

Chronic Renal Disease Management Tool Tutorial Introduction

Because renal disease is so common in the population SETMA treats and because SETMA treats so many patients with diabetes, which is the most common cause of chronic renal failure and ESRD, and because it is possible effectively to delay the progression of chronic renal disease, SETMA has incorporated the National Kidney Foundation's (NKF) treatment guidelines into our tutorial. The following introduction provides an overview of chronic kidney disease. The importance of this material is seen when you review the education piece which is found on the Evaluation Template under the heading entitled "Kidney Structure." It states:

"The two kidneys each contain 1.0-1.3 million independent nephrons. Possibly one-third of the nephrons could be lost to a chronic disease process or nephrotoxicity without a noticeable reduction in the whole-kidney glomerular filtration rate. If the remaining two-thirds of the nephrons hypertrophied so that the single nephron filtration rate increased by 50%, the whole-kidney glomerular filtration rate would remain the same.

"As a result, the kidney can suffer considerable damage before losing sufficient function to modify the normal clinical indicators of renal disease, such as the serum creatinine concentration. Approximately 50% or more of renal capacity can be lost before serum creatinine levels become abnormal and the disease is detectable clinically:"

It is our hope that the incorporation of the knowledge and treatment strategies identified by the NKF and presented here will improve the quality of care received by patients treated by SEMTA. The following "Clinical Review" is the work of the NKD.

Chronic Renal Disease - Clinical Review

Early identification and active management of patients with renal impairment in primary care can improve outcomes. The number of patients with end stage renal disease is growing worldwide. About 20-30 patients have some degree of renal dysfunction for each patient who needs renal replacement treatment. Diabetes and hypertension are the two most common causes of end stage renal disease and are associated with a high risk of death from cardiovascular disease.

Mortality in patients with end stage renal disease remains 10-20 times higher than that in the general population. The focus in recent years has thus shifted to optimizing the care of these patients during the phase of chronic kidney disease, before the onset of end stage renal disease. This review summarizes current knowledge about the various stages of chronic renal disease, the risk factors that lead to progression of disease, and their association with common cardiovascular risk factors. It also provides strategies for intervention at an early stage of the disease process, which can readily be implemented in primary care, to improve the overall morbidity and mortality associated with chronic renal disease.

- Significant renal dysfunction might be present even when serum creatinine is normal or only slightly abnormal
- Renal function declines progressively once creatinine clearance falls by about 25% of normal, but symptoms are often not apparent until renal failure is advanced
- The baseline rate of urinary protein excretion is the best single predictor of disease progression
- The prevalence of common cardiovascular risk factors is high in chronic renal disease; early identification and effective control of these risk factors is important to improve outcomes
- Cardiovascular disease accounts for 40% of all deaths in chronic renal disease
- Potentially reversible causes should be sought when renal function suddenly declines

- Irreversible but modifiable complications (anemia, cardiovascular disease, metabolic bone disease, malnutrition) begin early in the course of renal failure

Chronic renal failure is defined as either kidney damage or glomerular filtration rate less than 60 ml/min for three months or more. This is invariably a progressive process that results in end stage renal disease.

Serum creatinine is commonly used to estimate creatinine clearance but is a poor predictor of glomerular filtration rate, as it may be influenced in unpredictable ways by assay techniques, endogenous and exogenous substances, renal tubular handling of creatinine, and other factors (age, sex, body weight, muscle mass, diet, drugs). **Glomerular filtration rate is the "gold standard"** for determining kidney function, but its measurement remains cumbersome.

For practical purposes, calculated creatinine clearance is used as a correlate of glomerular filtration rate and is commonly estimated by using the Cockcroft-Gault formula or the recently described modification of diet in renal disease equation.

Methods for Estimating Creatinine Clearance (glomerular filtration rate) in ml/min/1.73 m²

- **Cockcroft-Gault formula** -- Creatinine Clearance = $[(140 - \text{Age}) \times (\text{Weight in kg})] / [0.8 \times (\text{Serum Creatinine in mg/dL})] \times (0.85 \text{ if female})$
- **Modification of Diet in Renal Disease Equation** -- Glomerular filtration rate = $186.3 \times (\text{serum creatinine})^{1.154} \times \text{age}^{0.203} \times (0.742 \text{ if female}) \times (1.21 \text{ if black})$

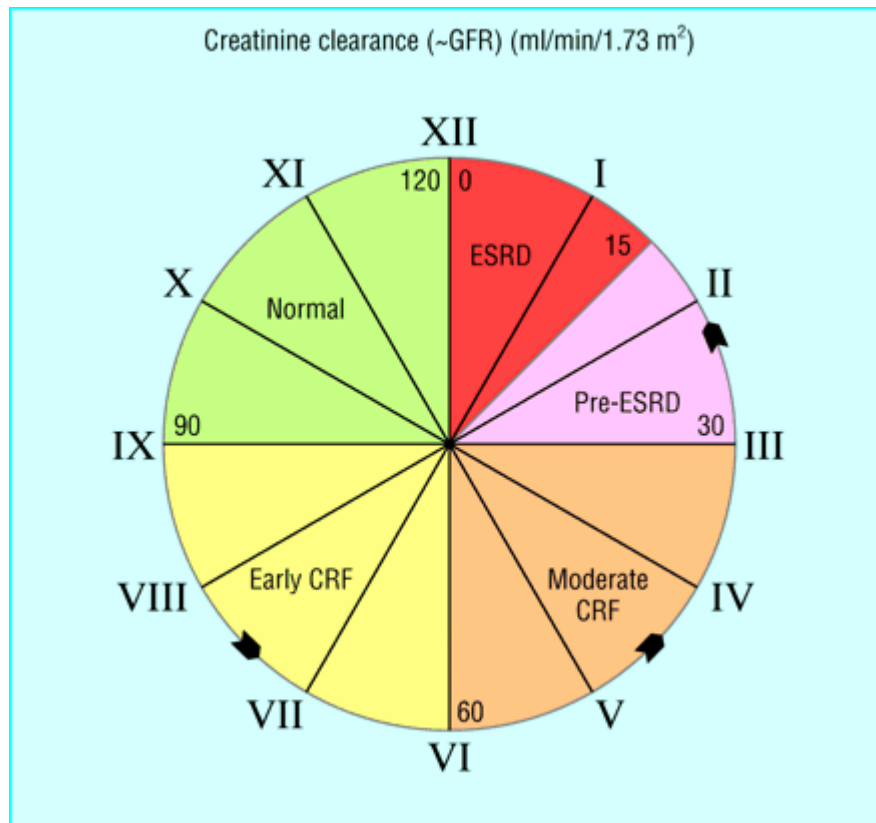
Chronic Renal Disease

Chronic renal disease is divided into five stages on the basis of renal function. Pathogenesis of progression is complex and is beyond the scope of this review. However, renal disease often progresses by "common pathway" mechanisms, irrespective of the initiating insult. In animal models, a reduction in nephron mass exposes the remaining nephrons to adaptive hemodynamic changes that sustain renal function initially but are detrimental in the long term.

Stages of Renal Dysfunction

Stage	Description	Creatinine Clearance (GFR) (mL/min/1.73m ²)	Metabolic Consequences
1	Normal or increased GFR - people at increased risk (box 2) or with early renal damage	>90	
2	Early renal insufficiency	60-89	Concentration of parathyroid hormone starts to rise (GFR=60-80)
3	Moderate renal failure (chronic renal failure)	30-59	Decrease in calcium absorption (GFR<50) Lipoprotein activity falls Malnutrition Onset of left ventricular hypertrophy Onset of anemia (erythropoietin deficiency)
4	Severe renal failure (pre-end stage renal disease)	15-29	Triglyceride concentrations start to rise Hyperphosphatemia Metabolic acidosis Tendency to hyperkalemia
5	End stage renal disease (uremia)	<15	Azotemia develops

Continuum of Renal Disease (anticlockwise model)



(CRF=chronic renal failure; ESRD=end stage renal disease; GFR=glomerular filtration rate)

Early Detection

Renal disease is often progressive once glomerular filtration rate falls by 25% of normal. Early detection is important to prevent further injury and progressive loss of renal function.

Patients at high risk should undergo evaluation for markers of kidney damage (albuminuria, abnormal urine sediment, elevated serum creatinine) and for renal function (estimation of glomerular filtration rate from serum creatinine) initially and at periodic intervals depending on the underlying disease process and stage of renal disease. Potentially reversible causes should be identified and effectively treated if a sudden decline in renal function is observed.

Risk Factors for Chronic Renal Disease

Risk factors (Factors that increase the risk of kidney damage)

- Age
- Diabetes*
- Hypertension*
- Family history of renal disease
- Renal transplant

Initiation factors (Factors that initiate kidney damage)

- Diabetes*
- Hypertension*
- Autoimmune diseases
- Primary glomerulopathies
- Systemic infections
- Nephrotoxic agents

Progression factors (Factors that cause progressive decline in renal function after onset of kidney damage)

- Persistent activity of underlying disease
- Persistent proteinuria
- Elevated blood pressure*
- Elevated blood glucose*
- High protein/phosphate diet
- Hyperlipidemia*
- Hyperphosphatemia
- Anemia
- Cardiovascular disease
- Smoking*

Other factors:

- elevated angiotensin II,
- hyperaldosteronism,
- increased endothelin,
- decreased nitric oxide

*Common modifiable cardiovascular risk factors

Definition of urinary albumin or protein excretion

- Normal albumin excretion: <30 mg/24 hours
- Microalbuminuria: 20-200 µg/min or 30-300 mg/24 hour or

in men urine albumin/creatinine 2.5-25 mg/mmol

in women urine albumin/creatinine 3.5-35 mg/mmol

- Macroalbuminuria (overt proteinuria): >300 mg/24 hour
- Nephrotic range proteinuria: >3 g/24 hour

Potentially reversible causes of worsening renal function

- Effective circulatory volume depletion: dehydration, heart failure, sepsis
- Obstruction: urinary tract obstruction
- Uncontrolled hypertension
- Toxic causes: nephrotoxic or radiocontrast agents

Diabetes

Diabetes is a common cause of chronic renal failure and accounts for a large part of the growth in end stage renal disease in North America. Effective control of blood glucose and blood pressure reduces the renal complications of diabetes.

Meticulous control of blood glucose has been conclusively shown to reduce the development of microalbuminuria by 35% in type 1 diabetes (diabetes control and complications trial) and in type 2 diabetes (United Kingdom prospective diabetes study). Other studies have indicated that glycemic control can reduce the progression of diabetic renal disease. Adequate control of blood pressure with a variety of antihypertensive agents, including angiotensin converting enzyme inhibitors, has been shown to delay the progression of albuminuria in both type 1 and type 2 diabetes. Recently, angiotensin receptor blockers have been shown to have renoprotective effects in both early and late nephropathy due to type 2 diabetes.

Management strategies for diabetic nephropathy (Ensure effective control of common cardiovascular risk factors for example, lipids, smoking at all times)

Initial stage (normal albumin excretion, <30 mg/24 hours):

- Optimal glycemic control (hemoglobin A1c <7%)
- Target blood pressure <130/80 mm Hg
- Monitor urinary albumin excretion

Incipient nephropathy (microalbuminuria, 30-300 mg/24 hour or 20-200 µg/min):

- Optimal glycemic control (hemoglobin A1c <7%)
- Target blood pressure <125/75 mm Hg
- Control urinary albumin excretion, irrespective of blood pressure
- Angiotensin inhibition

Overt nephropathy (albumin excretion >300):

- Optimal glycemic control (hemoglobin A1c <7%)
- Target blood pressure <125/75 mm Hg
- Control urinary protein excretion
- Angiotensin inhibition, irrespective of blood pressure
- Avoid malnutrition
- Modest protein restriction, in selected groups

Nephropathy with renal dysfunction:

- Optimal glycemic control; avoid frequent hypoglycemia
- Target blood pressure <125/75 mm Hg
- Angiotensin inhibition
- Watch for hyperkalemia
- Avoid malnutrition; consider protein and phosphate restriction

End stage renal disease:

- Renal replacement transplantation or dialysis
- Monitor for hyperkalemia
- Hold angiotensin inhibition (when glomerular filtration <15 ml/min) in selected patients

Hypertension

Hypertension is a well established cause, a common complication, and an important risk factor for progression of renal disease. Controlling hypertension is the most important intervention to slow the progression of renal disease.

Any antihypertensive agents may be appropriate, but angiotensin converting enzyme inhibitors are particularly effective in slowing progression of renal insufficiency in patients with and without diabetes by reducing the effects of angiotensin II on renal hemodynamics, local growth factors, and perhaps glomerular permselectivity. Non-dihydropyridine calcium channel blockers have also been shown to retard progression of renal insufficiency in patients with type 2 diabetes. Recently, angiotensin receptor blockers (irbesartan and losartan) have been shown to have a renoprotective effect in diabetic nephropathy, independent of reduction in blood pressure. Early detection and effective treatment of hypertension to target levels is essential. The benefit of aggressive control of blood pressure is most pronounced in patients with urinary protein excretion of >3 g/24 hours.

Target blood pressure in renal disease

- Blood pressure of <130/85 mm Hg in all patients with renal disease
- Blood pressure of <125/75 mm Hg in patients with proteinuric renal disease (urinary protein excretion 1 g/24 hours)

Proteinuria

Proteinuria, previously considered a marker of renal disease, is itself pathogenic and is the single best predictor of disease progression. Reducing urinary protein excretion slows the progressive decline in renal function in both diabetic and non-diabetic kidney disease.

Angiotensin blockade with angiotensin converting enzyme inhibitors or angiotensin receptor blockers is more effective at comparable levels of blood pressure control than conventional antihypertensive agents in reducing proteinuria, decline in glomerular filtration rate, and progression to end stage renal disease.

Intake of dietary protein

The role of dietary protein restriction in chronic renal disease remains controversial. The largest controlled study initially failed to find an effect of protein restriction, but secondary analysis based on achieved protein intake suggested that a low protein diet slowed the progression. However, early dietary review is necessary to ensure adequate energy intake, maintain optimal nutrition, and avoid malnutrition.

Dyslipidemia

Lipid abnormalities may be evident with only mild renal impairment and contribute to progression of chronic renal disease and increased cardiovascular morbidity and mortality. A meta-analysis of 13 controlled trials showed that hydroxymethyl glutaryl coenzyme A reductase inhibitors (statins) decreased proteinuria and preserved glomerular filtration rate in patients with renal disease, an effect not entirely explained by reduction in blood cholesterol.

Phosphate and parathyroid hormone

Hyperparathyroidism is one of the earliest manifestations of impaired renal function, and minor changes in bones have been found in patients with a glomerular filtration rate of 60 ml/min. Precipitation of calcium phosphate in renal tissue begins early, may influence the rate of progression of renal disease, and is closely related to hyperphosphataemia and calcium phosphate (Ca×P) product. Precipitation of calcium phosphate should be reduced by adequate fluid intake, modest dietary phosphate restriction, and administration of phosphate binders to correct serum phosphate. Dietary phosphate should be restricted before the glomerular filtration rate falls below 40 ml/min and before the development of hyperparathyroidism. The use of vitamin D supplements during chronic renal disease is controversial.

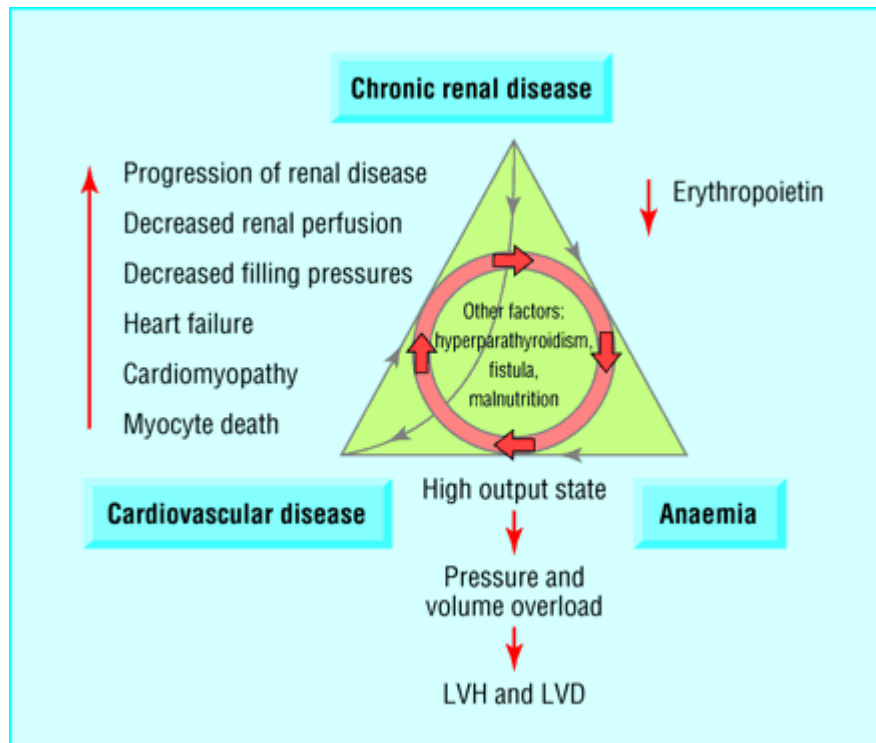
Smoking

Smoking, besides increasing the risk of cardiovascular events, is an independent risk factor for development of end stage renal disease in men with kidney disease. Smoking cessation alone may reduce the risk of disease progression by 30% in patients with type 2 diabetes.

Anemia

Anemia of chronic renal disease begins when the glomerular filtration rate falls below 30-35% of normal and is normochromic and normocytic. This is primarily caused by decreased production of erythropoietin by the failing kidney, but other potential causes should be considered. Whether anemia accelerates the progression of renal disease is controversial. However, it is independently associated with the development of left ventricular hypertrophy and other cardiovascular complications in a vicious cycle.

Perpetuating triad of chronic kidney disease, anemia, and cardiovascular disease



(LVH=left ventricular hypertrophy; LVD=left ventricular dilatation)

Treatment of anemia with recombinant human erythropoietin may slow progression of chronic renal disease but requires further study. Treatment of anemia results in partial regression of left ventricular hypertrophy in both patients with pre-end stage renal disease and patients receiving dialysis and has reduced the frequency of heart failure and hospitalization among patients receiving dialysis.

Both National Kidney Foundation and European best practice guidelines recommend evaluation of anemia when hemoglobin is <11 g/dl and consideration of recombinant human erythropoietin if hemoglobin is consistently <11 g/dl to maintain a target hemoglobin of >11 g/dl.

Prevention or attenuation of complications and comorbidities

Malnutrition

The prevalence of hypoalbuminemia is high among patients beginning dialysis, is of multifactorial origin, and is associated with poor outcome. Hypoalbuminemia may be a reflection of chronic inflammation rather than of nutrition in itself. Spontaneous intake of protein begins to decrease when the glomerular filtration rate falls below 50 ml/min. Progressive decline in renal function causes decreased appetite, thereby increasing the risk of malnutrition. Hence early dietary review is important to avoid malnutrition. Adequate dialysis is also important in maintaining optimal nutrition.

Cardiovascular disease

The prevalence, incidence, and prognosis of clinical cardiovascular disease in renal failure is not known with precision, but it begins early and is independently associated with increased cardiovascular and all cause mortality. Both traditional and uremia specific risk factors (anemia, hyperphosphatemia, hyperparathyroidism) contribute to the increased prevalence of cardiovascular disease. Cardiac disease, including left ventricular structural and functional disorders, is an important and potentially treatable comorbidity of early kidney disease.

No specific recommendations exist for either primary or secondary prevention of cardiovascular disease in patients with chronic renal disease. Current practice is mostly derived from studies in patients with diabetic or non-renal disease. At present, in the absence of evidence, clinical judgment indicates effective control of modifiable and uraemia specific risk factors at an early stage of renal disease; definitive guidelines for intervention await well designed, adequately powered prospective studies.

Preparing patient for renal replacement treatment

Integrated care by the primary care physician, nephrologist, and renal team from an early stage is vital to reduce the overall morbidity and mortality associated with chronic renal disease. Practical points helpful at this stage of renal disease include

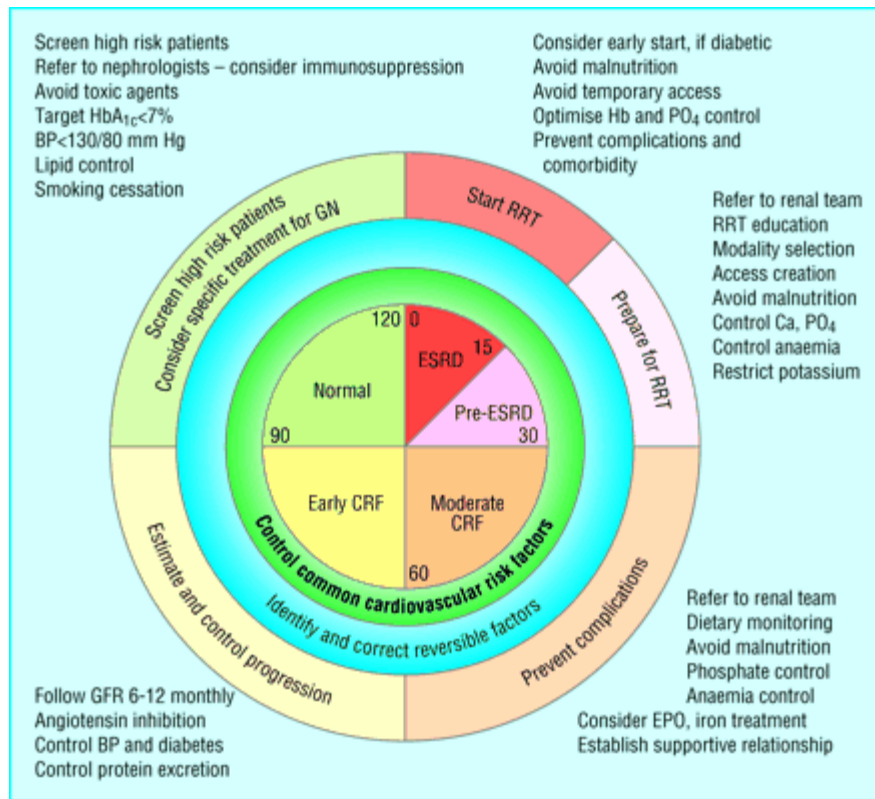
- Patients should be referred to a nephrologist before serum creatinine is 150-180 $\mu\text{mol/l}$
- Patients receiving comprehensive care by the renal team have shown slower rates of decline in renal function, greater probability of starting dialysis with higher hemoglobin, better calcium control, a permanent access, and a greater likelihood of choosing peritoneal dialysis
- Patients with progressive renal failure should be educated to save vessels of the non-dominant arm for future hemodialysis access; they should have a permanent vascular access (preferably arteriovenous fistula) created when the glomerular filtration rate falls below 25 ml/min or renal replacement treatment is anticipated within a year
- Patients starting dialysis at relatively higher levels of residual renal function (early starts) have better solute clearance, less malnutrition, better volume control, and less morbidity and mortality than patients starting at traditional low levels of renal function (late starts).

