. Calculations for the creation of the dummy variables are shown in Table 11. Results of the Multiple Regression are listed in Table 12.

The significant predictors of GFR Time 1 were: younger age, higher systolic blood pressure, lower diastolic blood pressure and more miles from the clinic. Use of ACE inhibitors, diagnosis of diabetes, and family history of diabetes or hypertension were not significant predictors. The equation yielded an R Square of .377, meaning that over 37% of the variance in the GFR was explained by this combination of variables. The F ratio was statistically significant. A similar analysis was conducted with GFR at Time 4 as the dependent variable and including GFR at Time 1 as a predictor. The only significant predictor of GFR Time 4 was GFR Time 1.

Table 11. Dummy Variables for Diabetes, Family History of Diabetes/Hypertension.

Original Variable	If	Target Variable	Equals
Diagnosis of Diabetes	1	Diabetes	0
	2	Diabetes	1
	3	Diabetes	1
	4-6	Diabetes	0
Family History	1	Family History Hypertension	1
Hypertension	2	Family History Hypertension	0
	3	Family History Hypertension	1
	4-6	Family History Hypertension	0
Family History Diabetes	1	Family History Diabetes	0
	2	Family History Diabetes	1
	3	Family History Diabetes	1
	4-6	Family History Diabetes	0

Table 12. Predictors of GFR at Time 1: Multiple Regression

Predictor	Beta	Sig.	F	Sig. of F
Age	-.499	.000	5.674	.000
Ace Inhibitor	-.131	.168		
Systolic B/P T1	.257	.026		
Diastolic B/P T1	-.213	.056		
Number of Miles From Clinic	.191	.050		
Diabetes	-.037	.756		
Family Hx. Diabets	-.065	.605		
Family Hx.Hypertension.	.163	.111		

R Square = .377

Research Question Number Four: In what way do the risk factors compare with those identified in literature? The following table compares the risks of participants in this study versus those found in literature. There are no tables available in the literature that depict percentages of risk factors.

Table 13. Predictors of Renal Disease.

	Literature	Carda Study
Diabetes	40%	28.5%
Hypertension	30%	57.5%
Other	30%	24.0%

Source of Data : National Kidney Foundation, 2004

Thus, this study showed a much greater percentage of participants with hypertension and a much lower percentage of participants with diabetes than stated repeatedly in the literature.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

The purpose of this study was to assess the needs of patients diagnosed with renal insufficiency living in a rural/frontier setting. A chart review of all patients with 593.9 diagnostic code (renal insufficiency) was conducted. The sample size was 85 (42 males and 43 females).

Conclusions and Discussion

The first research question asked about the characteristics of the sample. Percentages of males and females were compared in regard to age, distance from the clinic or access to health care, support system, medications and co-morbidities. The co-morbidities examined in this study were hypertension, diabetes, congestive heart failure (CHF), coronary artery disease (CAD), and cancer. The patients ranged in age from 35 to 90 plus years. The largest age group for men was the 70-79 year age group and for the women the 80-89 year age group. The 80-89 year age group was the largest with a total of 36 patients.

Hypertension was the predominant disease diagnosis (35.7% of the males, and 46.5% of the females). Diabetes as well as a diagnosis of both diabetes/hypertension were second and third, 11.9% males and 16.3% females and 19.0% males and 7.0% females, respectively. The other co-morbidities (CHF, CAD, and Cancer) were present in 27 patients. The most prominent of these was CHF (9.5% of males and 23.3% of females).

Examination of the data found that only 23 of the participants were taking an ACE inhibitor. The literature states that the use of an ACE inhibitor for hypertension with renal insufficiency reduces cardiac risks. An article by Reis (2002) stated that mild renal insufficiency may be an independent predictor of atherosclerotic coronary heart disease (CAD) in women; women with mild renal insufficiency were times more likely to have significant CAD than those with normal renal function. One could only speculate that the lack of ACE inhibitor use could be considered a contributing factor to the high incidence of CHF among the women in this study.

The distance from the clinic was a statistically significant predictor of Time 1 GFR. Over half of the patients lived within 10 miles of available health care. There was a greater percentage of females than males living more than 10 miles from clinic. This could be important because these patients tended to be in their 70's and 80's and possibly dependent on family for transportation. This is often the case in rural areas.

The hypertension risk factors according to Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation (JNC7) are: normal blood pressure <120/<80mmHg, pre-hypertension 120-139/80-89, and hypertension ≥140/≥90. The systolic blood pressure results at Time 1 revealed 31.0% of male and 32.6% of female patients were in the pre-hypertension category and 35.7% of males and 44.2%of females were in the hypertension category. The diastolic blood pressure results at time 1 revealed 36.4% of males and 40.5% of females at the pre-hypertension stage and 39.4% of males and 24.3% of females at the hypertension stage. These results suggest that the systolic blood pressure, not the diastolic, may be the greater concern. This is contrary to what has

been our current position on the importance of elevations in systolic versus diastolic pressures in hypertension. All patients had an initial blood pressure check, but not all patients had their blood pressure checked on subsequent visits. Charts lacking the data available to calculate the GFR for at least two times in a one year period were excluded. All charts with complete data were included making up our sample size of 85.

Family history of disease, especially diabetes and hypertension, the two main predictors of renal insufficiency, were studied along with the history of renal problems. The family history of hypertension amongst men was 28.2% compared to 21.2% for women. The history of diabetes was much less for men (14.6%) than for women (23.3%). There were more patients with the actual diagnosis of diabetes and hypertension than their family history shows. Family history of disease was not a significant predictor of the GFR at Time 1, although the literature states it is an important risk factor. It is unclear from this study how much attention in assessments is given to family history of disease. Reasons for this inconsistency may be related to the chart review as family history may have not been always recorded or recorded accurately.