Conclusion

Chronic renal failure represents a critical period in the evolution of chronic renal disease and is associated with complications and comorbidities that begin early in the course of the disease. These conditions are initially subclinical but progress relentlessly and may eventually become symptomatic and irreversible. Early in the course of chronic renal failure, these conditions are amenable to interventions with relatively simple treatments that have the potential to prevent adverse outcomes.

Figure Three summarizes strategies for effective management of chronic renal disease. By acknowledging these facts, we have an excellent opportunity to change the paradigm of management of chronic renal failure and improve patient outcomes.

Strategies for active management of chronic renal disease



(BP=blood pressure; Ca=calcium; CRF=chronic renal failure; EPO=erythropoietin; ESRD=end stage renal disease; GN=glomerulonephritis; GFR=glomerular filtration rate; Hb=hemoglobin; PO₄=phosphate; RRT=renal replacement treatment)

Comment about Cystatin C

A single blood test, cystatin C, correlates well with gold standard GFR, is sensitive for the detection of moderate chronic renal failure (4), including amongst older people (5), and circumvents the analytical problems of serum creatinine and the complexities of formulaic estimates. Given the wealth of recent published research into the use of cystatin C we were surprised not to read about it in an otherwise excellent and up to date article.

It is true that serum cystatin C concentration is a better marker than serum creatinine for detection of subtle changes in GFR, especially in the elderly. However, limited sample size, statistical methodology, lack of information on cystatin C assay calibration, and conflicting results make the available data inadequate for recommending cystatin C measurement for widespread clinical application at present.

Chronic Renal Disease Tutorial

SETMA's **Chronic-Renal-Disease Disease-Management Suite of templates** can be found by going to AAA Home and clicking on **Renal Failure** which is outlined in red below.



Patient Sex Age DOB
Home Phone Work Phone
Patient's Code Status

Patient has one or more alerts! [Click Here to View Alerts](#)

[SETMA's LESS Initiative](#) | [Preventing Diabetes](#) | [Preventing Hypertension](#) | [Medical Home Coordination Needs Attention!!](#)
[Charge Posting Tutorial](#) | [ICD-9 Code Tutorial](#) | [E&M Coding Recommendations](#)

[Master GP](#) | [Nursing Home](#) | [Ophthalmology](#) | [Pediatrics](#) | [Physical Therapy](#) | [Podiatry](#) | [Rheumatology](#)
[Daily Progress](#) | [Admission Orders](#) | [Discharge](#) | [Insulin Infusion](#) | [Colorectal Surgery](#) | [Pain Management](#)

[Exercise](#) | [CHF Exercise](#) | [Diabetic Exercise](#) | [Drug Interactions](#) | [Smoking Cessation](#) |
[Hydration](#) | [Nutrition](#) | [Guidelines](#) | [Lab Future](#) | [Lab Results](#)

Disease Management
[Acute Coronary Syn](#) | [Angina](#) | [Asthma](#) | [CHF](#) | [Diabetes](#) | [Headaches](#) | [Hypertension](#) | [Lipids](#) | [Cardiomatabolic Risk Syndrome](#) |
[Weight Management](#) | [Renal Failure](#) | [Diabetes Edu](#)

Patient's Pharmacy

Phone
Fax

Status	Priority	Referral	Referring Provider
Completed	Immediate		Anthony
Completed	Immediate	0	Wheeler
Completed	Immediate		Wheeler
Completed	Stat	SETMA Diabetes Education	Holly
Completed	Stat	SETMA	Holly

Pending Referrals | [Referral History](#)

Status	Priority	Referral	Referring Provider

Archived Referrals - Do not use for new referrals

Status	Priority	Referral	Referring Provider

Chart Note

Chronic Renal Failure				Patient			
Assessment Guidelines		Kidney Disease Summary		Sex	Age		
		Refresh Template / Check Labs <td style="text-align: center;">M</td> <td style="text-align: center;">62</td>		M	62		
		Hydration Assessment					
Height	73.00 in	MS Strip		Serum Osmolality	311.5		
Weight	185.0 lb	Alb/Creat		Serum Osmolarity	304.1		
BMI	24.44	Prot/Creat		Anion Gap	10.0		
Body Fat	27.1 %	24Hr Urine Pro		Osmolar Gap			
BMR	2332 cal/day	Sodium	145	Est. Glomerular Filtration Rate			
BEE	1723 cal/day	Potassium	4.4	Predicted	84 % Use?		
Waist	36.00 in	BUN	16	MDRD	90 107.1 ☐		
Hips	42.00 in	Creatinine	.9	Jelliffe (double-click)	☒		
Risk Ratio	.86	Chloride	107	Cockcroft-Gault	101 120.2 ☐		
Blood Pressure		HgbA1C	8.1	Salazar & Corcoran	107 127.4 ☐		
		Fructosamine		Schwartz	☐		
		Glucose	124				
		HGB	11.8				
Diabetes Mellitus		HCT	37.9	Urinalysis			
		Retic Count		01/06/2010	UWBC	5	
		B12	646.8	Ketones	Negative	URBC	1
		Folic Acid		Leukocytes	Negative	UEPI	
Metabolic Syndrome		Serum Iron	35	Nitrates	Negative	Bacteria	
		IBC	374	Spec Grav	.000	Mucous	
		Ferritin	63	Glucose	Normal	Casts	
		EPO	79.90	Protein	100	Yeast	
Hypertension Management		Ionized Calcium	5.7	24 Hr Urine Creatinine			
		PTH	34				
		Phosphorous	4.3				
		Vitamin D					
Weight Management		Calcitrol		Cholesterol	126	12/10/2009	
		Sed Rate	62	HDL	24	12/10/2009	
		Prealbumin	20.40	LDL	44	12/10/2009	
				Triglycerides	287	12/10/2009	
Lipids Management				Physician Information			
Vitals Over Time							
		Home					
		Lab Results					
		Classification					
		Evaluation					
		Acute Renal Disease					
		Proteinuria					
		GFR					
		GFR and Anemia					
		GFR and Hypertension					
		GFR and Nutrition					
		GFR and Bone Disease					
		GFR and Neuropathy					
		Renal Failure					
		Assessment					
		Document					

Across the top of this template, you will find the following functions

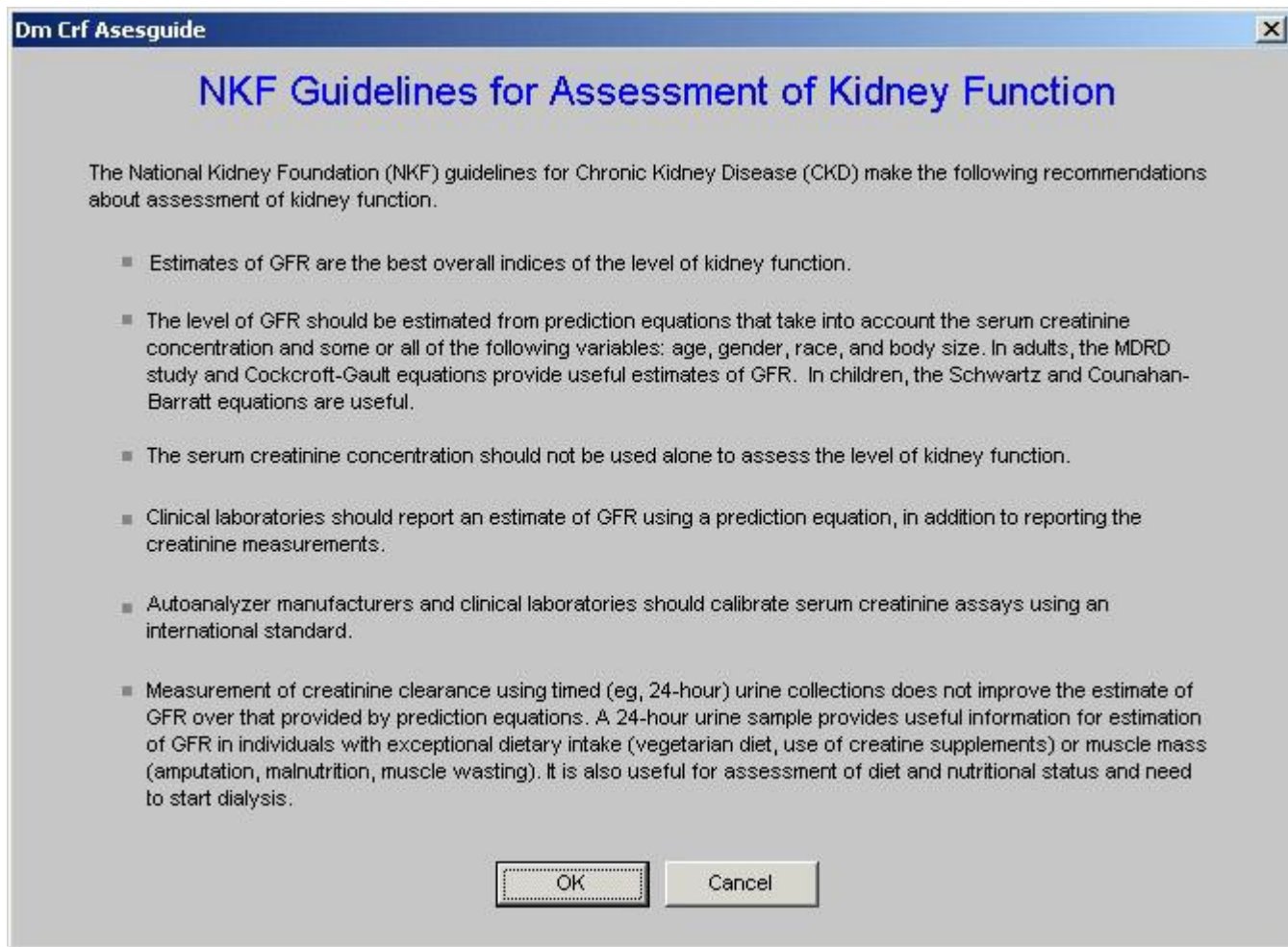
Chronic Renal Failure				Patient	
Assessment Guidelines		Kidney Disease Summary		Sex	M
				Age	62

Refresh Template / Check Labs				Hydration Assessment			
Height	73.00	in	MS Strip		///	Serum Osmolality	311.5
Weight	185.0	lb	Alb/Creat		///	Serum Osmolarity	304.1
BMI	24.44		Prot/Creat		///	Anion Gap	10.0
Body Fat	27.1	%	24Hr Urine Pro		///	Osmolar Gap	
BMR	2332	cal/day	Sodium	145	01/06/2010	Est. Glomerular Filtration Rate	
BEE	1723	cal/day	Potassium	4.4	01/06/2010	Predicted	84
Waist	36.00	in	BUN	16	01/06/2010	MDRD	90
Hips	42.00	in	Creatinine	.9	01/06/2010	Jelliffe (double-click)	
Risk Ratio	.86		Chloride	107	01/06/2010	Cockcroft-Gault	101
Blood Pressure			HgbA1C	8.1	01/06/2010	Salazar & Corcoran	107
	138 / 50	mmHg	Fructosamine		///	Schwartz	
			Glucose	124	01/06/2010		
Diabetes Mellitus			HGB	11.8	01/06/2010	Urinalysis	
+ ☐ - ☐			HCT	37.9	01/06/2010	01/06/2010	UWBC
Diabetic Since (year)		1998	Retic Count		///	Ketones	Negative
Metabolic Syndrome			B12	646.8	11/20/2009	Leukocytes	Negative
+ ☐ - ☐			Folic Acid		///	Nitrates	Negative
Hypertension Management			Serum Iron	35	11/20/2009	Spec Grav	.000
Weight Management			IBC	374	11/20/2009	Glucose	Normal
Lipids Management			Ferritin	63	11/20/2009	Protein	100
Vitals Over Time			EPO	79.90	12/11/2009	24 Hr Urine Creatinine	
			PTH	34	04/04/2007		///
			Phosphorous	4.3	03/14/2007	Cholesterol	126
			Vitamin D		///	HDL	24
			Calcitrol		///	LDL	44
			Sed Rate	62	12/02/2009	Triglycerides	287
			Prealbumin	20.40	01/06/2010		

Home
Lab Results
Classification
Evaluation
Acute Renal Disease
Proteinuria
GFR
GFR and Anemia
GFR and Hypertension
GFR and Nutrition
GFR and Bone Disease
GFR and Neuropathy
Renal Failure
Assessment
Document
Physician Information

- Title: Chronic Renal Failure
- Assessment Guidelines
- Kidney Disease Summary
- Patient's Name
- Gender
- Age

These functions are the foundation of SETMA's Chronic Kidney Disease evaluation. When accessed the **Assessment Guidelines** displays the **National Kidney Foundation's Guidelines for Assessment of Kidney Function**. :



When accessed the **Kidney Disease Summary** displays the same information as is contained in the ten-page introduction which begins this tutorial.

The remainder of the Master Template is organized into three columns.

The first column displays the patient's vital signs and links to five related disease management tools:

- **Diabetes**
- **Cardiometabolic Risk Syndrome**
- **Hypertension**
- **Weight management**
- **Lipid Management**

There is also a button which launches the **Vitals over Time function**

The following screen shot of the Chronic Renal Failure master template shows this section outlined in red.

Chronic Renal Failure

[Assessment Guidelines](#) [Kidney Disease Summary](#)

Patient
Sex M Age 62

Refresh Template / Check Labs

Hydration Assessment

Height 73.00 in
Weight 185.01 lb
BMI 24.44
Body Fat 27.1 %
BMR 2332 cal/day
BEE 1723 cal/day
Waist 36.00 in
Hips 42.00 in
Risk Ratio .86

Blood Pressure
 138 / 50 mmHg

[Diabetes Mellitus](#)

+ ☐ - ☐
Diabetic Since (year) 1998

[Metabolic Syndrome](#)

+ ☐ - ☐
[Hypertension Management](#)
[Weight Management](#)
[Lipids Management](#)

Vitals Over Time

MS Strip			
Alb/Creat			
Prot/Creat			
24Hr Urine Pro			
Sodium	145		01/06/2010
Potassium	4.4		01/06/2010
BUN	16		01/06/2010
Creatinine	.9		01/06/2010
Chloride	107		01/06/2010
HgbA1C	8.1		01/06/2010
Fructosamine			
Glucose	124		01/06/2010
HGB	11.8		01/06/2010
HCT	37.9		01/06/2010
Retic Count			
B12	646.81		11/20/2009
Folic Acid			
Serum Iron	35		11/20/2009
IBC	374		11/20/2009
Ferritin	63		11/20/2009
EPO	79.90		12/11/2009
Ionized Calcium	5.7		11/20/2008
PTH	34		04/04/2007
Phosphorous	4.3		03/14/2007
Vitamin D			
Calcitrol			
Sed Rate	62		12/02/2009
Prealbumin	20.40		01/06/2010

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

[Est. Glomerular Filtration Rate](#)

		%	Use?
Predicted	84		☐
MDRD	90	107.1	☐
Jelliffe (double-click)			☒
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis	01/06/2010	UWBC	5
Ketones	Negative	URBC	1
Leukocytes	Negative	UEPI	
Nitrates	Negative	Bacteria	
Spec Grav	.000	Mucous	
Glucose	Normal	Casts	
Protein	100	Yeast	

24 Hr Urine Creatinine

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

Home

Lab Results

Classification

Evaluation

Acute Renal Disease

Proteinuria

GFR

GFR and Anemia

GFR and Hypertension

GFR and Nutrition

GFR and Bone Disease

GFR and Neuropathy

Renal Failure

Assessment

Document

Physician Information

The abbreviations in this column which may not be familiar are:

- BMI – Body Mass Index
- BMR – Basal Metabolism Rate
- BEE – Basal Energy Expenditure

When the “**Refresh Template/Check Labs**” is clicked, the laboratory data in column two and at the bottom of column three is updated, and the values for the estimated **Glomerular Filtration Rates** (see below) are calculated.

The laboratory values are organized according to the following categories:

Random – Sed Rate and Prealbumin

Urinalysis

Lipids – Cholesterol, HDL, LDL, Triglycerides

These values are relevant to the evaluation and treatment of Chronic Renal Disease as it progresses from Stage I into ESRD.

The third column displays the following:

Chronic Renal Failure

[Assessment Guidelines](#) [Kidney Disease Summary](#)

Refresh Template / Check Labs

Height	73.00	in	MS Strip		//
Weight	185.01	lb	Alb/Creat		//
BMI	24.44		Prot/Creat		//
Body Fat	27.1	%	24Hr Urine Pro		//
BMR	2332	cal/day	Sodium	145	01/06/2010
BEE	1723	cal/day	Potassium	4.4	01/06/2010
Waist	36.00	in	BUN	16	01/06/2010
Hips	42.00	in	Creatinine	.9	01/06/2010
Risk Ratio	.86		Chloride	107	01/06/2010
Blood Pressure			HgbA1C	8.1	01/06/2010
	138	/ 50	Fructosamine		//
		mmHg	Glucose	124	01/06/2010
			HGB	11.8	01/06/2010
Diabetes Mellitus			HCT	37.9	01/06/2010
+ ☐ - ☐			Retic Count		//
Diabetic Since (year) 1998			B12	646.81	11/20/2009
Metabolic Syndrome			Folic Acid		//
+ ☐ - ☐			Serum Iron	35	11/20/2009
Hypertension Management			IBC	374	11/20/2009
Weight Management			Ferritin	63	11/20/2009
Lipids Management			EPO	79.90	12/11/2009
Vitals Over Time			Ionized Calcium	5.7	11/20/2008
			PTH	34	04/04/2007
			Phosphorous	4.3	03/14/2007
			Vitamin D		//
			Calcitrol		//
			Sed Rate	62	12/02/2009
			Prealbumin	20.40	01/06/2010

Hydration Assessment

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

[Est. Glomerular Filtration Rate](#)

Predicted	84	%	Use?
MDRD	90	107.1	☐
Jelliffe (double-click)			☒
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis

01/06/2010	UWBC	5	
Ketones	Negative	URBC	1
Leukocytes	Negative	UEPI	
Nitrates	Negative	Bacteria	
Spec Grav	.000	Mucous	
Glucose	Normal	Casts	
Protein	100	Yeast	

24 Hr Urine Creatinine //

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

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Sex M Age 62

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At the top of the third column is a link to the **Hydration Assessment Tool** which is followed by boxes for four values.

- Serum Osmolality
- Serum Osmolarity
- Anion Gap
- Osmolar Gap

These values are displayed **if the Hydration Assessment Template has been completed**. If it has not been, it can be completed by clicking on Hydration and following the simple steps of evaluating the risk of dehydration, the physical signs of dehydration and the metabolic evidence of dehydration .

Chronic Renal Failure

[Assessment Guidelines](#)[Kidney Disease Summary](#)

Refresh Template / Check Labs

Height73.00 in

Weight185.01 lb

BMI24.44

Body Fat27.1 %

BMR2332 cal/day

BEE1723 cal/day

Waist36.00 in

Hips42.00 in

Risk Ratio.86

Blood Pressure138 / 50 mmHg

Diabetes Mellitus+ -

Diabetic Since (year)1998

Metabolic Syndrome+ -

Hypertension Management

Weight Management

Lipids Management

Vitals Over Time

MS Strip / /

Alb/Creat / /

Prot/Creat / /

24Hr Urine Pro / /

Sodium14501/06/2010

Potassium4.401/06/2010

BUN1601/06/2010

Creatinine.901/06/2010

Chloride10701/06/2010

HgbA1C8.101/06/2010

Fructosamine / /

Glucose12401/06/2010

HGB11.801/06/2010

HCT37.901/06/2010

Retic Count / /

B12646.811/20/2009

Folic Acid / /

Serum Iron3511/20/2009

IBC37411/20/2009

Ferritin6311/20/2009

EPO79.9012/11/2009

Ionized Calcium5.711/20/2008

PTH3404/04/2007

Phosphorous4.303/14/2007

Vitamin D / /

Calcitrol / /

Sed Rate6212/02/2009

Prealbumin20.4001/06/2010

Patient / /

SexMAge62

Hydration Assessment

Serum Osmolality311.5

Serum Osmolality304.1

Anion Gap10.0

Osmolar Gap

Est. Glomerular Filtration Rate

Predicted84 % Use?

MDRD90107.1

Jelliffe (double-click)

Cockcroft-Gault101120.2

Salazar & Corcoran107127.4

Schwartz

Urinalysis01/06/2010

KetonesNegative

LeukocytesNegative

NitratesNegative

Spec Grav.000

GlucoseNormal

Protein100

24 Hr Urine Creatinine / /

Cholesterol12612/10/2009

HDL2412/10/2009

LDL4412/10/2009

Triglycerides28712/10/2009

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The next function in this third column is a button entitled “**Est Glomerular Filtration Rate**”, which launches an educational piece entitled “**Clinical Applications of Equations to Predict GFR**”.



SETMA I - 2929 Calder, Suite 100
SETMA II - 3570 College, Suite 200
SETMA West - 2010 Dowlen
(409) 833-9797
www.setma.com

Clinical Applications of Equations to Predict GFR

Serum creatinine-based estimates of GFR using prediction formulas in adults and children provide a basis for classification of chronic kidney disease and detection of substantial progression.

All individuals should be informed about their estimated level of GFR. Individuals with an estimated GFR below 60 mL/min/1.73 m² are classified as having chronic kidney disease and should be educated about their diagnosis and the implications of decreased kidney function.

Individuals with a serum creatinine of 2.0 mg/dL have moderate to severe decrease in GFR, regardless of the equation used to estimate GFR. However, these individuals constitute only a minority of individuals with chronic kidney disease.

Equations to predict GFR and creatinine clearance from serum creatinine and the use of relevant equations in children and adults has been shown to give more valid estimates of GFR than serum creatinine alone.

Serum creatinine alone is not an accurate index of the level of GFR. The use of the serum level of creatinine as an index of GFR rests on three important assumptions:

- (1) creatinine is an ideal filtration marker whose clearance approximates GFR;
- (2) creatinine excretion rate is constant among individuals and over time; and
- (3) measurement of serum creatinine is accurate and reproducible across clinical laboratories.

none of these assumptions is strictly true, and numerous factors can lead to errors in estimation of the level of GFR from the

Following this education piece are **six different formulae** for calculating the estimated GFR

Chronic Renal Failure

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Patient:

Sex: Age:

Refresh Template / Check Labs

Height	73.00	in
Weight	185.01	lb
BMI	24.44	
Body Fat	27.1	%
BMR	2332	cal/day
BEE	1723	cal/day
Waist	36.00	in
Hips	42.00	in
Risk Ratio	.86	

Blood Pressure: / mmHg

[Diabetes Mellitus](#)
+ ☐ - ☐

Diabetic Since (year):

[Metabolic Syndrome](#)
+ ☐ - ☐

[Hypertension Management](#)
[Weight Management](#)
[Lipids Management](#)

Vitals Over Time

Hydration Assessment

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

Est. Glomerular Filtration Rate

Formula	Value	%	Use?
Predicted	84		☐
MDRD	90	107.1	☐
Jelliffe (double-click)			☒
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis 01/06/2010

Ketones	Negative	UWBC	5
Leukocytes	Negative	URBC	1
Nitrates	Negative	UEPI	
Spec Grav	.000	Bacteria	
Glucose	Normal	Mucous	
Protein	100	Casts	
		Yeast	

24 Hr Urine Creatinine: / /

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

Refresh Template / Check Labs

MS Strip	/ /	
Alb/Creat	/ /	
Prot/Creat	/ /	
24Hr Urine Pro	/ /	
Sodium	145	01/06/2010
Potassium	4.4	01/06/2010
BUN	16	01/06/2010
Creatinine	.9	01/06/2010
Chloride	107	01/06/2010
HgbA1C	8.1	01/06/2010
Fructosamine	/ /	
Glucose	124	01/06/2010
HGB	11.8	01/06/2010
HCT	37.9	01/06/2010
Retic Count	/ /	
B12	646.81	11/20/2009
Folic Acid	/ /	
Serum Iron	35	11/20/2009
IBC	374	11/20/2009
Ferritin	63	11/20/2009
EPO	79.90	12/11/2009
Ionized Calcium	5.7	11/20/2008
PTH	34	04/04/2007
Phosphorous	4.3	03/14/2007
Vitamin D	/ /	
Calcitrol	/ /	
Sed Rate	62	12/02/2009
Prealbumin	20.40	01/06/2010

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SETMA displays six formulae for which the Calculated GFR can be determined. They are:

- **Predicted**
- **MDRD** – this is often considered the most accurate
- **Jelliffe** – this may be more accurate in patients with unstable renal disease. As will be seen this formula involves a multi-stage process for calculation.
- **Cockcroft-Gault** – even though there are documented problems with this formula, it is often considered the standard.
- **Salazar-Corcoran** – this formula may be more accurate in obese patients.
- **Schwartz** – this formula may be more accurate in children

Each of the formulae has its own limitations and benefits. All six formulae will be discussed later, but at this point, we will address “MDRD” which is the formula SETMA uses in determining the Stage of Renal Disease.

Once the button entitled “**Refresh Template/Check Labs**” is deployed, the calculated GFR will appear beside each of the formulae names.

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Refresh Template / Check Labs

Hydration Assessment

Height73.00 in

Weight185.01 lb

BMI24.44

Body Fat27.1 %

BMR2332 cal/day

BEE1723 cal/day

Waist36.00 in

Hips42.00 in

Risk Ratio.86

Blood Pressure

138 / 50 mmHg

MS Strip

Alb/Creat

Prot/Creat

24Hr Urine Pro

Sodium14501/06/2010

Potassium4.401/06/2010

BUN1601/06/2010

Creatinine.901/06/2010

Chloride10701/06/2010

HgbA1C8.101/06/2010

Fructosamine

Glucose12401/06/2010

HGB11.801/06/2010

HCT37.901/06/2010

Retic Count

B12646.811/20/2009

Folic Acid

Serum Iron3511/20/2009

IBC37411/20/2009

Ferritin6311/20/2009

EPO79.9012/11/2009

Ionized Calcium5.711/20/2008

PTH3404/04/2007

Phosphorous4.303/14/2007

Vitamin D

Calcitriol

Sed Rate6212/02/2009

Prealbumin20.4001/06/2010

Est. Glomerular Filtration Rate

Predicted84 % Use?

MDRD90107.1

Jelliffe (double-click)

Cockcroft-Gault101120.2

Salazar & Corcoran107127.4

Schwartz

Urinalysis01/06/2010

KetonesNegative

LeukocytesNegative

NitratesNegative

Spec Grav.000

GlucoseNormal

Protein100

UWBC5

URBC1

UEPI

Bacteria

Mucous

Casts

Yeast

24 Hr Urine Creatinine

Cholesterol12612/10/2009

HDL2412/10/2009

LDL4412/10/2009

Triglycerides28712/10/2009

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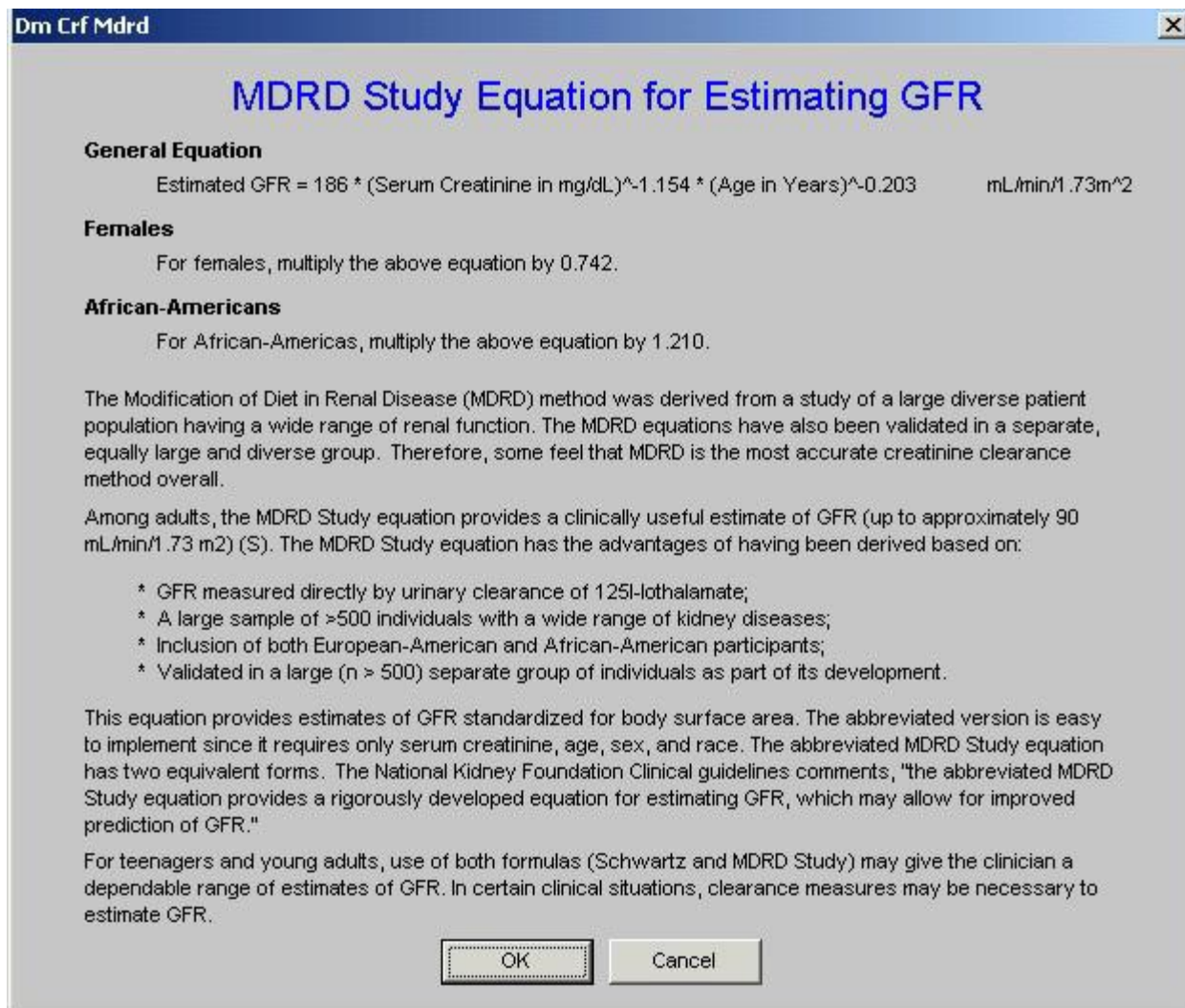
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You will notice that the titles of each of the formulae are highlighted, which means that they are hyperlinks. If you click on the names, an information pop-up is deployed for each. The second formula, and the first we will discuss, is entitled “**MDRD**,” which stands for “**Modification of Diet in Renal Disease**.” When the “**MRDR**” button is depressed, the following pop-up appears which explains the origin of this formula.

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As indicated on this pop-up, many feel that this is the most accurate of the formulae and **“MDRD” is the formula SETMA uses in order to calculate the state of renal disease**, if any. The other five GFR estimation formulae will be discussed later. To skip to that discussion [click here](#).

Calculating the stage of Renal Disease

When the **“Refresh Template/Check Labs”** button is depressed, the box next to **“MDRD”**, will be automatically checked. In order to use this in the calculation of the stage of renal disease, it is necessary to manually click in any of the boxes next to one of the other formulae and then recheck the box by the **“MDRD”** calculated GFR. Once this is done, it is possible to calculate the stage of renal disease as will be discussed below. (This action “loads” the computation of Stage of Renal Disease with the formula which will be used for the determination of the estimated GFR which will in turn be used to calculate the Stage of Renal Disease.)

The following is a screen shot of the Master Renal Template after the “**Refresh Template/Check Labs**” has been clicked. Notice the box next to “MDRD” is checked.

Chronic Renal Failure

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Refresh Template / Check Labs

Hydration Assessment

Height

73.00

in

Weight

185.01

lb

BMI

24.44

Body Fat

27.1

%

BMR

2332

cal/day

BEE

1723

cal/day

Waist

36.00

in

Hips

42.00

in

Risk Ratio

.86

Blood Pressure

138 / 50

mmHg

Diabetes Mellitus

+

☒

-

☐

Diabetic Since (year)

1998

Metabolic Syndrome

+

☒

-

☐

Hypertension Management

Weight Management

Lipids Management

Vitals Over Time

MS Strip

//

Alb/Creat

//

Prot/Creat

//

24Hr Urine Pro

//

Sodium

145

01/06/2010

Potassium

4.4

01/06/2010

BUN

16

01/06/2010

Creatinine

.9

01/06/2010

Chloride

107

01/06/2010

HgbA1C

8.1

01/06/2010

Fructosamine

//

Glucose

124

01/06/2010

HGB

11.8

01/06/2010

HCT

37.9

01/06/2010

Retic Count

//

B12

646.81

11/20/2009

Folic Acid

//

Serum Iron

35

11/20/2009

IBC

374

11/20/2009

Ferritin

63

11/20/2009

EPO

79.90

12/11/2009

Ionized Calcium

5.7

11/20/2008

PTH

34

04/04/2007

Phosphorous

4.3

03/14/2007

Vitamin D

//

Calcitrol

//

Sed Rate

62

12/02/2009

Prealbumin

20.40

01/06/2010

Sex

M

Age

62

Est. Glomerular Filtration Rate

Predicted

84

%

Use?

MDRD

90

107.1

☒

Jelliffe (double-click)

☐

Cockcroft-Gault

101

120.2

☐

Salazar & Corcoran

107

127.4

☐

Schwartz

☐

Urinalysis

01/06/2010

Ketones

Negative

Leukocytes

Negative

Nitrates

Negative

Spec Grav

.000

Glucose

Normal

Protein

100

UWBC

5

URBC

1

UEPI

Bacteria

Mucous

Casts

Yeast

24 Hr Urine Creatinine

//

Cholesterol

126

12/10/2009

HDL

24

12/10/2009

LDL

44

12/10/2009

Triglycerides

287

12/10/2009

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Now it is important to place a check mark in the box beside any formula other than MDRD. See the following screen shot with a red circle around the check box beside the Jeffittee formula box.

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Patient
Sex M Age 62

Refresh Template / Check Labs

Hydration Assessment

Height	73.00	in	MS Strip		//
Weight	185.01	lb	Alb/Creat		//
BMI	24.44		Prot/Creat		//
Body Fat	27.1	%	24Hr Urine Pro		//
BMR	2332	cal/day	Sodium	145	01/06/2010
BEE	1723	cal/day	Potassium	4.4	01/06/2010
Waist	36.00	in	BUN	16	01/06/2010
Hips	42.00	in	Creatinine	.9	01/06/2010
Risk Ratio	.86		Chloride	107	01/06/2010
Blood Pressure	138 / 50	mmHg	HgbA1C	8.1	01/06/2010
	/		Fructosamine		//
	/		Glucose	124	01/06/2010
Diabetes Mellitus	☐ + ☒ - ☐	HGB	11.8	01/06/2010	
Diabetic Since (year)	1998	HCT	37.9	01/06/2010	
Metabolic Syndrome	☐ + ☒ - ☐	Retic Count		//	
Hypertension Management		B12	646.81	11/20/2009	
Weight Management		Folic Acid		//	
Lipids Management		Serum Iron	35	11/20/2009	
Vitals Over Time		IBC	374	11/20/2009	
		Ferritin	63	11/20/2009	
		EPO	79.90	12/11/2009	
		Ionized Calcium	5.7	11/20/2008	
		PTH	34	04/04/2007	
		Phosphorous	4.3	03/14/2007	
		Vitamin D		//	
		Calcitrol		//	
		Sed Rate	62	12/02/2009	
		Prealbumin	20.40	01/06/2010	

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

[Est. Glomerular Filtration Rate](#)

Predicted	84	%	Use?
MDRD	90	107.1	☐
Jelliffe (double-click)			☒
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis	01/06/2010	UWBC	5
Ketones	Negative	URBC	1
Leukocytes	Negative	UEPI	
Nitrates	Negative	Bacteria	
Spec Grav	.000	Mucous	
Glucose	Normal	Casts	
Protein	100	Yeast	

24 Hr Urine Creatinine		//
------------------------	----------------------	----

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

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Now, you must manually return the check mark to the box by "MDRD." This process "loads" the equation for the calculation of the Stage of Renal Disease. If you miss this step, you will be told that you have to answer all questions and you will have to come back to this point and take this step before proceeding.

Chronic Renal Failure

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Patient
Sex M Age 62

Refresh Template / Check Labs

Hydration Assessment

Height	73.00	in	MS Strip		/ /
Weight	185.0	lb	Alb/Creat		/ /
BMI	24.44		Prot/Creat		/ /
Body Fat	27.1	%	24Hr Urine Pro		/ /
BMR	2332	cal/day	Sodium	145	01/06/2010
BEE	1723	cal/day	Potassium	4.4	01/06/2010
Waist	36.00	in	BUN	16	01/06/2010
Hips	42.00	in	Creatinine	.9	01/06/2010
Risk Ratio	.86		Chloride	107	01/06/2010
Blood Pressure	138 / 50	mmHg	HgbA1C	8.1	01/06/2010
	/		Fructosamine		/ /
	/		Glucose	124	01/06/2010
Diabetes Mellitus	☐ + ☒ - ☐		HGB	11.8	01/06/2010
Diabetic Since (year)	1998		HCT	37.9	01/06/2010
Metabolic Syndrome	☐ + ☒ - ☐		Retic Count		/ /
Hypertension Management			B12	646.8	11/20/2009
Weight Management			Folic Acid		/ /
Lipids Management			Serum Iron	35	11/20/2009
Vitals Over Time			IBC	374	11/20/2009
			Ferritin	63	11/20/2009
			EPO	79.90	12/11/2009
			Ionized Calcium	5.7	11/20/2008
			PTH	34	04/04/2007
			Phosphorous	4.3	03/14/2007
			Vitamin D		/ /
			Calcitrol		/ /
			Sed Rate	62	12/02/2009
			Prealbumin	20.40	01/06/2010

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

Est. Glomerular Filtration Rate

Predicted	84	%	☐ Use?
MDRD	90	107.1	☒
Jelliffe (double-click)			☐
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis	01/06/2010	UWBC	5
Ketones	Negative	URBC	1
Leukocytes	Negative	UEPI	
Nitrates	Negative	Bacteria	
Spec Grav	.000	Mucous	
Glucose	Normal	Casts	
Protein	100	Yeast	

24 Hr Urine Creatinine		/ /
------------------------	----------------------	--------------------------

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

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GFR and Hypertension

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An explanation of the other five formulae will be presented below, but **at this point, we will present the explanation of how to complete the evaluation of the stage of renal disease.**

After removing the check box from beside the MDRD, placing it next to any of the other five formulae and then returning it to the box next to MDRD, you must select the navigation button entitled “**Evaluation**” in the fourth column of the Master Renal template. It is outlined in red below.

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[Refresh Template / Check Labs](#)
[Hydration Assessment](#)

Patient

Sex Age

Height	73.00	in
Weight	185.01	lb
BMI	24.44	
Body Fat	27.1	%
BMR	2332	cal/day
BEE	1723	cal/day
Waist	36.00	in
Hips	42.00	in
Risk Ratio	.86	

Blood Pressure

138	/	50	mmHg

[Diabetes Mellitus](#)
+ ☐ - ☐
Diabetic Since (year)
[Metabolic Syndrome](#)
+ ☐ - ☐
[Hypertension Management](#)
[Weight Management](#)
[Lipids Management](#)
[Vitals Over Time](#)

MS Strip		//
Alb/Creat		//
Prot/Creat		//
24Hr Urine Pro		//
Sodium	145	01/06/2010
Potassium	4.4	01/06/2010
BUN	16	01/06/2010
Creatinine	.9	01/06/2010
Chloride	107	01/06/2010
HgbA1C	8.1	01/06/2010
Fructosamine		//
Glucose	124	01/06/2010
HGB	11.8	01/06/2010
HCT	37.9	01/06/2010
Retic Count		//
B12	646.81	11/20/2009
Folic Acid		//
Serum Iron	35	11/20/2009
IBC	374	11/20/2009
Ferritin	63	11/20/2009
EPO	79.90	12/11/2009
Ionized Calcium	5.7	11/20/2008
PTH	34	04/04/2007
Phosphorous	4.3	03/14/2007
Vitamin D		//
Calcitrol		//
Sed Rate	62	12/02/2009
Prealbumin	20.40	01/06/2010

[Est. Glomerular Filtration Rate](#)
[Predicted](#) % ☐ Use?
[MDRD](#) ☐
[Jelliffe](#) (double-click) ☒
[Cockcroft-Gault](#) ☐
[Salazar & Corcoran](#) ☐
[Schwartz](#) ☐

Urinalysis 01/06/2010

Ketones	Negative	WBC	5
Leukocytes	Negative	URBC	1
Nitrates	Negative	UEPI	
Spec Grav	.000	Bacteria	
Glucose	Normal	Mucous	
Protein	100	Casts	
		Yeast	

24 Hr Urine Creatinine

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

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Acute Renal Disease

Proteinuria

GFR

GFR and Anemia

GFR and Hypertension

GFR and Nutrition

GFR and Bone Disease

GFR and Neuropathy

Renal Failure

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When the “**Evaluation**” button is depressed, the following template appears.

Evaluation of Chronic Renal Failure

[Review of Systems](#)
[Decreased GFR](#)
[Return](#)

Modifiable Risk Factors

- | | |
|--|---|
| ☐ Anemia | ☐ Lack of awareness |
| ☐ Cardiovascular disease | ☐ Lower urinary tract obstruction |
| ☐ Decreased nitric oxide | ☐ Menopause |
| ☐ Depression/poor mental health | ☐ Nutrition (high protein/high phosphate diet) |
| ☒ Diabetes | ☐ Oxidative stress |
| ☐ Drug toxicity | ☐ Poor glycemic control in diabetes |
| ☒ Dyslipidemia | ☐ Poor physical functioning |
| ☐ Elevated angiotensin II | ☐ Smoking |
| ☐ Elevated homocysteine | ☐ Systemic infections |
| ☐ Elevated/persistent proteinuria | ☐ Thrombogenic factors |
| ☐ Hyperaldosteronism | ☐ Uremic toxins |
| ☒ Hypertension | ☐ Urinary stones |
| ☐ Increased endothelin | ☐ Urinary tract infections |
| ☐ Infection/Inflammation | ☐ Vocational disability |

Non-modifiable Risk Factors

- | |
|--|
| ☐ Age |
| ☐ Autoimmune diseases |
| ☐ Ethnicity
(African-American, American Indian, Hispanic, Asian, Pacific Islander) |
| ☐ Exposure (chemical/environmental) |
| ☐ Family history of kidney disease |
| ☐ Low birth weight |
| ☐ Low income/education |
| ☐ Neoplasm |
| ☐ Recovery from acute kidney failure |
| ☐ Reduction in kidney mass |
| ☐ Renal transplant |

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Classification of Risk Factors

Stage of Kidney Disease

Total	3	Modifiable	1	Class I	0	Class III	Stage 1
	0	Non-modifiable	0	Class II	1	Class IV	

At the top of this template are two buttons:

- Review of Systems
- Decreased GFR

When the **Review of Systems** button is depressed a pop-up appears entitled **Chronic Renal Failure Signs and Symptoms**. This displays three classes of signs and symptoms of Chronic Renal disease.

- Initial Symptoms,
- Later Symptoms and
- Additional Symptoms.

Dm Crf Ros

Chronic Renal Failure Symptoms & Signs

Initial Symptoms		Later Symptoms		Additional Symptoms			
-	+	-	+	-	+		
☐	☐ Weight loss (unintentional)	☐	☐ Tendency to bruise easily	☒	☐ Confusion/Delirium	☐	☐ Nocturia
☒	☐ Nausea	☒	☐ Tendency to bleed easily	☐	☐ Blood in vomit	☐	☐ Abnormally dark or light skin
☒	☐ Vomiting	☒	☐ Muscle cramps	☐	☐ Melena	☐	☐ Polydipsia
☒	☒ Fatigue	☐	☐ Muscle spasms	☐	☐ Hematochezia	☐	☒ High Blood Pressure
☐	☒ Headache	☐	☐ Polyuria	☐	☐ Lethargy	☐	☐ Loss of appetite
☒	☐ Pruritus	☐	☐ Oliguria	☐	☐ Seizures	☐	☐ Agitation
☐	☐ Hiccups	☐	☐ Drowsiness/Decreased alertness	☒	☐ Coma	☐	☐ Paleness
		☒	☐ Numbness in extremities			☐	☐ Nail abnormalities
						☐	☐ Breath odor

The signs and symptoms which are captured elsewhere in the EMR are automatically checked off, others can be added.

The next button on the **Evaluation** template is entitled “**Decreased GFR**”. When that button is activated, the following pop-up appears. It gives a **definition of Decrease GFR in the absence of renal disease** and also **the causes of decreased GFR in the absence of renal disease**

Dm Crf DecGFR

Decreased GFR

Individuals with GFR 60 to 89 mL/min/1.73 m2 without kidney damage are classified as “decreased GFR.”

- Decreased GFR without recognized markers of kidney damage is very frequent in infants and older adults, and is usually considered to be “normal for age.”
- The age-related decline in GFR in adults is accompanied by pathological findings of global glomerular sclerosis and cortical atrophy.
- The consequences of declining GFR with age have not been carefully studied.
- It is interesting to speculate whether the increasing incidence of end-stage renal disease in the elderly could be due, in part, to age-associated decline in GFR.

Other causes of chronically decreased GFR without kidney damage in adults include:

- ☐ Vegetarian diets
- ☐ Unilateral nephrectomy
- ☐ Extracellular fluid volume depletion
- ☐ Systemic illnesses associated with reduced kidney perfusion, such as heart failure and cirrhosis

It is not certain whether individuals with chronically decreased GFR in the range of 60 to 89 mL/min/1.73 m2 without kidney damage are at increased risk for adverse outcomes, such as toxicity from drugs excreted by the kidney or acute kidney failure.

Beneath the above two buttons on the **Evaluation Template** are three columns which display **Modifiable Risk Factors** and **Non-modifiable Risk Factors** for Renal Disease. Those factors which are captured elsewhere in the EMR are automatically documented. The provider can mark others which apply.