The main lab values examined were the BUN and Serum Creatinine; these were used along with the age, weight, and sex to determine the level of kidney function. This is expressed as the Glomelular Filtration Rate (GFR). At Time 1, 38.8% of patients were at stage 3; this increased to 45.2% at Time 2, then decreased to 34.5% at Time 3 and 38.% at Time 4. There was a slow increase in the percent at stage 4 across the four time periods. The GFR of patients at the other times were constant at a range of 35% to 38%. A greater percent of males, than females were at mild and stage two or higher stages across all four time

periods. These results may reflect better monitoring of medications and other factors after the medical diagnosis was made. They also may reflect the younger age of the men. There is nothing in the data that would indicate why the changes occurred at these times. It may have occurred with a change or addition of medications, or the first time treatment was sought. Literature states that a decrease GFR is a predictor of cardiac events. It is paramount that the GFR be monitored closely over time.

A comparison of the study results regarding risk factors with the percentage listed in the literature yielded a major discrepancy. The literature states that 40% of those with renal insufficiency had diabetes and 30% had hypertension (National Kidney Foundation, 2003). The study results indicate that 57.5% of the patients had hypertension and only 28.5% had diabetes (excluding those with both diagnoses). One could only speculate why this discrepancy occurred. A possible reason is lack of education about hypertension. Little patient education is conducted with the newly diagnosed hypertension patient, as compared to the newly diagnosed diabetic who undergoes many hours of education. Another reason for the discrepancy may be related to the change in the diagnostic criteria for hypertension. Lowering of these normal values may increase the number of patients diagnosed with hypertension.

Study Limitations

The main limitation to this study is the chart review design, which limited the sample size. The numbers of patients were definitely available, but the data to support their illness was not. It was difficult to conduct a multiple regression, as the number of predictors that could be used in a multiple regression was limited. The limitations in the

design are thus congruent with those in many of the other previous studies. They tended to be small with limited data.

Recommendations for Further Study

More study needs to be done in the area of prescribing an ACE inhibitor, or at least the reasoning why one is not being used, or if it has been used and failed. No data were collected in this study regarding other types of blood pressure management being used in the rural area. There were no data collected in regard to the number of patients who actually had a 24 hour urine study. This should be investigated if a similar study is conducted. If a 24 hour urine is ordered and not completed, perhaps compliance is a factor.

It would be interesting to interview each of the patients with 593.9 diagnostic code to see what they actually know about their renal insufficiency and its causes. Questions should address whether they have hypertension and what they know about their disease. The data collected from these interviews could then be used to develop an educational tool for patients and their families as well as a tool for the professional to teach patients about their high blood pressure and the risks which are present.

Recommendations for Practice

This study has definitely yielded greater awareness of the incidence of hypertension and educational needs that need to be met. Providers need to be more aggressive with their patients in the area of hypertension as well as providing more educational opportunities for the communities that they serve. An educational tool that will help patients in the rural setting become more aware and possibly better informed

about their disease needs to be developed. A greater emphasis also needs to be placed on provider awareness of family history of disease, particularly hypertension.

A lot of emphasis in literature and in practice appears to focus more on the diagnosis of diabetes and patient education. This study results suggest that there may be a shift more in the direction of hypertension and cardiac disease, though there may or may not be some areas where diabetes is the prevalent diagnosis among patients with renal insufficiency.

Summary

This research study began due to the increased numbers of patients being seen with a common diagnosis of renal insufficiency. It set out to discover why this increase occurred in this rural area. The study sample and design varied only slightly from what is stated in literature. For example, it was small, lacked ethnic and racial diversity and only had a limited assessment of risk factors, which compares quite well to a statement made in a report on the CRIC Study (Kusek, 2003). An unexpected result was the important role of elevated systolic blood pressure as a predictor of renal insufficiency. This result is contrary to what has been taught in the past about hypertension. The higher percentage of patients with hypertension versus diabetes was also amazing. It will be interesting to see the outcome of the CRIC study when it is completed in 2010.

APPENDIX
DATA COLLECTION FORM

#_____

mr#_____

AGE_____ SEX_____

DIAGNOSIS_____

MEDICATIONS:_____

_____

_____

_____

DIAGNOSIS_____

MEDICATIONS

_____

_____

_____

_____

DIAGNOSIS_____

MEDICATIONS:_____

_____

_____

	(T/1)	(T/2)	(T/3)	(T/4)
BUN				
CREATININE				
HGB				
HCT				
GFR/STAGE				
HGB A1C				
# CLINIC VISITS				

	(T/1)	(T/2)	(T/3)	(T/4)
SYSTOLIC B/P				
DIASTOLIC B/P				
WEIGHT				

HOUSEHOLD COMPOSITION

RELATIONSHIP	AGE	CAREGIVER

SOCIAL SUPPORT CHANGE WITHIN THE YEAR PRIOR TO STUDY? YES NO WHO_____

MARITAL STATUS: SINGLE___ DIV./SEP.____ MARRIED___ WIDOWED___

LIVING ARRANGEMENT OF PATIENT:_____

REFERRALS: YES NO DATE_____

STAGE OF DISEASE: T/1_____, T/2_____, T/3_____, T/4_____

FAMILY HISTORY: DIABETES_____ HYPERTENSION_____ RENAL PROBLEMS_____

MORTALITY: YES NO DATE OF DEATH_____

DISTANCE FROM CLINIC/HOSPITAL_____MILES

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