Evaluation of Chronic Renal Failure

[Review of Systems](#) [Decreased GFR](#)

Return

Modifiable Risk Factors

☐ Anemia	☐ Lack of awareness
☐ Cardiovascular disease	☐ Lower urinary tract obstruction
☐ Decreased nitric oxide	☐ Menopause
☐ Depression/poor mental health	☐ Nutrition (high protein/high phosphate diet)
☒ Diabetes	☐ Oxidative stress
☐ Drug toxicity	☐ Poor glycemic control in diabetes
☒ Dyslipidemia	☐ Poor physical functioning
☐ Elevated angiotensin II	☐ Smoking
☐ Elevated homocysteine	☐ Systemic infections
☐ Elevated/persistent proteinuria	☐ Thrombogenic factors
☐ Hyperaldosteronism	☐ Uremic toxins
☒ Hypertension	☐ Urinary stones
☐ Increased endothelin	☐ Urinary tract infections
☐ Infection/Inflammation	☐ Vocational disability

Non-modifiable Risk Factors

☐ Age
☐ Autoimmune diseases
☐ Ethnicity (African-American, American Indian, Hispanic, Asian, Pacific Islander)
☐ Exposure (chemical/environmental)
☐ Family history of kidney disease
☐ Low birth weight
☐ Low income/education
☐ Neoplasm
☐ Recovery from acute kidney failure
☐ Reduction in kidney mass
☐ Renal transplant

[Classification of Risk Factors](#) [Stage of Kidney Disease](#)

Total	3	Modifiable	1	Class I	0	Class III	Stage 1
	0	Non-modifiable	0	Class II	1	Class IV	

To complete the process of calculating the stage of Chronic Renal Disease, click the button entitled **Total**. This will do the following:

1. Cause the **Risk Factors** to be totaled into a **Modifiable and Non-Modifiable** box and
2. Cause the Risk Factors to be totaled into one of **Four Classes of Risk Factors** entitled Class I, Class II, Class III, Class IV.

Evaluation of Chronic Renal Failure

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Modifiable Risk Factors

- ☐ Anemia
- ☐ Cardiovascular disease
- ☐ Decreased nitric oxide
- ☐ Depression/poor mental health
- ☒ Diabetes
- ☐ Drug toxicity
- ☒ Dyslipidemia
- ☐ Elevated angiotensin II
- ☐ Elevated homocysteine
- ☐ Elevated/persistent proteinuria
- ☐ Hyperaldosteronism
- ☒ Hypertension
- ☐ Increased endothelin
- ☐ Infection/Inflammation

- ☐ Lack of awareness
- ☐ Lower urinary tract obstruction
- ☐ Menopause
- ☐ Nutrition (high protein/high phosphate diet)
- ☐ Oxidative stress
- ☐ Poor glycemic control in diabetes
- ☐ Poor physical functioning
- ☐ Smoking
- ☐ Systemic infections
- ☐ Thrombogenic factors
- ☐ Uremic toxins
- ☐ Urinary stones
- ☐ Urinary tract infections
- ☐ Vocational disability

Non-modifiable Risk Factors

- ☐ Age
- ☐ Autoimmune diseases
- ☐ Ethnicity
(African-American, American Indian, Hispanic, Asian, Pacific Islander)
- ☐ Exposure (chemical/environmental)
- ☐ Family history of kidney disease
- ☐ Low birth weight
- ☐ Low income/education
- ☐ Neoplasm
- ☐ Recovery from acute kidney failure
- ☐ Reduction in kidney mass
- ☐ Renal transplant

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Total

[Classification of Risk Factors](#)

[Stage of Kidney Disease](#)

3	Modifiable	1	Class I	0	Class III
0	Non-modifiable	0	Class II	1	Class IV

Stage 1

Above the Class I, II, III and IV Risk Classes totals is a button entitled **Classification of Risk Factors**. When this button is deployed the following pop-up with an explanation of the four classes appears.

Dm Crf Riskclass

Classification of Risk Factors

Class I Factors for which interventions have been proven to lower risk.

Class II Factors for which interventions are likely to lower risk.

Class III Factors for which modification may lower risk.

Class IV Factors for which modification is not possible.

OK Cancel

When the **Total** button is depressed on the Evaluation Template, the following pop-up appears which is entitled **Stage of Kidney Disease**..

Dm Crf Stagecalc

Stage of Kidney Disease

To calculate the stage of kidney disease, answer the following three questions and click "Calculate."

1. Is kidney damage present in this patient? ☒ Yes ☐ No
 Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

2. Does this patient have high blood pressure? ☒ Yes ☐ No
 High blood pressure is defined as >140/90 mmHg in adults and >90th percentile for height and weight in children.

3. Select the estimated glomerular filtration rate you would like to use for the determination of the stage of kidney disease.

					%	Use?
<u>Predicted</u>	84	%	Use?	<u>Cockcroft-Gault</u>	101 120.2	☐
<u>MDRD</u>	90	107.1	☐	<u>Salazar & Corcoran</u>	107 127.4	☐
<u>Jelliffe</u>			☒	<u>Schwartz</u>		☐

We are now only a step away from the calculation of the Stage of Renal Disease. So far, we are prepared for this process with the following steps:

1. Opening the **Chronic Renal Disease Master Template**.
2. Clicking the button entitled **Refresh Template/Check Lab**.
3. Clicking **one of the GFR formulae in stead of the MDRD** which has been automatically selected.
4. Clicking the box next to the **MDRD formula**
5. Clicking the Navigation button in the right hand column entitled **Evaluation**.
6. Clicking the **Total** button on the Evaluation Template

You are now ready to complete the process of calculating the State of Chronic Renal Disease.. The pop-up which appears when you deploy the **Total** button on the Evaluation template is entitled **Stage of Kidney Disease**.

Dm Crf Stagecalc

Stage of Kidney Disease

To calculate the stage of kidney disease, answer the following three questions and click "Calculate."

1. Is kidney damage present in this patient? ☒ Yes ☐ No
 Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

2. Does this patient have high blood pressure? ☒ Yes ☐ No
 High blood pressure is defined as >140/90 mmHg in adults and >90th percentile for height and weight in children.

3. Select the estimated glomerular filtration rate you would like to use for the determination of the stage of kidney disease.

	Predicted	%	Use?		%	Use?
Predicted	84			Cockcroft-Gault	101	120.2 ☐
MDRD	90	107.1	☐	Salazar & Corcoran	107	127.4 ☐
Jelliffe			☒	Schwartz		☐

Beneath the title **Stage of Renal Disease** is the statement, “**To calculate the stage of kidney disease, answer the following three questions and click ‘calculate.’**” The three questions are:

1. **Is kidney damage present in this patient?** Following the this question is this explanation: Kidney damage is defined as pathologic abnormalities or makers of damage, including abnormalities in blood or urine tests or imaging studies. There are three conditions which allow you to answer “yes” to the question, “Is kidney damage present in this patient”:
 - a. the presence of microalbuminuria,
 - b. a serum creatinine above 1.5 and/or
 - c. an abnormal renal ultrasound which indicates the presence of medical renal disease.

The earliest evidence of kidney damage is the presence of protein in the urine. In the introduction to this tutorial, the National Kidney Foundation defines normal and abnormal **urinary albumin or protein excretion**

- Normal albumin excretion: <30 mg/24 hours
- Microalbuminuria: 20-200 µg/min or 30-300 mg/24 hour or in men urine albumin/creatinine 2.5-25 mg/mmol and in women urine albumin/creatinine 3.5-35 mg/mmol
- Macroalbuminuria (overt proteinuria): >300 mg/24 hour
- Nephrotic range proteinuria: >3 g/24 hour

(More definitive information on Proteinuria can be found in the explanation of the template entitled Proteinuria)

On the **Evaluation template** there are six buttons with educational information presented. The fourth button is entitled “Chronic Kidney Disease” and addresses the definition of Chronic Kidney disease. It states:

All individuals with GFR <60 mL/min/1.73 m² for 3 months are classified as having chronic kidney disease, irrespective of the presence or absence of kidney damage.

- a. Reduction in kidney function to this level or lower represents loss of half or more of the adult level of normal kidney function,
- b. This may be associated with a number of complications

All individuals with kidney damage are classified as having chronic kidney disease, irrespective of the level of GFR.

- a. The rationale for including individuals with GFR 60 mL/min/1.73 m² is that GFR may be sustained at normal or increased levels despite substantial kidney damage and
- b. Patients with kidney damage are at increased risk of the two major outcomes of chronic kidney disease: loss of kidney function and development of cardiovascular disease

Once you have answered the first question, “yes,” or “no,” you must answer the second question which is:

2. “Does the patient have high blood pressure.”

The definition is then given for the presence of high blood pressure; it is, “High blood pressure is defined as >140/90 in adults and >90 Percentile in height and weight in children.”

If the current blood pressure is elevated, the box indicating “yes” will be automatically selected but if the patient has high blood pressure which is controlled, you will need to manually check the box next to “yes.”

The third question will be automatically answered for you.

3. Select the estimated glomerular filtration rate you would like to use for the determination of the stage of kidney disease.

This will automatically default to the MDRD equation and does not need to be changed again.

Dm Crf Stagecalc

Stage of Kidney Disease

To calculate the stage of kidney disease, answer the following three questions and click "Calculate."

1. Is kidney damage present in this patient? ☒ Yes ☐ No
 Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

2. Does this patient have high blood pressure? ☒ Yes ☐ No
 High blood pressure is defined as $\geq 140/90$ mmHg in adults and ≥ 90 th percentile for height and weight in children.

3. Select the estimated glomerular filtration rate you would like to use for the determination of the stage of kidney disease.

	Predicted	%	Use?		%	Use?
Predicted	84			Cockcroft-Gault	101	120.2 ☐
MDRD	90	107.1	☐	Salazar & Corcoran	107	127.4 ☐
Jelliffe			☒	Schwartz		☐

When you depress the “Calculate” button on the Stage of Renal Disease pop-up, **the Stage of Renal Disease will appear**. Some times, you will receive a message in an alert message which states:

“You MUST answer both questions 1 and 2 as well as select which value is to be used under 3.”

If you have answered questions 1 and 2 and still receive this alert, you must then **go back to Chronic Renal Disease Master template and follow the steps which were described above** to change the box which was automatically checked beside the MDRD equation. The box must be checked next to another formula and then changed back to MDRD. This alerts the computer that this is the formula which is to be used to calculate the Stage of Chronic

Review of the Steps by which the Stage of Chronic Renal Disease is calculated

The steps to the calculation of the Stage of Renal Disease are as follows. Once learned, these steps take only a few seconds to complete.

- Open the **Chronic Renal Disease Master Template**.
- Click the button entitled **Refresh Template/Check Lab**.
- Click **one of the GFR formulae in stead of the MDRD** which has been automatically selected.
- Click the box next to the **MDRD formula**
- Click the **Navigation button** in the right hand column entitled **Evaluation**.
- Click the **Total** button on the Evaluation Template
- Answer questions 1 and 2 on the **Stage of Kidney Disease Pop-up**
- Click the button entitled **Calculate** on the Stage of Kidney Disease Pop-up

The **Stage of Kidney disease** will then be displayed and can be added to the ICD-9 Code list under Chronic Conditions and to the Acute Assessment. Any stage of kidney disease is an HCC Risk and needs annual evaluation.

An explanation of the other five formulae for calculating GFR

The first formula listed is called “Predicted.”

Chronic Renal Failure

[Assessment Guidelines](#) [Kidney Disease Summary](#)

Refresh Template / Check Labs

Patient Sex Age

Height in
Weight lb
BMI
Body Fat %
BMR cal/day
BEE cal/day
Waist in
Hips in
Risk Ratio
Blood Pressure / mmHg
[Diabetes Mellitus](#)
+ ☐ - ☐
Diabetic Since (year)
[Metabolic Syndrome](#)
+ ☐ - ☐
[Hypertension Management](#)
[Weight Management](#)
[Lipids Management](#)
Vitals Over Time

MS Strip		//
Alb/Creat		//
Prot/Creat		//
24Hr Urine Pro		//
Sodium	145	01/06/2010
Potassium	4.4	01/06/2010
BUN	16	01/06/2010
Creatinine	.9	01/06/2010
Chloride	107	01/06/2010
HgbA1C	8.1	01/06/2010
Fructosamine		//
Glucose	124	01/06/2010
HGB	11.8	01/06/2010
HCT	37.9	01/06/2010
Retic Count		//
B12	646.81	11/20/2009
Folic Acid		//
Serum Iron	35	11/20/2009
IBC	374	11/20/2009
Ferritin	63	11/20/2009
EPO	79.90	12/11/2009
Ionized Calcium	5.7	11/20/2008
PTH	34	04/04/2007
Phosphorous	4.3	03/14/2007
Vitamin D		//
Calcitrol		//
Sed Rate	62	12/02/2009
Prealbumin	20.40	01/06/2010

Hydration Assessment

Serum Osmolality	311.5
Serum Osmolarity	304.1
Anion Gap	10.0
Osmolar Gap	

[Est. Glomerular Filtration Rate](#)

Predicted	84	<input <="" td="" type="text" value="%"/> <td>☐ Use?</td>	☐ Use?
MDRD	90	107.1	☐
Jelliffe (double-click)			☒
Cockcroft-Gault	101	120.2	☐
Salazar & Corcoran	107	127.4	☐
Schwartz			☐

Urinalysis

Ketones	Negative	UWBC	5
Leukocytes	Negative	URBC	1
Nitrates	Negative	UEPI	
Spec Grav	.000	Bacteria	
Glucose	Normal	Mucous	
Protein	100	Casts	
		Yeast	

24 Hr Urine Creatinine

Cholesterol	126	12/10/2009
HDL	24	12/10/2009
LDL	44	12/10/2009
Triglycerides	287	12/10/2009

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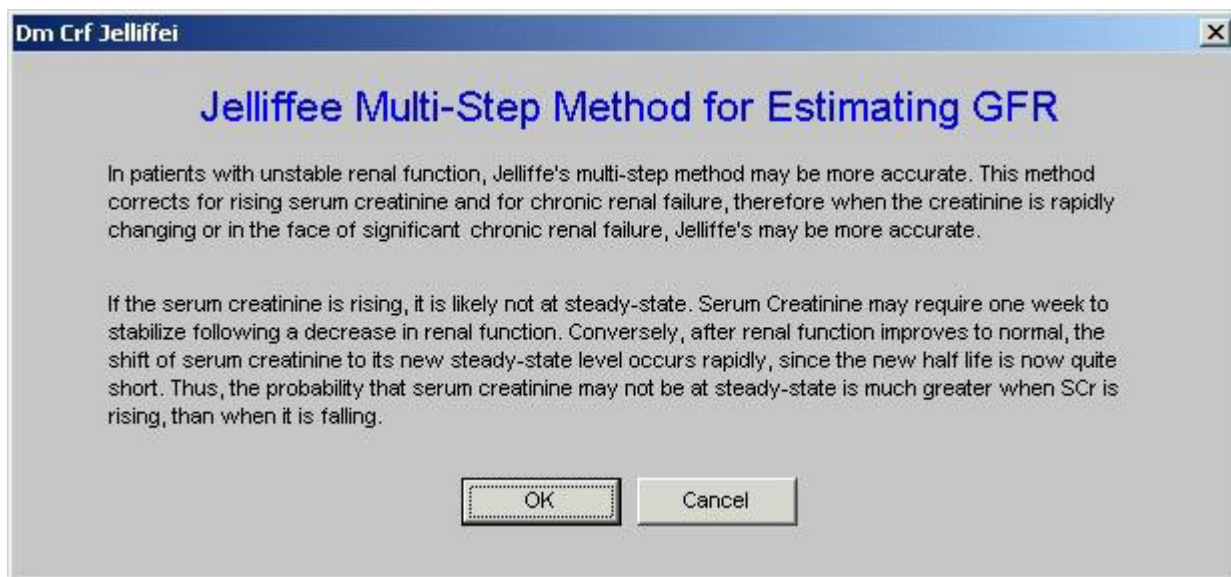
Document

Physician Information

You will notice that the title of this box “**Predicted**” is in blue, which means that it is a hyperlink. If you click on “Predicted,” the formula for calculating this Predicted GFR will be displayed.



We have discussed the second formula entitled “MDRD” above. The third formula is entitled “Jeffillee”. The pop-up which appears when the button is clicked states:



As mentioned previously the Jeffillee formula is the only *multi*-stage formula. In order to display the estimated glomerular filtration rate calculated by this formula it is necessary to go through several steps.

In the space between the title of this template and the box where the result is displayed is a note which states, “**Double Click.**”

Chronic Renal Failure

[Assessment Guidelines](#)[Kidney Disease Summary](#)

Refresh Template / Check Labs

Hydration Assessment

Patient

Sex

M

Age

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GFR and Hypertension

GFR and Nutrition

GFR and Bone Disease

GFR and Neuropathy

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Assessment

Document

Physician Information

Height

73.00

in

Weight

185.01

lb

BMI

24.44

Body Fat

27.1

%

BMR

2332

cal/day

BEE

1723

cal/day

Waist

36.00

in

Hips

42.00

in

Risk Ratio

.86

Blood Pressure

138 / 50

mmHg

Diabetes Mellitus

+ -

Diabetic Since (year)

1998

Metabolic Syndrome

+ -

Hypertension Management

Weight Management

Lipids Management

Vitals Over Time

MS Strip

/ /

Alb/Creat

/ /

Prot/Creat

/ /

24Hr Urine Pro

/ /

Sodium

145

01/06/2010

Potassium

4.4

01/06/2010

BUN

16

01/06/2010

Creatinine

.9

01/06/2010

Chloride

107

01/06/2010

HgbA1C

8.1

01/06/2010

Fructosamine

/ /

Glucose

124

01/06/2010

HGB

11.8

01/06/2010

HCT

37.9

01/06/2010

Retic Count

/ /

B12

646.81

11/20/2009

Folic Acid

/ /

Serum Iron

35

11/20/2009

IBC

374

11/20/2009

Ferritin

63

11/20/2009

EPO

79.90

12/11/2009

Ionized Calcium

5.7

11/20/2008

PTH

34

04/04/2007

Phosphorous

4.3

03/14/2007

Vitamin D

/ /

Calcitrol

/ /

Sed Rate

62

12/02/2009

Prealbumin

20.40

01/06/2010

Est. Glomerular Filtration Rate

Predicted

84

%

Use?

MDRD

90

107.1

Jelliffe

(double-click)

Cockcroft-Gault

101

120.2

Salazar & Corcoran

107

127.4

Schwartz

Urinalysis

01/06/2010

WBC

5

Ketones

Negative

URBC

1

Leukocytes

Negative

UEPI

Nitrates

Negative

Bacteria

Spec Grav

.000

Mucous

Glucose

Normal

Casts

Protein

100

Yeast

24 Hr Urine Creatinine

/ /

Cholesterol

126

12/10/2009

HDL

24

12/10/2009

LDL

44

12/10/2009

Triglycerides

287

12/10/2009

When you double click in the box next to Jeffillee, the following pop-up is deployed, which is entitled **Jeffillee Multi-step Method for Estimating GFR.**

38

Dm Crf Jelliffe

Jellifee Multi-Step Method for Estimating GFR

Is the patient's creatinine level rising? ☐ Yes ☐ No

Sex

LBW

Height

Age

E

E Corrected

BSA

Weight

Latest Creatinine mg/dL

Estimated GFR mL/min/1.73m²

To complete this formula follow the steps indicated.

The fourth formula is the **Cockcroft-Gault** formula. When the hyperlink is accessed the following pop-up is displayed which gives details about this formula and its value.

Dm Crf Cockcroft

Cockcroft-Gault Equation for Estimating GFR

General Equation

$$C_{cr} = \frac{140 - (\text{Age in Years}) * (\text{Weight in kg})}{72 * (\text{Serum Creatinine in mg/dL})} \text{ mL/min}$$

The Cockcroft equation has become the defacto standard despite many documented problems. The Cockcroft-Gault produces consistent results in patients of average size and build, with stable renal function and a SCr less than 3 mg%. However, it is problematic in others. The equation was dervied from a group of lean males.

The Cockcroft-Gault equation tends to over-estimate creatinine clearance in the elderly. Therefore, an empiric "correction" commonly employed is to round up the serum creatinine to 1.0 mg% in elderly patients. However, most studies have found this to be an inappropriate practice which under-estimates true creatinine clearance.

Use of a very low serum creatinine (0.5 mg% or less) in the Cockcroft-Gault equation leads to a falsely elevated creatinine clearance. Therefore, many practitioners designate 0.7 mg% as the minimum serum creatinine which should be used in the equation.

Women

The Cockcroft-Gault was from a group of men, the 0.85 factor for women was added afterwards, to correct for the smaller muscle mass of females. One study found that a 0.9 factor for women may be more accurate.

Diet

Serum creatinine will be affected by dietary extremes. Patients who are following an unusual vegetarian diet may have a lower serum creatinine than expected. A diet excessively rich in red meat will lead to the reverse error.

The fifth formula is the **Salazar & Corcoran** formula. The following is the pop-up which appears when this hyperlink is accessed.

Dm Crf Salazar

Salazar-Corcoran Equation for Estimating GFR

Males

$$\text{GFR} = \frac{(137 - (\text{age in years})) * [(0.285 * (\text{weight in kg})) + (12.1 * (\text{height in m})^2)]}{51 * (\text{serum creatinine in mg/dL})}$$

Females

$$\text{GFR} = \frac{(146 - (\text{age in years})) * [(0.287 * (\text{weight in kg})) + (9.74 * (\text{height in m})^2)]}{60 * (\text{serum creatinine in mg/dL})}$$

The Cockcroft-Gault was derived from a group of 296 males, all within 10% of LBW, leading many to question the validity of this method in obese patients. Studies have generally found that use of total body weight tends to over-estimate creatinine clearance in obese patients, while use of lean body weight tends to under-estimate creatinine clearance. Various weight correction factors have been proposed, each has their proponents and detractors:

a. Use of LBW plus 20 to 40% of the excess weight.

b. Normalizing to 72 kg.

c. Normalizing to BSA of 1.73 M2

An alternative for this group is the Salazar-Corcoran method which was derived from an obese patient population.

OK

Cancel

The sixth formula is the Schwartz formula. When this hyperlink is accessed, the following pop-up is displayed.

Dm Crf Schwartz

Schwartz Equation for Estimating GFR in Children

GFR =

0.55 * (Height in cm)

(Serum Creatinine in mg/dL)

mL/min/1.73m^2

In children 12 and older, the Cockcroft-Gault equation gives a reasonably accurate estimate of creatinine clearance. For younger children, infants and neonates, no method of estimating creatinine clearance is reliable. The Swartz equation is the standard equation for young children, however, the results are not consistent enough to be used for pk (drug dosing) modeling.

The National Kidney Foundation Clinical Guidelines commented, "In children, several studies have compared the accuracy of prediction equations in estimating GFR with 24 hour or timed creatinine clearance studies. None of these studies demonstrated substantial improvement in estimating creatinine clearance using a 24-hour or timed urine collection over the use of the Schwartz prediction equation."

Many of the studies evaluating the Schwartz formula in children have substituted creatinine clearance for GFR in assessing it bias and precision in different populations. The bias of Schwartz formula estimates compared to creatinine clearances is relative small; however, the Schwartz formula has been shown to overestimate inulin clearance, particularly in children with low GFR. Although formulas that estimate creatinine clearance overestimate GFR, they provide an estimate that is accurate enough for most clinical purposes and represent a better alternative to assessing kidney function than serum creatinine alone.

For teenagers and young adults, use of both formulas (Schwartz and MDRD Study) may give the clinician a dependable range of estimates of GFR. In certain clinical situations, clearance measures may be necessary to estimate GFR.

OK

Cancel

As will be noted by reading this, in dealing with teenagers, the use of the Cockcroft-Gault and Schwartz formulae together may give a better picture of the renal function than either one alone.

41

Chronic Renal Failure				Patient		
				Sex	M	Age
						62
Assessment Guidelines Kidney Disease Summary						
Refresh Template / Check Labs				Hydration Assessment		
Height	73.00	in	MS Strip		/	/
wWeight	185.0	lb	Alb/Creat		/	/
BMI	24.44		Prot/Creat		/	/
Body Fat	27.1	%	24Hr Urine Pro		/	/
BMR	2332	cal/day	Sodium	145	01/06/2010	
BEE	1723	cal/day	Potassium	4.4	01/06/2010	
wWaist	36.00	in	BUN	16	01/06/2010	
Hips	42.00	in	Creatinine	.9	01/06/2010	
Risk Ratio	.86		Chloride	107	01/06/2010	
Blood Pressure			HgbA1C	8.1	01/06/2010	
138	/	50	Fructosamine			
		mmHg	Glucose	124	01/06/2010	
			HGB	11.8	01/06/2010	
Diabetes Mellitus			HCT	37.9	01/06/2010	
+ ☒ - ☐			Retic Count			
Diabetic Since (year) 1998			B12	646.8	11/20/2009	
Metabolic Syndrome			Folic Acid			
+ ☒ - ☐			Serum Iron	35	11/20/2009	
Hypertension Management			IBC	374	11/20/2009	
Weight Management			Ferritin	63	11/20/2009	
Lipids Management			EPO	79.90	12/11/2009	
Vitals Over Time			Ionized Calcium	5.7	11/20/2008	
			PTH	34	04/04/2007	
			Phosphorous	4.3	03/14/2007	
			Vitamin D			
			Calcitrol			
			Sed Rate	62	12/02/2009	
			Prealbumin	20.40	01/06/2010	
Est. Glomerular Filtration Rate						
Predicted	84	%	Use?			
MDRD	90	107.1	☐			
Jelliffe (double-click)			☒			
Cockcroft-Gault	101	120.2	☐			
Salazar & Corcoran	107	127.4	☐			
Schwartz			☐			
Urinalysis	01/06/2010	UWBC	5			
Ketones	Negative	URBC	1			
Leukocytes	Negative	UEPI				
Nitrates	Negative	Bacteria				
Spec Grav	.000	Mucous				
Glucose	Normal	Casts				
Protein	100	Yeast				
24 Hr Urine Creatinine						
Cholesterol	126	12/10/2009				
HDL	24	12/10/2009				
LDL	44	12/10/2009				
Triglycerides	287	12/10/2009				

Home

Lab Results

Classification

Evaluation

Acute Renal Disease

Proteinuria

GFR

GFR and Anemia

GFR and Hypertension

GFR and Nutrition

GFR and Bone Disease

GFR and Neuropathy

Renal Failure

Assessment

Document

Physician Information

The fourth column of the Master Chronic Renal Disease Template contains 16 navigation buttons. Each will be described and its use and means explained. The 16 buttons are outlined in red below:

Chronic Renal Failure

[Assessment Guidelines](#) [Kidney Disease Summary](#)

Refresh Template / Check Labs

Hydration Assessment

Est. Glomerular Filtration Rate

Urinalysis

24 Hr Urine Creatinine

Cholesterol

HDL

LDL

Triglycerides

Diabetes Mellitus

Metabolic Syndrome

Hypertension Management

Weight Management

Lipids Management

Vitals Over Time

Navigation Buttons (Right Column):

- Home
- Lab Results
- Classification
- Evaluation
- Acute Renal Disease
- Proteinuria
- GFR
- GFR and Anemia
- GFR and Hypertension
- GFR and Nutrition
- GFR and Bone Disease
- GFR and Neuropathy
- Renal Failure
- Assessment
- Document
- Physician Information

The use of each of these buttons and the functions which they launch will now be described. (For those functions which require more detailed explanation, this general and brief introduction of all of the navigation buttons will be followed by a detailed explanation.)

1. **Home** – this button is used to return the user to the AAA Home template
2. **Lab Results** – this button launches the laboratory results template which will place all current lab on the patient's Chronic-Renal-Disease chart note. (click here for an explanation of the Lab Results template.)
3. **Classification** – this launches a template which lists the pathology and etiology of most causes of Chronic Renal Disease.
4. **Evaluation** – the content and use of the template has been described above (click here to return to the section on the Evaluation template)
5. **Acute Renal Failure** – this template displays the cause of Acute Renal Failure and explains the three categories of Acute Renal Disease.

6. **Proteinuria** – this template defines microalbuminuria and albuminuria, discusses albumin/creatinine ratio, false positive proteinuria and calculates the degree of proteinuria from laboratory tests which are displayed.
7. **GFR** – this template displays the results of various equations for calculating estimated GFR, discusses the limitations of estimated GFR and calculates the estimated GFR.
8. **GFR and Anemia** – this template addresses the causes of anemia in Chronic Renal Disease and addresses procrit therapy, dosing and safety.
9. **GFR and Hypertension** – this template addresses elevated blood pressure in the patient with Chronic Renal Disease. It includes the ability to identify the mechanisms of blood pressure elevation in Chronic Renal Disease, the goal of blood pressure control, treatment recommendations, and links to SETMA's hypertension disease management tools, low salt diet, weight management and exercise prescriptions.
10. **GFR and Nutrition** – this template allows for evaluation of Protein Energy Malnutrition (PEM) in chronic renal disease, the definition of PEM, and also calculates Dailey Protein Intake as well as Daily Energy Intake in various stages of Chronic Renal Disease.
11. **GFR and Bone Disease** – this template addresses abnormalities of bone metabolism which is seen in patients with a GFR below 60 ml/min/1.72 meters². It identifies the importance of Calcium, Phosphate, Vitamin D3, PTH and Ca x PO4 in Chronic Renal Disease.
12. **GFR and Neuropathy** – this template discusses the applications of uremic neuropathy including autonomic neuropathy in Chronic Renal Disease. The review of systems and physical examination relevant to uremic neuropathy are discussed.
13. **Renal Failure** – this template discusses common causes of renal failure and common causes of an acute decline in GFR. The definition of renal failure and predicting a decline in GFR are discussed.
14. **Assessment** – this template summarizes the renal status of the patient and includes a summary of the nutritional status, lipid status, Calcium Phosphorus Product, Hyperparathyroidism, Immunizations and habits.
15. **Document** – this button launches the creation of the Renal Chart Note for this patient encounter
16. **Physician Information** – this button launches a series of education documents about the care of patients with renal disease.

Description of the templates launched by Navigation Buttons

Classification

The full title of this template is **Classification of Chronic Kidney Disease**. In addition to diabetes there are five other classes of chronic kidney disease based on pathology; they are:

- Glomerular Diseases (Primary or Secondary) and these are divided into Proliferative and Non-proliferative
- Vascular Disease
- Tubulointerstitial Disease
- Cystic Disease
- Diseases in the Transplant

The template also addresses etiologies of each of the above. Many of the categories and etiologies names are in bold blue, which means that there are documents associated with each of these which give details about each disorder.

Classification of Chronic Kidney Disease

[Return](#)

Pathology

Etiology (Examples)

☒ [Diabetic Glomerulonephritis](#)

[Diabetes Mellitus](#)

☐ Type I ☒ Type II

Glomerular Diseases (Primary or Secondary)

Proliferative glomerulonephritis

- ☐ [Mesangial proliferative glomerulonephritis](#)
- ☐ [Membranoproliferative glomerulonephritis](#)
- ☐ [Focal proliferative glomerulonephritis](#)
- ☐ [Diffuse proliferative glomerulonephritis](#)
- ☐ [Crescentic glomerulonephritis](#)

Noninflammatory glomerular diseases

- ☐ Minimal change disease
- ☐ [Focal glomerular sclerosis](#)
- ☐ [Membranous nephropathy](#)
- ☐ Fibrillary glomerular diseases

☐ Hereditary nephritis (Alport's)

- ☐ System Lupus Erythematosus
- ☐ Vasculitis
- ☐ [Bacterial endocarditis](#)
- ☐ [Chronic hepatitis B](#)
- ☐ [Chronic hepatitis C](#)
- ☐ HIV infection

[Doc](#)

- ☐ Post-streptococcal glomerulonephritis
- ☐ ANCA Disease
- ☐ [\(Antineutrophil Cytoplasmic Antibody Glomerulonephritis\)](#)

- ☐ Hodgkin's disease
- ☐ [HIV Infection](#)
- ☐ Heroin toxicity
- ☐ Drug toxicity
- ☐ Solid tumors
- ☐ Amyloidosis
- ☐ Light chain disease

Vascular Disease

- ☐ [Diseases of large-size vessels](#)
- ☐ [Diseases of medium-size vessels](#)
- Nephrosclerosis
- ☐ [Diseases of small-size vessels](#)
- Microangiopathy

- ☐ [Renal artery stenosis](#)
- ☐ Hypertension

- ☐ Sickle cell disease
- ☐ [Hemolytic uremic syndrome](#)
- including ☐ Cyclosporine toxicity ☐ Tacrolimus toxicity

Tubulointerstitial Diseases

[Tubulointerstitial nephritis](#)

- ☐ [Pyelonephritis](#)
- ☐ Analgesic nephropathy
- ☐ [Allergic interstitial nephritis](#)
- ☐ Granulomatous interstitial nephritis
- ☐ Autoimmune interstitial nephritis

Noninflammatory tubulointerstitial nephritis

- ☐ Infection
- ☐ Stones
- ☐ [NSAID](#)
- ☐ [Antibiotics](#)
- ☐ [Sarcoidosis](#)
- ☐ Uveitis

If the pathologic cause of the patient's renal disease or if the etiology of the patient's renal disease is selected on the Classification template, it will automatically note that on the **Assessment Template** (this function does not work at present but will be added in 2010).

Renal Assessment

Referring Provider: James Holly

Etiology: DM II Renal Manifestat Contr

Stage of CKD: Stage 1

Degree of Proteinuria:

Stability

☒ Stable ☐ Progressive ☐ Improving

Anemia

☐ Of Chronic Disease ☐ Megaloblastic

☐ Iron Deficiency ☐ Hemolytic

Hemodynamic

☒ Acceptable ☐ Needs Improvement

Metabolic Status

☐ Acidosis ☐ Alkalosis ☐ Acceptable

Anion Gap: ☒ Normal ☐ High ☐ Low

Chloride: ☒ Sensitive ☐ Resistant

Volume Status

☐ Euvolemic ☒ Dehydrated ☐ Fluid Overload

Access for Renal Replacement Therapy

☐ Indicated ☒ Not Indicated

Referral to CV Surgeon for AV Fistula

☐ Indicated ☒ Not Required

Referrals (Double-click to Add/Edit)

Status	Referral
Completed	Beaudry, Carl
Completed	0

Medications (Double-Click to Add/Edit)

Brand Name	Generic Name	Dose	Sig Codes
ASPIRIN EC	ASPIRIN	81MG	1 po daily
AUGMENTIN	AMOX TR/POTASSIUM CLAVULANATE	875-125MG	1 po BID

Nutritional Status

Height: 73.00 inches

Weight: 185.01 pounds

BMI: 24.44 kg/m²

Weight Loss: ☐ Yes ☒ No

Serum Albumin: 3.1 12/10/2009

Prealbumin: 20.40 01/06/2010

Lipid Status

☐ Acceptable ☒ Requires Therapy

Cholesterol: 126 12/10/2009

Triglycerides: 287 12/10/2009

HDL: 24 12/10/2009

LDL: 135 08/06/2009

Calcium * Phosphorous Product

Ca: 10.0 01/06/2010

PO4: 4.3 03/14/2007

Product: 43

Hyperparathyroidism

☐ Primary ☐ Secondary ☐ Tertiary

PTH: 34 04/04/2007

Immunizations

Pneumovax: 05/25/2009

Influenza: 09/28/2009

Hepatitis B 1: / /

2: / /

3: / /

History

Alcohol: ☐ Yes ☒ No

Drugs: ☐ Yes ☒ No

Smoking: ☐ Yes ☒ No

Possible nephrotoxic drugs? ☐ Yes ☒ No

Return

Renal Lab Orders

Main Lab Orders

Immunizations

Comments - 1

Comments - 2

Document

Treatment Plan

SETMA's Treatment Audit

PCPI Treatment Audit

Follow-Up

Acute Care Follow-Up

Follow - up: 3 month(s)

Routine Care Follow-Up:

Acute Renal Disease

Common Causes

Causes of acute kidney failure fall into one of the following categories:

Prerenal

Problems affecting the flow of blood before it reaches the kidneys.

Postrenal

Problems affecting the movement of urine out of the kidneys.

Renal - Problems with the kidney itself that prevent proper filtration of blood or production of urine.

Return

Information

[Renal Damage](#)

[Glomerulonephritis](#)

[Acute Interstitial Nephritis](#)

[Acute Tubular Necrosis](#)

WBC	9.7	01/06/2010	ALB	3.1	12/10/2009
HGB	11.8	01/06/2010	AST	30	12/10/2009
HCT	37.9	01/06/2010	ALT	25	12/10/2009
PLT	390	01/06/2010	ALP	159	12/10/2009
RBC	4.61	01/06/2010	BILI-D	.0	12/10/2009
MCV	82.3	01/06/2010	BILI-T	.0	12/10/2009
MCH	25.6	01/06/2010	TP	6.0	12/10/2009
MCHC	31.1	01/06/2010	Spot K		/ /
Lymph #	1.4	01/06/2010	Urinalysis Protein		
Lymph %	14.8	01/06/2010		100	01/06/2010
Eos #	.1	01/06/2010	Check for New Labs		
Eos %	.9	01/06/2010			

Hydration Assessment

☐ Good

☐ Adequate

☒ Marginal

☐ Dehydrated

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At the top of the Acute Renal Disease template is a button entitled “**Common Causes.**” When this button is launched a template is deployed which is entitled “**The Most Common Causes of Acute Renal Dysfunction.**” It is possible for a patient to have more than one of these causes simultaneously and this tool makes it possible to designate as many as apply to the patient.

Dm Crf Acute Cause

Most Common Causes of Acute Renal Dysfunction

The most common causes of acute renal dysfunction include:

☐ Volume depletion	☐ Renal vascular disease
☐ Severe heart failure	☐ Sepsis
☐ Urinary tract obstruction	☐ Rhabdomyolysis
☐ Acute tubular necrosis (ATN)	☐ Hemolysis
☐ Acute interstitial nephritis	☐ ACE Inhibitors
☐ Acute pyelonephritis	☐ NSAIDs
☐ Acute glomerulonephritis	☐ ARBs
☐ Atheroembolic disease	☐ Cyclosporine
☐ Radiographic contrast	☐ Tacrolimus
☐ Selected antimicrobial agents (aminoglycosides and amphotericin B)	

Below the “**Common Causes**” button is a section which discusses the three categories of acute renal failure. They are:

1. **Prerenal** – this is defined as “**Problems which affect blood flow before it reaches the kidney.**” When this button is deployed the following pop-up appears.

Dm Crf Prerenal

Prerenal Failure

Prerenal failure is by far the most common type of acute renal failure. Your kidneys do not receive enough blood to filter. Prerenal failure can be caused by the following conditions:

- ☐ Dehydration - From vomiting, diarrhea, water pills, or blood loss

Disruption of blood flow to the kidneys - From a variety of causes:

- ☐ Drastic drop in blood pressure - From major surgery, severe injury or burns, or infection in the bloodstream (sepsis) causing blood vessels to inappropriately relax
- ☐ Blockage or narrowing of a blood vessel carrying blood to the kidneys
- ☐ Heart failure or heart attacks causing low blood flow
- ☐ Liver failure causing changes in hormones that affect blood flow and pressure to the kidney

There is no actual damage to the kidneys with prerenal failure. With appropriate treatment, it usually can be reversed unless the insult to the kidneys is prolonged and damage to the kidney tissue proper occurs.

OK Cancel

This pop-up makes it possible to designate what the causes of the patient’s decrease in renal function are. There can be more than one affecting a patient at any given time.

2. **Postrenal** – this is defined as “**Problems affecting the movement of urine out of the kidney.**”

Dm Crf Postrenal

Postrenal Failure

Postrenal failure is sometimes referred to as obstructive renal failure, since it is often caused by something blocking elimination of urine produced by the kidneys. This problem also can be reversed, unless the obstruction is present long enough to cause damage to kidney tissue.

Obstruction of one or both ureters can be caused by the following:

- ☐ Kidney stone
- ☐ Cancer of the urinary tract organs or structures near the urinary tract that may obstruct the outflow of urine
- ☐ Medications

Obstruction at the bladder level can be caused by the following:

- ☐ Bladder stone
- ☐ Enlarged prostate (the most common cause in men)
- ☐ Blood clot
- ☐ Bladder cancer
- ☐ Neurologic disorders of the bladder impairing its ability to contract

Treatment consists of relieving the obstruction. Once the blockage is removed, the kidneys usually recover in 1-2 weeks if there is no infection or other problem.

This pop-up addresses the location of obstructions which affect the flow of urine out of the kidney and allow for the documentation of the problem which affects this patient.

3. **Renal** – this is defined as “**Problems with the kidney itself that prevent proper filtration of blood or production of urine.**”

On the **Acute Renal Disease Template**, after the **definitions of prerenal, postrenal and renal** disease, there is a display of all laboratory values which relate to kidney function. At the bottom of the second column of lab values, there is a button entitled “**Check for New Labs,**” which allows you to update the presentation of current labs.

This is followed by a link to the **Hydration Template**. When the **Hydration Assessment** has been completed, the results of the level of hydration of the patient is displayed on this template. And, there is a button entitled, “Check for new labs,” which allows the system to check for new laboratory values.

Finally, to the right of the Acute Renal Disease template there are **four “information” buttons** which launch documents about:

- Renal Disease
- Glomerulonephritis
- Acute Interstitial Nephritis
- Acute Tubular Necrosis

Proteinuria

Proteinuria

[Early Detection of Kidney Damage](#)[Definition and Classification](#)

[Proteinuria](#) is an early and sensitive marker of kidney damage in many types of chronic kidney disease. Albuminuria is a more sensitive marker than total protein for chronic kidney disease due to diabetes, hypertension and glomerular diseases.

Check for New Labs

UA	01/06/2010	MS Strip	Positiv	01/06/2010	Degree of Proteinuria		
UWBC	2	Alb/Creat		/ /			
URBC	1	Prot/Creat		/ /	False Positive Proteinuria		
UEPI		<i>A positive MS Strip should be supplemented with a quantitiave measurement such as an Albumin/Creatinine ratio or a Protein/Creatinine ratio</i>					
UBacteria		Na	145	01/06/2010	ALB	3.1	12/10/2009
Mucous		K	4.4	01/06/2010	AST	30	12/10/2009
Casts		Cl	107	01/06/2010	ALT	25	12/10/2009
Cast #		CO2	30	01/06/2010	ALP	159	12/10/2009
Yeast		Glucose	124	01/06/2010	BILI-D	.0	12/10/2009
Yeast #		BUN	16	01/06/2010	BILI-T	.0	12/10/2009
Protein	100	Creatinine	.9	01/06/2010	TP	6.0	12/10/2009
		Ca	10.0	01/06/2010			

Information
[Evaluation of Urine Dip Stick](#)
[Evaluation of Proteinuria](#)
[Types of Proteinuria](#)
[Normal Urinary Albumin](#)

Guidelines for Evaluating Proteinuria
[Adults and Children](#)
[Adult Specifics](#)
[Children w/o Diabetes](#)
[Children w/ Diabetes](#)

At the top of the **Proteinuria** template are two buttons which give information about the **early detection of kidney damage** and **definitions of proteinuria and albuminuria**.

The first button is entitled “**Early Detection of Kidney Damage.**” When it is launched the following is displayed.

Early Detection of Kidney Damage

- Early detection: Persistently increased urinary excretion of protein is a sensitive marker of kidney damage. Early detection allows more timely introduction of therapy to slow disease progression.
- Albuminuria is more sensitive marker for adults with CKD due to diabetes, hypertension, and glomerular diseases than total protein.
- NKF recommends random spot urine measurements due to the inconvenience and errors associated with timed-urine samples.
- First morning specimens are preferred: if not available, random specimens are acceptable

- If 1+ protein, assess total protein-to-creatinine ratio or albumin-to-creatinine ratio within 3 months.

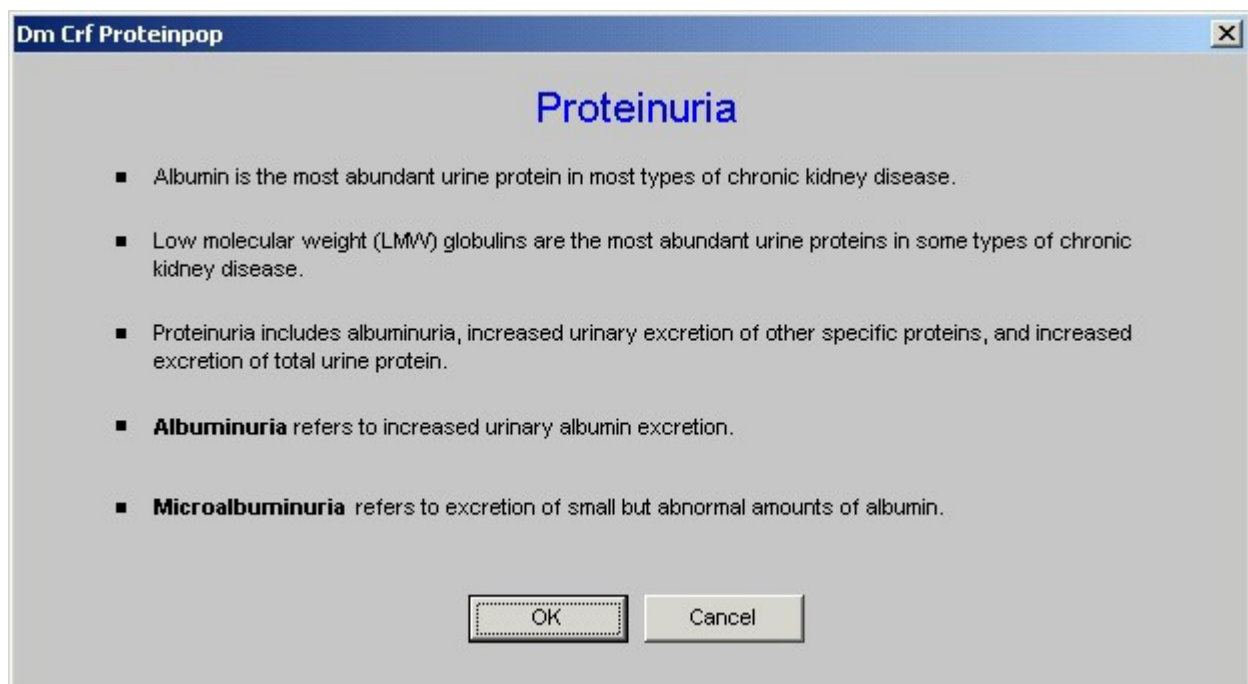
The second button is entitled “**Definitions of Proteinuria and albuminuria.**” When this button is activated, the following information appears.

Definitions of Proteinuria and Albuminuria

	Urine Collection Method	Normal	Microalbuminuria	Albuminuria or Clinical Proteinuria
Total Protein	24-Hour Excretion (varies with method)	<300 mg/day	NA	>300 mg/day
	Spot Urine Dipstick	<30 mg/dL	NA	>30 mg/dL
	Spot Urine Protein-to-Creatinine Ratio (varies with method)	<200 mg/g	NA	>200 mg/g
Albumin	24-Hour Excretion	<30 mg/day	30–300 mg/day	>300 mg/day
	Spot Urine Albumin-Specific Dipstick	<3 mg/dL	>3 mg/dL	NA
	Spot Urine Albumin-to-Creatinine Ratio (varies by gender ^a)	<17 mg/g (men) <25 mg/g (women)	17–250 mg/g (men) 25–355 mg/g (women)	>250 mg/g (men) >355 mg/g (women)

^a Gender-specific cut-off values are from a single study.¹⁹ Use of the same cut-off value for men and women leads to higher values of prevalence for women than men. Current recommendations from the American Diabetes Association define cut-off values for spot urine albumin-to-creatinine ratio for microalbuminuria and albuminuria as 30 and 300 mg/g, respectively, without regard to gender.⁸

The next hyperlink on this template is entitled **Proteinuria** and when launched, it displays the following information:



After the hyperlink entitled **Proteinuria**, there are **two facts about proteinuria** which are very important:

1. Protein is an early and sensitive marker of kidney damage in many types of kidney disease.
2. Albuminuria is a more sensitive marker than total protein for chronic kidney disease due to diabetes, hypertension and glomerular disease.

Proteinuria

[Early Detection of Kidney Damage](#) [Definition and Classification](#)

Proteinuria is an early and sensitive marker of kidney damage in many types of chronic kidney disease. Albuminuria is a more sensitive marker than total protein for chronic kidney disease due to diabetes, hypertension and glomerular diseases.

[Return](#)

[Check for New Labs](#)

Urinalysis 01/06/2010

UWBC5

URBC1

UEPI

UBacteria

Mucous

Casts

Cast #

Yeast

Yeast #

Protein100

MS Strip

Alb/Creat

Prot/Creat

Na14501/06/2010

K4.401/06/2010

Cl10701/06/2010

CO23001/06/2010

Glucose12401/06/2010

BUN1601/06/2010

Creatinine.901/06/2010

Ca10.001/06/2010

Degree of Proteinuria

False Positive Proteinuria

*A positive MS Strip should be supplemented with a quantitative measurement such as an Albumin/Creatinine ratio or a **Protein/Creatinine ratio***

ALB3.112/10/2009

AST3012/10/2009

ALT2512/10/2009

ALP15912/10/2009

BILI-D.012/10/2009

BILI-T.012/10/2009

TP6.012/10/2009

Information
[Evaluation of Urine Dip Stick](#)
[Evaluation of Proteinuria](#)
[Types of Proteinuria](#)
[Normal Urinary Albumin](#)

Guidelines for Evaluating Proteinuria
[Adults and Children](#)
[Adult Specifics](#)
[Children w/o Diabetes](#)
[Children w/ Diabetes](#)

Following these statements, there is a box in which the “**degree of proteinuria**” is automatically documented.

Note: In order for the “degree of proteinuria” to be calculated an **albumin/creatinine ratio** or a **protein/creatinine ratio** must be documented in the lab values.

Above the box entitled “degree of proteinuria,” there is a button of the same name, which when launched displays the following information:

Degree of Proteinuria

normal:	< 150 mg/24hr
microalbuminuria:	30-300 mg/24 (specifically albumin; usually measured in diabetics)
trace proteinuria:	150 to 500 mg/24 hr
mild proteinuria:	500 mg to 1 g/24 hr
moderate proteinuria:	1-3 g/24 hr
	nephrotic range proteinuria: > 3 g/24 hr

Beneath the box in which “degree of proteinuria” is displayed, there is a button entitled, “**False Positive Proteinuria.**” When this button is clicked, the following pop-up is displayed..

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Dm Crf Falseprot

Common Causes of False Results in Routine Measurement of Urinary Albumin or Total Protein

Select any of the following traits which may be present and causing false results in this patient.

Causes of False Positives	Causes of False Negatives
☒ Dehydration	☐ Excessive hydration
☒ Hematuria	☐ Urine proteins other than albumin
☒ Exercise	
☐ Infection	

This allows the provider to document the presence of any condition which might influence the measurement of urinary protein and which might give a false value.

Below the **Degree-of-Proteinuria** box, there is a caution about the **MS Strip or Micral Strip**. See it below outlined in red.

Proteinuria

[Early Detection of Kidney Damage](#)[Definition and Classification](#)

Proteinuria is an early and sensitive marker of kidney damage in many types of chronic kidney disease. Albuminuria is a more sensitive marker than total protein for chronic kidney disease due to diabetes, hypertension and glomerular diseases.

Check for New Labs

UA01/06/2010

UWBC2

URBC1

UEPI

UBacteria

Mucous

Casts

Cast #

Yeast

Yeast #

Protein100

MS StripPositiv01/06/2010

Alb/Creat

Prot/Creat

Degree of Proteinuria

False Positive Proteinuria

A positive MS Strip should be supplemented with a quantitative measurement such as an Albumin/Creatinine ratio or a [Protein/Creatinine ratio](#)

Na14501/06/2010

K4.401/06/2010

Cl10701/06/2010

CO23001/06/2010

Glucose12401/06/2010

BUN1601/06/2010

Creatinine.901/06/2010

Ca10.001/06/2010

ALB3.112/10/2009

AST3012/10/2009

ALT2512/10/2009

ALP15912/10/2009

BILI-D.012/10/2009

BILI-T.012/10/2009

TP6.012/10/2009

Information

[Evaluation of Urine Dip Stick](#)[Evaluation of Proteinuria](#)[Types of Proteinuria](#)[Normal Urinary Albumin](#)

Guidelines for Evaluating Proteinuria

[Adults and Children](#)[Adult Specifics](#)[Children w/o Diabetes](#)[Children w/ Diabetes](#)

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A hyperlink is attached to the phrase “**Protein/Creatinine Ratio,**” which when launched displays the following:

Evaluation of Proteinuria

Spot protein/creatinine ratio estimates 24-hour excretion of protein in grams/24 hr. To perform the test, a random urine sample is submitted to the laboratory for protein concentration (in mg/dL) and creatinine concentration (in mg/dL). The protein/concentration is divided by the creatinine concentration, and the unit-less number is the estimated daily protein excretion in gm/24 hrs. An abnormal ratio is >0.15 , which estimates a 24 hour protein excretion of >150 mg/day (>0.15 gm/day). Many nephrologists recommend using protein/creatinine ratios to quantify protein excretion instead of a 24 hour urine collection.

Beneath this information is a display of 15 lab values pertinent to Proteinuria evaluation.

To the right of this information there is a series of **information buttons** which launch documents on:

- Evaluation of Urine Dip Stick
- Evaluation of Proteinuria
- Types of Proteinuria
- Normal Urinary Albumin

Followed by a series of articles entitled “**Guidelines for Evaluating Proteinuria.**”

- Adult and Children
- Adult Specific
- Children without Diabetes
- Children with Diabetes

GFR (Glomerular Filtration Rate)

This template addresses the value of GFR as a measure of kidney function; it is simple and straightforward in its use.

Glomerular Filtration Rate (GFR)

The level of **GFR** is accepted as the best measure of overall kidney function in health and disease.

Decreased GFR is associated with a wide range of complications in other organ systems, manifested by high blood pressure, laboratory abnormalities, and symptoms. Severity of complications worsens as level of GFR declines.

Signs & Symptoms of Glomerulonephritis

-	+
☐	☐ Hematuria
☐	☐ Weight loss (unintentional)
☒	☐ Nausea
☒	☐ Vomiting
☐	☐ Malaise
☒	☒ Fatigue
☒	☐ Pruritis
☐	☐ Oliguria
☐	☐ Nocturia

-	+
☐	☐ Tendency to bruise
☒	☐ Tendency to bleed
☐	☐ Drowsiness/decreased alertness
☒	☐ Confusion/delerium
☒	☐ Coma
☒	☐ Muscle cramps
☐	☐ Muscle spasms
☐	☐ Seizures
☐	☐ Paleness

-	+
☐	☐ Pigmentary changes
☐	☐ Polyuria
☐	☐ Nosebleeds
☐	☒ High BP
☐	☐ Blood in vomit
☐	☐ Melena
☐	☐ Hematochezia
☐	☐ Hiccups

Estimated Glomerular Filtration Rate

Predicted		%	Use?
<u>Predicted</u>	84		
<u>MDRD</u>	90	107.1	☐
<u>Jelliffe</u>			☐

Limitations of GFR Equations

		%	Use?
<u>Cockcroft-Gault</u>	101	120.2	☐
<u>Salazar-Corcoran</u>	107	127.4	☐

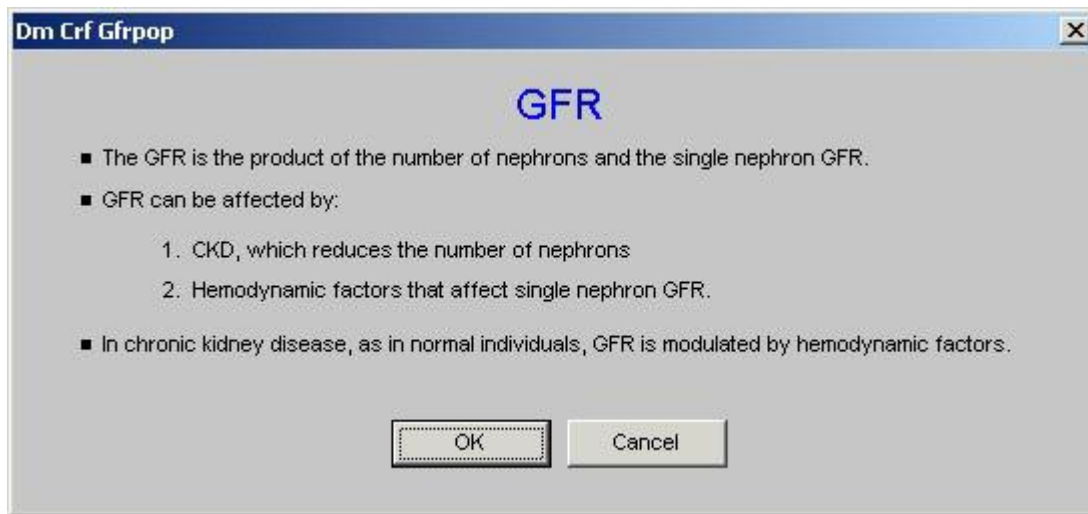
GFR Category

<< Calculate >>

Normal

57

The hyperlink attached to GFR in the first sentence on this template addresses the two ways in which GFR can be affected. When launched the pop-up associated with this hyperlink states:



The remainder of this template is self-explanatory.

GFR and Anemia

GFR and Anemia

[Causes of Anemia in CKD](#)

Anemia develops during the course of chronic kidney disease. Lower hemoglobin may result from the: loss of erythropoietin synthesis in the kidneys and/or the, or the presence of inhibitors of erythropoiesis.

Anticipate and Assess for Anemia

- Declining Hgb level should be expected as kidney disease increases. Hb levels should be monitored over time in all individuals with CKD.
- NKF recommends evaluating for anemia in patients with GFR <60 mL/min/1.73 m2 (stage 3, moderate disease)

Signs and Symptoms

-	+	
☒	☒	Fatigue
☐	☐	Dyspnea
☒	☐	Palpitations
☒	☐	Peripheral (ankle) edema
☒	☐	Cyanosis
☐	☐	Tachycardia
☐	☐	Gallop rhythm
☐	☐	Ejection murmur
☐	☐	Cervical venous hum
☐	☐	Increased left ventricular volume

Labs

HCT	37.9	01/06/2010	B12	646.8l	11/20/2009
Hgb	11.8	01/06/2010	Folic Acid		/ /
MCV	82.3	01/06/2010	Reticulocyte Count		/ /
MCHC	31.1	01/06/2010	Occult Blood		/ /
Serum Iron	35	11/20/2009			/ /
Serum Ferritin	63	11/20/2009			/ /
IBC		/ /			

Check for New Labs

Pharmacotherapy

[Procrit Therapy](#)

[Procrit Safety](#)

[Dosing Procrit](#)

Return

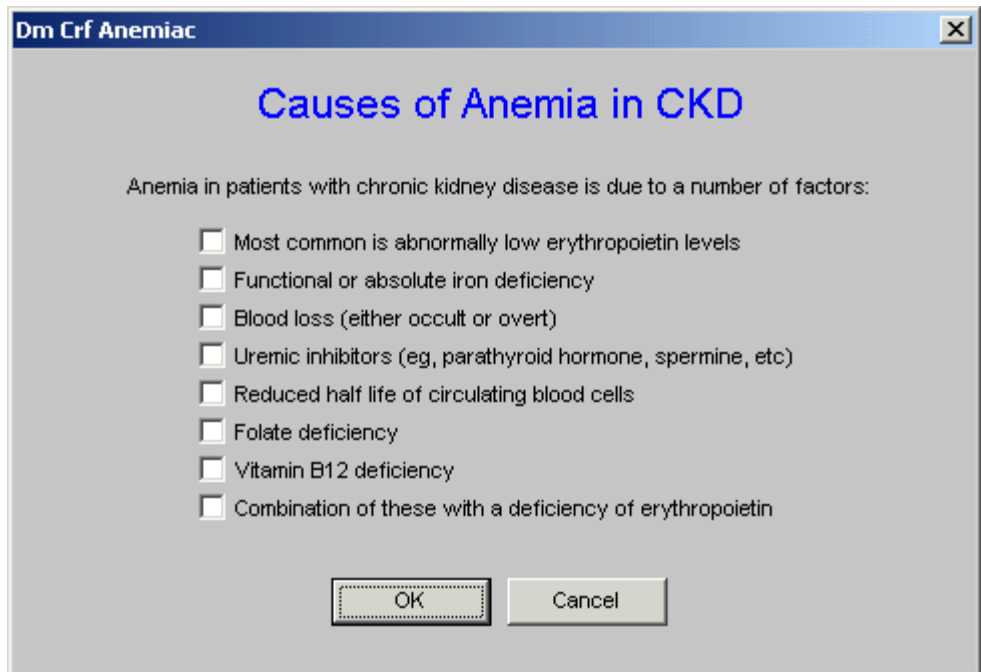
Information

[Complications of Anemia](#)

[Other Blood Problems](#)

[Anemia and GFR](#)

The first button on this template is entitled “Cause of Anemia in CKD.” When this button is clicked, the following pop-up appears on which the known causes of anemia can be documented:



The remainder of the GFR and Anemia is self explanatory. The theory of therapy with Procrit is explained in three documents and there are three documents which address anemia and GRF.

GFR and Hypertension

GFR and Hypertension

[Hypertension Management](#)

Return

High [blood pressure](#) can be either a cause or a consequence of chronic kidney disease. High blood pressure causes a faster decline in kidney function and cardiovascular disease.

Prevalence of high blood pressure is related to the level of GFR. Patients with chronic kidney disease have a high prevalence of high blood pressure, even when GFR is only mildly reduced.

[Mechanisms of HBP in Kidney Disease](#)

Blood Pressure (This Visit)

138

/

50

mmHg

Blood Pressure History (Hypertension Mgmt)

Beginning

128

/

60

07/31/2006

[Low Sodium Diet](#)

Highest

188

/

82

08/10/2009

[Exercise](#)

Calculate

[Algorithm](#)

BP Goal

< 135/85

Nonpharmacologic Therapy

Reduction in dietary salt

Pharmacologic Therapy

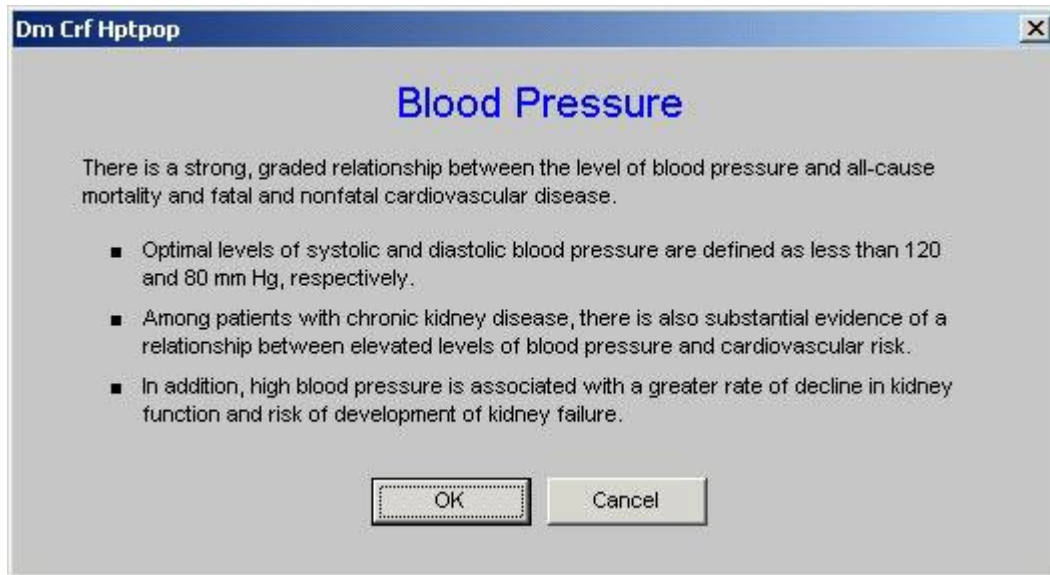
ACE-inhibitors or angiotensin 2 receptor blockers (diuretics), or CCBs in kidney transplant

This template displays information about the presence and activity of high blood pressure in patients with renal disease.

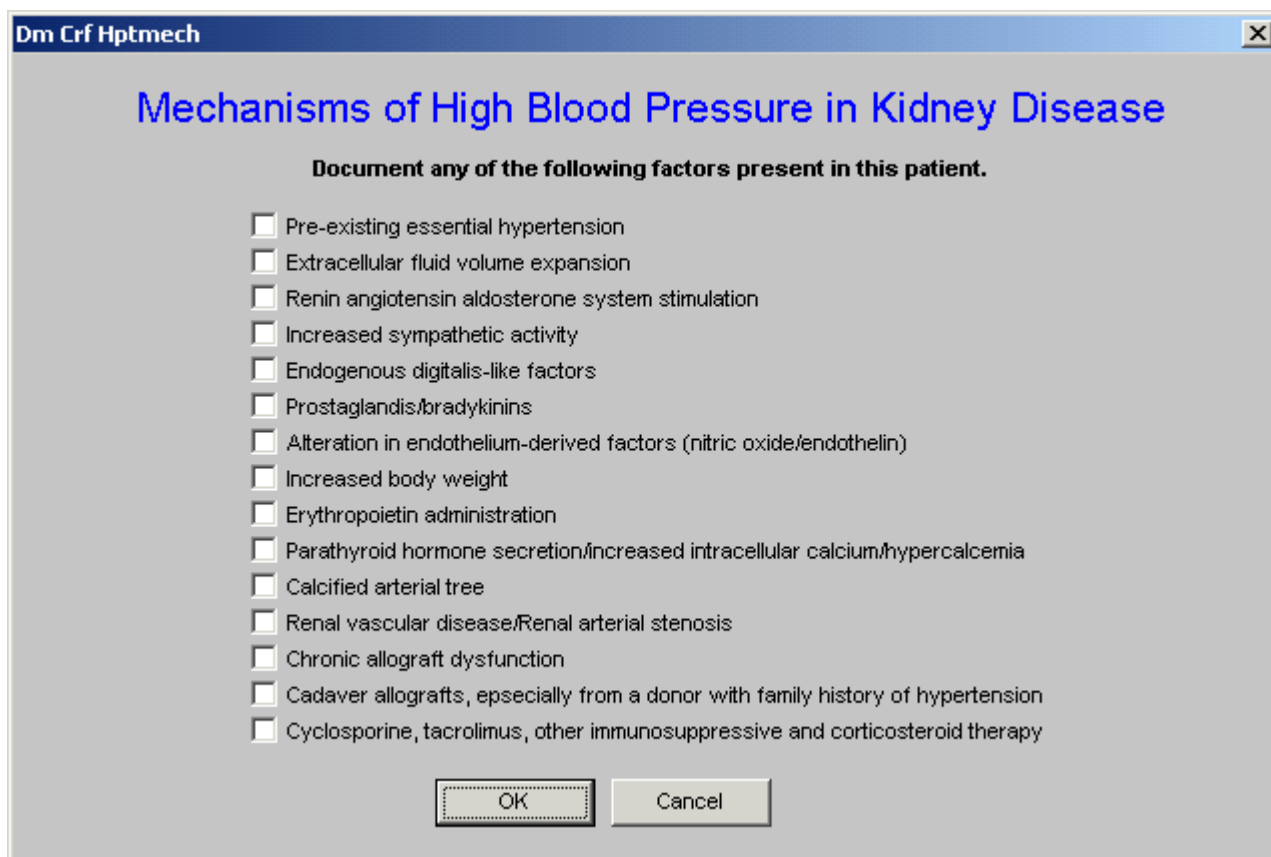
61

There are six hyperlinks on this template.

1. **“Hypertension”** at the top of the template. deploys SETMA’s **Hypertension Disease Management Tool**
2. **“Blood Pressure”** – deployment of this hyperlink displays the following pop-up which presents three important facts about high blood pressure in patients with chronic kidney disease.



3. **“Mechanisms of HBP in Kidney Disease.”** – this button deploys the following pop-up.



4. “Algorithm” which launches a pop-up entitled “**Blood Pressure Recommendations from the NKF.**”

Population	BP Goal (mmHg)	Nonpharmacologic Therapy	Pharmacologic Therapy
General Population	< 130/80	Reduction in dietary salt, Exercise	Beta-blockers, diuretics
CKD Stages 1-4 w/ proteinuria (>1 g/d)	< 125/75	Reduction in dietary salt	ACE-inhibitors or angiotensin 2 receptor blockers (diuretics), or CCBs in kidney transplant patients
CKD Stages 1-4 (w/o proteinuria)	< 135/85	Reduction in dietary salt	ACE-inhibitors or angiotensin 2 receptor blockers (diuretics), or CCBs in kidney transplant patients
Stage 5	< 140/90	Reduction in dietary salt. Reduction in fluid intake and ultrafiltration in dialysis patients.	Any, except diuretics in dialysis patients

OK Cancel

5. “**Low Sodium Diet**” – this button produces a printable low sodium diet.
6. “**Exercise**” – this button deploys SETMA Exercise Prescription template.

On the **GFR and Hypertension** template, there is also a button entitled “**Calculate.**” When that button is activated, it completes the following information for this patient based on the information in “Algorithm” discussed above.

- Blood Pressure Goal
- Non-pharmacologic therapy
- Pharmacologic Therapy

GFR and Hypertension

Hypertension Management

[Return](#)

High [blood pressure](#) can be either a cause or a consequence of chronic kidney disease. High blood pressure causes a faster decline in kidney function and cardiovascular disease.

Prevalence of high blood pressure is related to the level of GFR. Patients with chronic kidney disease have a high prevalence of high blood pressure, even when GFR is only mildly reduced.

Mechanisms of HBP in Kidney Disease

Blood Pressure (This Visit)

/ mmHg

Blood Pressure History (Hypertension Mgmt)

Beginning / [Low Sodium Diet](#)
Highest / [Exercise](#)

Calculate

[Algorithm](#)

BP Goal

< 135/85

Nonpharmacologic Therapy

Reduction in dietary salt

Pharmacologic Therapy

ACE-inhibitors or angiotensin 2 receptor blockers (diuretics), or CCBs in kidney transplant

GFR and Nutrition

[Nutritional Assessment](#) [Markers of PEM](#)

[Return](#)

[Protein energy malnutrition](#) (PEM) develops during chronic kidney disease and is associated with adverse outcomes. Low protein and calorie intake is an important cause of malnutrition in chronic kidney disease. Patients with GFR <60 mL/min/1.73 m² should undergo assessment of dietary protein, energy intake and nutritional status.

Information
[Nutritional Issues in CKD](#)
[Protein and Energy Intake](#)

Height	73.00	in
Weight	185.0	lb
BMI	24.44	
BMR	2332	cal/day
BEE	1723	cal/day
Protein Req	100	grams/day

Daily Protein Intake (DPI)
Select one of the following for this patient.

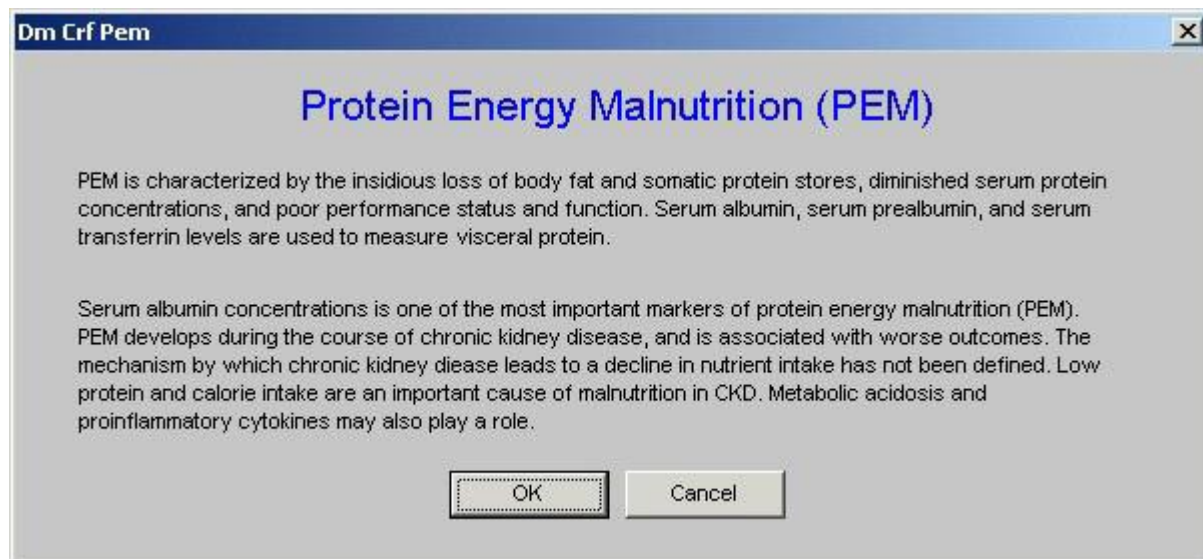
☒	Stages 1-3	63	grams/day
☐	Stages 4-5	50	grams/day

Daily Energy Intake (DEI)
Select one of the following for this patient.

☒	Stages 1-3	2943	calories/day
☐	Stages 4-5	2943	calories/day

At the top of this template are two buttons:

- **“Nutritional Assessment”** – this is a hyperlink to SETMA’s **Nutrition Assessment Template**. You can review this template by clicking on this hyperlink.
- **“Markers of PEM “(Protein Energy Malnutrition)**



The template then displays the following (if the stage of renal disease has been calculated, it will automatically populate these fields, if it has not been you must select the stage).

- **Daily Protein Intake** – the NKF recommendation is based on the stage of renal disease
- **Daily Energy Intake** – the NKF recommendation is also based on the stage of renal disease.

There are then two information pieces which can be launched from buttons entitled:

- **Nutritional Issues in**
- **CKD Protein and Energy Intake**

GFR and Bone Disease

This template declares that bone disease is frequently associated with Chronic Renal Disease when the GFR is below 60 ml/min/1.73 meters²

GFR and Bone Disease

Bone disease and disorders of calcium and phosphorus metabolism develop during the course of chronic kidney disease and are associated with adverse outcomes. Patients with GFR <60 mL/min/1.73 m2 should be evaluated for [bone disease and disorders](#) of calcium and phosphorus metabolism.

Return

Lab Results

PTH

34

04/04/2007

Ionized Calcium

/ /

Phosphorus

4.3

03/14/2007

Calcitrol

/ /

Vitamin D

/ /

Ca * PO4

43

[Disorders of Calcium Metabolism](#)

[Phosphate Metabolism](#)

[Markers of Abn Bone Metabolism](#)

[Secondary Hyperparathyroidism](#)

[Clinical Applications](#)

In addition to the laboratory results for chronic renal disease and bone disorders, there are six information pieces present on this template; they are:

1. Bone Disease and Disorders of Calcium and Phosphorus Metabolism
2. Disorders of Calcium Metabolism
3. Disorders of Phosphate Metabolism
4. Markers of Abn Bone Metabolism
5. Secondary hyperparathyroidism
6. Clinical Applications

67

GFR and Neuropathy

[Clinical Applications](#)

Return

Neuropathy develops during the course of chronic kidney disease and may become symptomatic.

Review of Systems

Uremic neuropathy may affect the central, peripheral, or autonomic nervous systems. Early uremic encephalopathy may present with...

- | - | + |
|-------------------------------------|---|
| ☒ | ☐ Fatigue |
| ☒ | ☐ Impaired memory |
| ☒ | ☐ Impaired concentration |

With more advanced uremia...

- | | |
|-------------------------------------|---|
| ☒ | ☐ Confusion/Disorientation |
| ☒ | ☐ Coma |
| ☒ | ☐ Convulsions |
| ☒ | ☐ Hallucinations |

Physical Exam

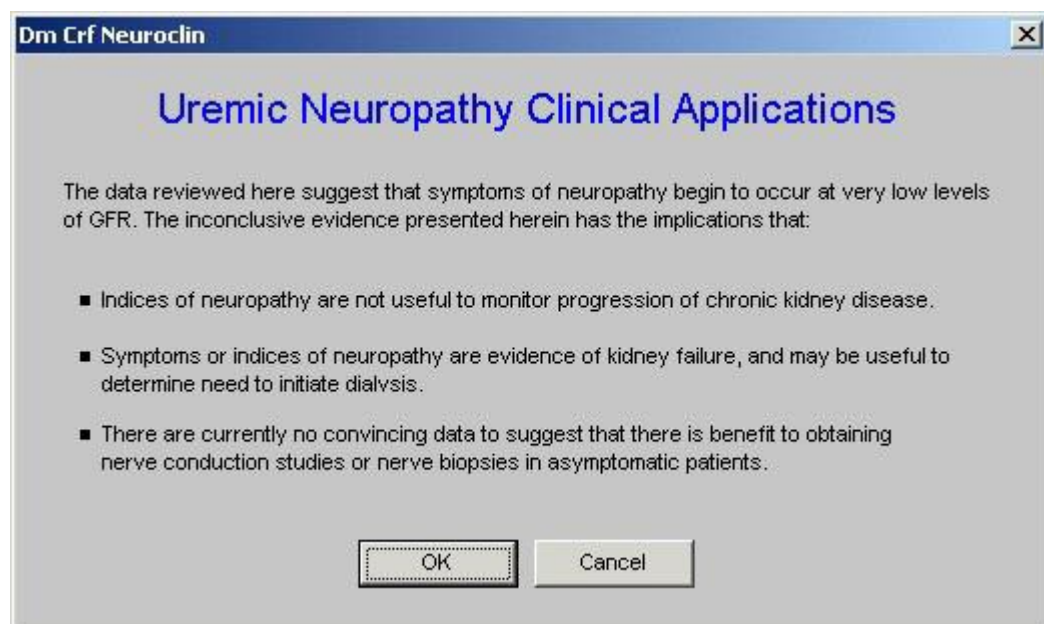
Generally, uremic polyneuropathy is a symmetrical, mixed sensory and motor polyneuropathy, with distal nerves more severely affected. Patients may complain of...

- | - | + |
|-------------------------------------|---|
| ☒ | ☐ Pruritus |
| ☒ | ☐ Weakness |
| ☒ | ☐ Muscle cramps |
| ☒ | ☐ Muscle irritability |
| ☒ | ☐ Muscle atrophy |
| ☒ | ☐ Loss of deep tendon reflexes |
| ☐ | ☐ Abnormal/altered reflexes (ankle jerk in particular) |
| ☐ | ☐ Impaired sensation (vibratory, light pressure touch, pain) |

[Uremic Heart and Lung Complications](#)

[Uremic EEG Changes](#)

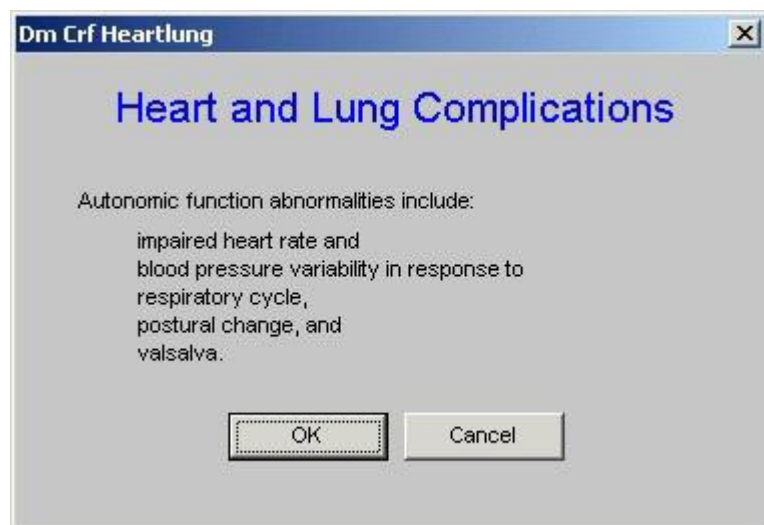
The first element on this **template** is entitled “**Clinical Application**” which launches a pop-up entitled “**Uremic Neuropahty Clinic Applications.**”



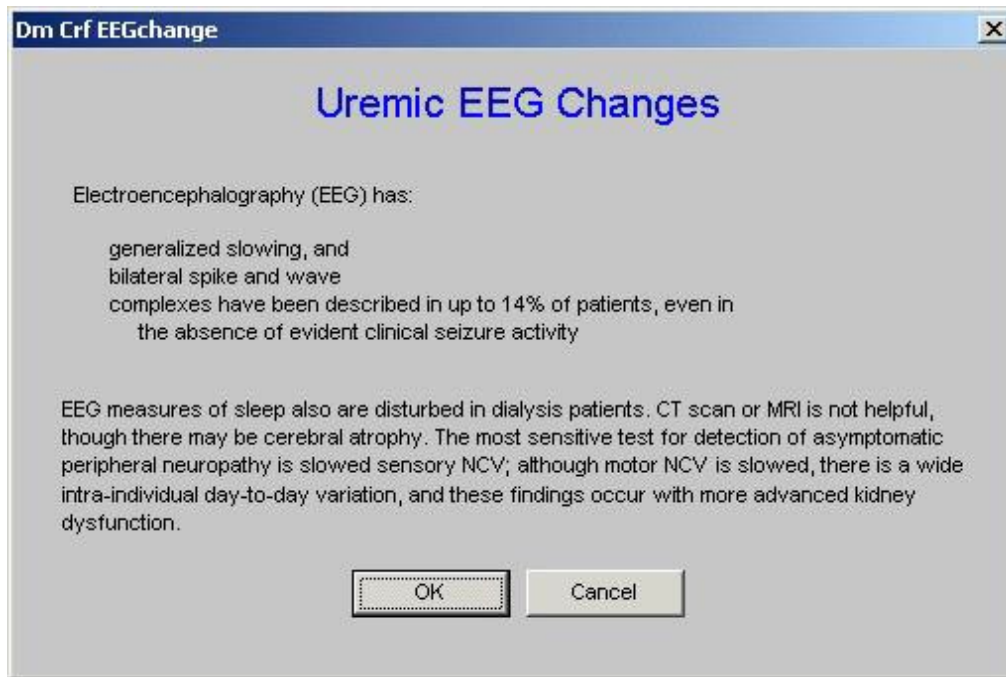
After this the template displays a Review of Systems and a Physical Examination which interacts with the body of SETMA’s EMR and which is specific to issues related to uremic neuropathy.

The final elements on this template are two buttons:

- **Uremic Heart and Lung Complication**



- Uremic EEG changes



Renal Failure

Renal Failure

Common Causes of Renal Failure

Acute GFR Decline

Return

Kidney failure is defined as either:

- GFR <15 mL/min/1.73 m2, accompanied by signs and symptoms of uremia, or
- Need for initiation of kidney replacement therapy (dialysis or transplantation)

Estimated Glomerular Filtration Rate

Predicted

MDRD

Jelliffe

84

90

%

107.1

Use?

☐

☒

Cockcroft-Gault

Salazar & Corcoran

Schwartz

101

107

%

120.2

127.4

Use?

☐

☐

☐

Predicting the Decline of GFR

Date	MDRD	Jelliffe	Cockcroft	Salazar	Schwartz
01/06/2010 09:45 AM	90		101	107	
10/07/2008 09:30 AM	46		60	62	

Information

End Stage Renal Disease

Risk of Kidney Failure

Rate of GFR Decline

Absolute Indications for Dialysis

Relative Indications for Dialysis

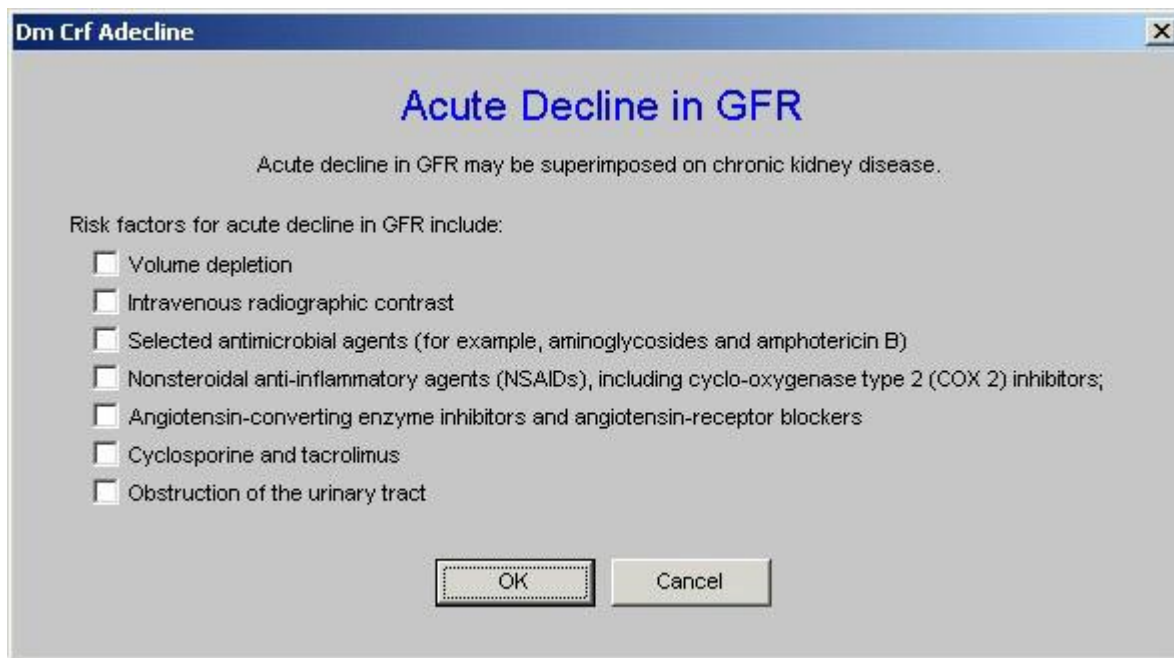
Slowing the Rate of GFR Decline

At the top of the template are two buttons:

- 1, “Common Causes of Renal Failure” when deployed this launches a template entitled “**Most Common Causes of Renal Failure.**”

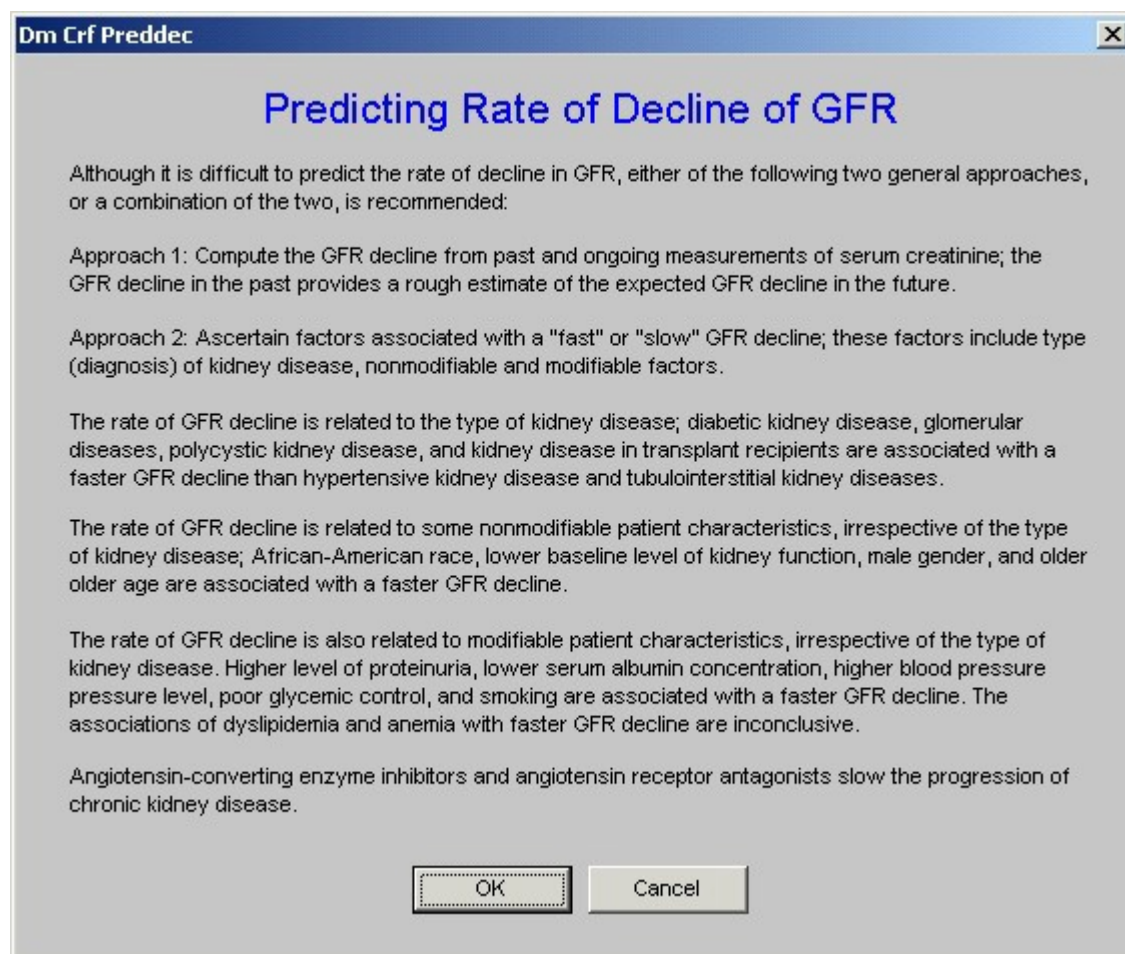


- 2, “Acute GFR Decline” – the first statement on this template is “Acute decline in GFR may be superimposed upon chronic renal disease.”



These two buttons are followed by the **definition of kidney failure**.. This definition is followed by the estimated GFR from the formulae discussed above.

The button “**Predicting the decline of GFR**” launches the following template which defines how the decline in GFR can be predicted.



Finally, there is a presentation of the estimated GFR by various formulae shown overtime.

Renal Failure

[Common Causes of Renal Failure](#)[Acute GFR Decline](#)

Kidney failure is defined as either:

- GFR <15 mL/min/1.73 m2, accompanied by signs and symptoms of uremia, or
- Need for initiation of kidney replacement therapy (dialysis or transplantation)

Estimated Glomerular Filtration Rate

					%	Use?
Predicted	84	%	Use?	Cockcroft-Gault	101	120.2 ☐
MDRD	90	107.1	☐	Salazar & Corcoran	107	127.4 ☐
Jelliffe			☒	Schwartz		☐

Predicting the Decline of GFR

Date	MDRD	Jelliffe	Cockcroft	Salazar	Schwartz
01/06/2010 09:45 AM	90		101	107	
10/07/2008 09:30 AM	46		60	62	

Information
[End Stage Renal Disease](#)
[Risk of Kidney Failure](#)
[Rate of GFR Decline](#)
[Absolute Indications for Dialysis](#)
[Relative Indications for Dialysis](#)
[Slowing the Rate of GFR Decline](#)

To the right side of this template are six buttons which launch education materials. They are entitled:

1. “End stage of renal disease”

Dm Crf Esrd

End Stage Renal Disease

End-stage renal disease (ESRD) is an administrative term in the United States, based on the conditions for payment for health care by the Medicare ESRD Program, specifically the level of GFR and the occurrence of signs and symptoms of kidney failure necessitating initiation of treatment by replacement therapy. ESRD includes patients treated by dialysis or transplantation, irrespective of the level of GFR.

2. “Risk of Renal Failure”



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SETMA III - 2010 Dowlen
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www.setma.com

Risk of Kidney Failure

The Risk of kidney failure depends on:

- The level of GFR (severity) at detection of kidney disease and
- The rate of loss of GFR thereafter.

Level of GFR can be improved by specific treatment in some chronic kidney diseases, but not in most others.

Rate of loss of GFR (progression of kidney disease) is affected by:

- diagnosis and by
- modifiable and nonmodifiable patient factors.

These factors can be assessed even before the decline in GFR, thereby allowing implementation of interventions to slow progression while GFR is still normal. Some therapies to prevent or slow the loss of GFR are specific for the diagnosis, while others are non-specific.

It is difficult to estimate the rate of progression until there has been a decline in GFR. In diseases characterized by a quantifiable marker of damage for example, albuminuria in diabetic kidney disease progression, stability, or regression can be estimated by change in the marker. For most diseases, however, quantitative relationships between changes in markers and progression have not been established.✖

3. “Rate of GFR Decline”



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www.setma.com

Rate of GFR Decline

The rate of GFR decline is related to the type of kidney disease:

1. diabetic kidney disease,
2. glomerular diseases,
3. polycystic kidney disease,
4. and kidney disease in transplant recipients are associated with a faster GFR decline
5. than hypertensive kidney disease and tubulointerstitial kidney diseases

The rate of GFR decline is related to some nonmodifiable patient characteristics, irrespective of the type of kidney disease:

1. African-American race,
2. lower baseline level of kidney function,
3. male gender, and
4. older age are associated with a faster GFR decline

The rate of GFR decline is also related to modifiable patient characteristics, irrespective of the type of kidney disease:

1. Higher level of proteinuria,
2. lower serum albumin concentration,
3. higher blood pressure level,
4. poor glycemic control, and

4. “Absolute Indications for Dialysis”



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Absolute Indications for Dialysis

Advanced uremia

- Uremic pericarditis
- Uremic encephalopathy
- Uremic pancreatitis

Metabolic disturbances refractory to medical management

- Hyperkalemia
- Metabolic acidosis

Uremic symptoms not amenable to dietary modification

- Severe nausea and vomiting
- Anorexia with weight loss
- Uremic encephalopathy
- Neuropathy

Refractory volume overload

- Congestive heart failure

5. “Relative Indications for Dialysis”



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Relative Indications for Dialysis

- * Estimated glomerular filtration rate $<10 \text{ mL/min/1.73m}^2$ ($\text{Kt/V urea} <2.0$), unless:
 - Lean body mass is stable or increasing
 - and
 - Normalized protein nitrogen appearance rate (nPNA) $>0.8 \text{ g/kg/day}$
- * Estimated glomerular filtration rate of $10\text{-}20 \text{ mL/min/1.73m}^2$ with signs of malnutrition (normalized protein nitrogen appearance rate $<0.8 \text{ g/kg/day}$ or loss of lean body mass)
- * Moderately severe to severe volume overload

6. “Slowing the Rate of GFR Decline”

Dm Crf SlowingGFR

Strategies Which Slow the Rate of GFR Decline

- Strict glycemic control in diabetes slows the development and progression of chronic kidney disease
- Interventions may slow rate of GFR decline in chronic kidney disease in some circumstances
- Strict blood pressure control slows the progression of chronic kidney disease
- Angiotensin-converting enzyme inhibitors and angiotensin receptor antagonists slow the progression of chronic kidney disease

OK

Cancel

Assessment

Renal Assessment

Referring Provider: James Holly Etiology: DM II Renal Manifestat Contr Stage of CKD: Stage 1 Degree of Proteinuria: Stability ☒ Stable ☐ Progressive ☐ Improving Anemia ☐ Of Chronic Disease ☐ Megaloblastic ☐ Iron Deficiency ☐ Hemolytic Hemodynamic ☒ Acceptable ☐ Needs Improvement Metabolic Status ☐ Acidosis ☐ Alkalosis ☐ Acceptable Anion Gap: ☒ Normal ☐ High ☐ Low Chloride: ☒ Sensitive ☐ Resistant Volume Status ☐ Euvolemic ☒ Dehydrated ☐ Fluid Overload Access for Renal Replacement Therapy ☐ Indicated ☒ Not Indicated Referral to CV Surgeon for AV Fistula ☐ Indicated ☒ Not Required Referrals (Double-click to Add/Edit) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Status</th> <th>Referral</th> </tr> </thead> <tbody> <tr> <td>Completed</td> <td>Beaudry, Carl</td> </tr> <tr> <td>Completed</td> <td>0</td> </tr> </tbody> </table> Medications (Double-Click to Add/Edit) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Brand Name</th> <th>Generic Name</th> <th>Dose</th> <th>Sig Codes</th> </tr> </thead> <tbody> <tr> <td>ASPIRIN EC</td> <td>ASPIRIN</td> <td>81MG</td> <td>1 po daily</td> </tr> <tr> <td>AUGMENTIN</td> <td>AMOX TR/POTASSIUM CLAVULANATE</td> <td>875-125MG</td> <td>1 po BID</td> </tr> </tbody> </table>	Status	Referral	Completed	Beaudry, Carl	Completed	0	Brand Name	Generic Name	Dose	Sig Codes	ASPIRIN EC	ASPIRIN	81MG	1 po daily	AUGMENTIN	AMOX TR/POTASSIUM CLAVULANATE	875-125MG	1 po BID	Nutritional Status Height: 73.00 inches Weight: 185.01 pounds BMI: 24.44 kg/m² Weight Loss: ☐ Yes ☒ No Serum Albumin: 3.1 12/10/2009 Prealbumin: 20.40 01/06/2010 Lipid Status ☐ Acceptable ☒ Requires Therapy Cholesterol: 126 12/10/2009 Triglycerides: 287 12/10/2009 HDL: 24 12/10/2009 LDL: 135 08/06/2009 Calcium * Phosphorous Product Ca: 10.0 01/06/2010 PO4: 4.3 03/14/2007 Product: 43 Hyperparathyroidism ☐ Primary ☐ Secondary ☐ Tertiary PTH: 34 04/04/2007 Immunizations Pneumovax: 05/25/2009 Influenza: 09/28/2009 Hepatitis B 1: / / 2: / / 3: / / History Alcohol: ☐ Yes ☒ No Drugs: ☐ Yes ☒ No Smoking: ☐ Yes ☒ No Possible nephrotoxic drugs? ☐ Yes ☒ No	Return Renal Lab Orders Main Lab Orders Immunizations Comments - 1 Comments - 2 Document Treatment Plan SETMA's Treatment Audit PCPI Treatment Audit
Status	Referral																			
Completed	Beaudry, Carl																			
Completed	0																			
Brand Name	Generic Name	Dose	Sig Codes																	
ASPIRIN EC	ASPIRIN	81MG	1 po daily																	
AUGMENTIN	AMOX TR/POTASSIUM CLAVULANATE	875-125MG	1 po BID																	

This template provides a summary of the renal evaluation of the patient and provides the ability to order testing and referrals. It is organized into three columns. .

The first four data points in the first column are automatically documented when they have been previously identified. They are:

- **Referring Provider** – the name of the provider completing the renal evaluation
- **Etiology** – from the **Classification** template (the automatic completion of this data point does not occur presently but will in 2010.
- **Stage of Kidney Disease** – from the **Stage of Renal Disease** template
- **Degree of Proteinuria** – from the **Proteinuria** template

It is then possible to address the following

- **Stability – this requires the provider to make a judgment**
- **Anemia – this requires the provider to note what kind of anemia if any**
- **Hemodynamics – this requires the provider to note the status**
- **Metabolic Status** including **anion gap** which is automatically noted if the **Hydration template** has been completed.
- **Volume Status** which is automatically noted if the **Hydration template** has been completed.
- **Access for Renal Replacement Therapy – if the patient has renal stag I-III this will be automatically noted as not applicable**
- **Referral to CV Surgeon or Interventional Radiologist for AV Fistula – if the patient has renal stage I-III this will be automatically noted as not applicable.**

A the bottom of the first column are the following functions:

- **Referrals**
- **Medications**

In the second column, it is possible to address the following issues in the care and condition of the patient with Chronic Renal Disease

Renal Assessment

Referring Provider: James Holly

Etiology: DM II Renal Manifestat Contr

Stage of CKD: Stage 1

Degree of Proteinuria:

Stability

☒ Stable ☐ Progressive ☐ Improving

Anemia

☐ Of Chronic Disease ☐ Megaloblastic

☐ Iron Deficiency ☐ Hemolytic

Hemodynamic

☒ Acceptable ☐ Needs Improvement

Metabolic Status

☐ Acidosis ☐ Alkalosis ☐ Acceptable

Anion Gap: ☒ Normal ☐ High ☐ Low

Chloride: ☒ Sensitive ☐ Resistant

Volume Status

☐ Euvolemic ☒ Dehydrated ☐ Fluid Overload

Access for Renal Replacement Therapy

☐ Indicated ☒ Not Indicated

Referral to CV Surgeon for AV Fistula

☐ Indicated ☒ Not Required

Referrals (Double-click to Add/Edit)

Status	Referral
Completed	Beaudry, Carl
Completed	0

Medications (Double-Click to Add/Edit)

Brand Name	Generic Name	Dose	Sig Codes
ASPIRIN EC	ASPIRIN	81MG	1 po daily
AUGMENTIN	AMOX TR/POTASSIUM CLAVULANATE	875-125MG	1 po BID

Nutritional Status

Height: 73.00 inches

Weight: 185.01 pounds

BMI: 24.44 kg/m²

Weight Loss: ☐ Yes ☒ No

Serum Albumin: 3.1 12/10/2009

Prealbumin: 20.40 01/06/2010

Lipid Status

☐ Acceptable ☒ Requires Therapy

Cholesterol: 126 12/10/2009

Triglycerides: 287 12/10/2009

HDL: 24 12/10/2009

LDL: 135 08/06/2009

Calcium * Phosphorous Product

Ca: 10.0 01/06/2010

PO4: 4.3 03/14/2007

Product: 43

Hyperparathyroidism

☐ Primary ☐ Secondary ☐ Tertiary

PTH: 34 04/04/2007

Immunizations

Pneumovax: 05/25/2009

Influenza: 09/28/2009

Hepatitis B 1: / /

2: / /

3: / /

History

Alcohol: ☐ Yes ☒ No

Drugs: ☐ Yes ☒ No

Smoking: ☐ Yes ☒ No

Possible nephrotoxic drugs? ☐ Yes ☒ No

Return

Renal Lab Orders

Main Lab Orders

Immunizations

Comments - 1

Comments - 2

Document

Treatment Plan

SETMA's Treatment Audit

PCPI Treatment Audit

Follow-Up

Acute Care Follow-Up

Follow - up: 3 month(s)

Routine Care Follow-Up

In this column, the following data is automatically aggregated for review of the patient with renal disease

1. Nutritional Status including

- Height
- Weight
- BMI
- Serum Albumin
- Pre-albumin
- Weight Loss

2. Lipid Status

3. Calcium times Phosphorus Product

4. Hyperparathyroidism

5. Immunization

6. History

- Alcohol
- Drugs
- Smoking
- Nephrotoxic drugs

In the third column, the following functions appear:

Renal Assessment

Referring Provider: James Holly
Etiology: DM II Renal Manifestat Contr
Stage of CKD: Stage 1
Degree of Proteinuria:

Stability
☒ Stable ☐ Progressive ☐ Improving

Anemia
☐ Of Chronic Disease ☐ Megaloblastic
☐ Iron Deficiency ☐ Hemolytic

Hemodynamic
☒ Acceptable ☐ Needs Improvement

Metabolic Status
☐ Acidosis ☐ Alkalosis ☐ Acceptable
Anion Gap: ☒ Normal ☐ High ☐ Low
Chloride: ☒ Sensitive ☐ Resistant

Volume Status
☐ Euvolemic ☐ Dehydrated ☐ Fluid Overload

Access for Renal Replacement Therapy
☐ Indicated ☒ Not Indicated

Referral to CV Surgeon for AV Fistula
☐ Indicated ☒ Not Required

Referrals (Double-click to Add/Edit)

Status	Referral
Completed	Beaudry, Carl
Completed	0

Medications (Double-Click to Add/Edit)

Brand Name	Generic Name	Dose	Sig Codes
ASPIRIN EC	ASPIRIN	81MG	1 po daily
AUGMENTIN	AMOX TR/POTASSIUM CLAVULANATE	875-125MG	1 po BID

Nutritional Status
Height: 73.00 inches
Weight: 185.01 pounds
BMI: 24.44 kg/m²
Weight Loss: ☐ Yes ☐ No
Serum Albumin: 3.1 12/10/2009
Prealbumin: 20.40 01/06/2010

Lipid Status
☐ Acceptable ☒ Requires Therapy
Cholesterol: 126 12/10/2009
Triglycerides: 287 12/10/2009
HDL: 24 12/10/2009
LDL: 135 08/06/2009

Calcium * Phosphorous Product
Ca: 10.0 01/06/2010
PO4: 4.3 03/14/2007
Product: 43

Hyperparathyroidism
☐ Primary ☐ Secondary ☐ Tertiary
PTH: 34 04/04/2007

Immunizations
Pneumovax: 05/25/2009
Influenza: 09/28/2009
Hepatitis B 1: / /
2: / /
3: / /

History
Alcohol: ☐ Yes ☒ No
Drugs: ☐ Yes ☒ No
Smoking: ☐ Yes ☒ No
Possible nephrotoxic drugs? ☐ Yes ☐ No

Follow-Up
Acute Care Follow-Up: Follow - up 3 month(s)
Routine Care Follow-Up:

Navigation Sidebar (Red Boxed):
Return
Renal Lab Orders
Main Lab Orders
Immunizations
Comments - 1
Comments - 2
Document
Treatment Plan

SETMA's Treatment Audit
PCPI Treatment Audit

1. **Return** – this is a navigation button which returns you to the Master Renal Template.
2. **Renal Lab Orders** – this is a copy of the endocrine lab orders and allows you to order any of these specialized tests
3. **Main Lab Orders**– this is a copy of the main lab order template and allows you to order any of the lab tests which are there.
4. **Immunizations** – this links you to the ability to order immunizations
5. **Comment I** – this allows you to add more detailed comments about elements of column I

The screenshot shows a software window titled "Dm Crf Assescom1" with a standard Windows-style title bar (blue on the left, grey on the right with a close button). The main content area has a light grey background and is titled "Renal Assessment Comments" in a large, bold, blue font. Below the title, there are six sections, each with a label in bold black font and a corresponding white text input box with a thin grey border:

- Stability**: Input box
- Anemia**: Input box
- Hemodynamics**: Input box
- Metabolic Status**: Input box
- Volume Status**: Input box
- Referral to Surgeon or Interventional Radiologist**: Input box

At the bottom of the window, there are two buttons: "OK" (highlighted with a dotted border) and "Cancel".

6. **Comment II** -- this allow you to add more detailed comments about elements of Column I and II

Renal Assessment Comments

Nutritional Status

Lipid Status

Caclium * Phosphorous Product

Hyperparathyroidsism

Immunizations

History

OK Cancel

6. **Document** – this produces a document for the Renal Suite of templates
7. **Treatment Plan --** This button generates the **Plan of Care and Treatment Plan for the Renal Suite of Templates** which should be given to the patient at least once a year. The following is an example of a real patient. This patient’s document illustrates the function of each of the templates in this suite particularly of anemia, nutrition, bone health, renal failure and it gives the patient information about how to improve their kidney health.

Beneath the Treatment Plan Button two Audit buttons two additional buttons appear:

- **SETMA’s Treatment Audit** – because no national agency – PCPI, NQF, NCQA, NQF, AQA, HEDIS or other – has published a renal quality audit for Chronic Renal Disease Stage I-III, SETMA designed its own. This is it.
- **PCPI Treatment Audit**

The first is SETMA’s Renal Audit. This is an audit tool which SETMA developed to evaluate the care which patients with Stage I-III Renal Disease should be receiving. The second is the PCPI Renal which is the Physician Consortium for Performance Improvement Data Set for evaluating the quality of care which patients with Stage IV & V Renal Disease are receiving

Dm Crf Audit

SETMA's Chronic Kidney Disease Treatment Audit

Has the patient's urinary protein been assessed within the last year?

Latest Result

Has the stage of the patient's renal disease been assessed within the last year?

Stage

If the patient has disease of Stage 2 or higher, have they been referred for a Renal Ultrasound within the last 3 years?

If the patient has disease of Stage 3 or higher, have they been referred to a nephrologist?

Has the patient been referred to Medical Nutrition Therapy at least once?

Has the patient had lipid panel within the last year?

Latest Results

Cholesterol LDL

Triglycerides HDL

Has the patient had a prealbumin test within the last year?

Latest Result

Is the patient's blood pressure controlled to below 135/85 mmHg?

Has the patient received a personalized exercise prescription within the last year?

Date of Last Prescription

Has the patient received a weight management assessment including BMI, BMR and how to change both within the last year?

Date of Last Assessment

If the patient smokes, have they received counseling as to stopping and been given methods of doing so?

Has the patient received immunizations for...

Influenza

Pneumonia

Hepatitis B

Is the patient anemic? Latest HGB

If so, have the following labs been ordered: B12, Erythropoietin, Ferritin, Folic Acid, Occult Blood, Retic Count?

Has the renal treatment and plan of care document been generated within the last year?

Date Last Completed

Double-Click to Add Referrals

Referral	Status
Beaudry, Carl	Completed
0	Completed
	Completed

The key to the elements of this audit are:

- The elements in black apply to this patient and have been fulfilled.
- The elements in grey do not apply to this patient.
- The elements in +red apply to this patient and have not been fulfilled.

PCPI Chronic Kidney Disease Measures

[Return](#)

This patient **IS NOT** eligible for submittal of the measures in the CKD measures group.

Patients with stage 4 or 5 kidney disease who are not receiving renal replacement therapy are eligible for this measure.

Laboratory Testing Ca, Phos, PTH, Lipids

Patient not eligible for submittal of CKD measures.

Blood Pressure Target < 130/80

Patient not eligible for submittal of CKD measures.

Blood Pressure Plan

Patient not eligible for submittal of CKD measures.

Influenza Immunization

Patient not eligible for submittal of CKD measures.

Referral for AV Fistula

Patient not eligible for submittal of CKD measures.

Elevated Hemoglobin for Patients Receiving ESA Therapy

Patient not eligible for submittal of CKD measures.

Not applicable. Patient not on ESA therapy.

Not applicable. Patient not on ESA therapy.

The PCPI Chronic Renal Disease quality measurement set is identical to the PQRS measures for the same condition.

Physician Information

The last button on the Master Chronic Renal Failure template is entitled “Physician Information.” It is outline in red below.

Chronic Renal Failure

[Assessment Guidelines](#)[Kidney Disease Summary](#)

Refresh Template / Check Labs

Hydration Assessment

Height73.00in

Weight185.0lb

BMI24.44

Body Fat27.1%

BMR2332cal/day

BEE1723cal/day

Waist36.00in

Hips42.00in

Risk Ratio.86

Blood Pressure138 / 50mmHg

Diabetes Mellitus

+☐

-☐

Diabetic Since (year)1998

Metabolic Syndrome

+☐

-☐

Hypertension Management

Weight Management

Lipids Management

Vitals Over Time

MS Strip

Alb/Creat

Prot/Creat

24Hr Urine Pro

Sodium14501/06/2010

Potassium4.401/06/2010

BUN1601/06/2010

Creatinine.901/06/2010

Chloride10701/06/2010

HgbA1C8.101/06/2010

Fructosamine

Glucose12401/06/2010

HGB11.801/06/2010

HCT37.901/06/2010

Retic Count

B12646.811/20/2009

Folic Acid

Serum Iron3511/20/2009

IBC37411/20/2009

Ferritin6311/20/2009

EPO79.9012/11/2009

Ionized Calcium5.711/20/2008

PTH3404/04/2007

Phosphorous4.303/14/2007

Vitamin D

Calcitrol

Sed Rate6212/02/2009

Prealbumin20.4001/06/2010

Hydration Assessment

Serum Osmolality311.5

Serum Osmolarity304.1

Anion Gap10.0

Osmolar Gap

Est. Glomerular Filtration Rate

Predicted84%

MDRD90107.1

Jelliffe (double-click)

Cockcroft-Gault101120.2

Salazar & Corcoran107127.4

Schwartz

Use?

☐

☒

☐

☐

☐

Urinalysis01/06/2010

KetonesNegative

LeukocytesNegative

NitratesNegative

Spec Grav.000

GlucoseNormal

Protein100

UWBC5

URBC1

UEPI

Bacteria

Mucous

Casts

Yeast

24 Hr Urine Creatinine

Cholesterol12612/10/2009

HDL2412/10/2009

LDL4412/10/2009

Triglycerides28712/10/2009

Home

Lab Results

Classification

Evaluation

Acute Renal Disease

Proteinuria

GFR

GFR and Anemia

GFR and Hypertension

GFR and Nutrition

GFR and Bone Disease

GFR and Neuropathy

Renal Failure

Assessment

Document

Physician Information

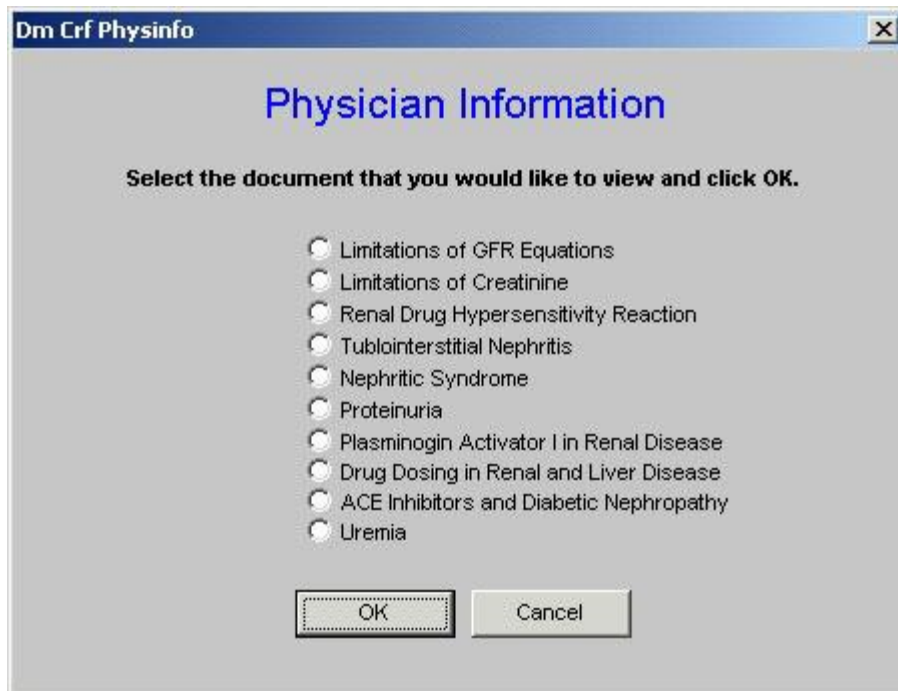
Patient

SexM

Age62

When the navigation button “Physician Information” is deployed the following appears:

87



This function provides for healthcare provider information on the following subjects. Any of these documents is launched by checking the box next to the title and the clicking “OK.”

- **Limitations of GFR Equations**
- **Limitations of Creatinine**
- **Renal Drug Hypersensitivity Reaction**
- **Tublointerstitial Nephritis**
- **Nephritic Syndrome**
- **Proteinuria**
- **Plasminogen Activator I in Renal Disease**
- **Drug Dosing in Renal and Liver Disease**
- **Ace Inhibitors and Diabetic Nephropathy**
- **Uremia**



SETMA I - 2929 Calder, Suite 100

Sample of SETMA's Chronic Renal Failure Treatment Plan and Plan of Care.

After completing the review of a patient's renal status and an analysis of their present renal condition, the following Treatment Plan and Plan of Care, which is personalized with the individual patient's data, can be completed with the click of a button.

Particularly in regard to the standards of Patient-Centered Medical Home recognition by NCQA and generally in regard to the standards of excellence of care, a written, personalized Treatment Plan and Plan of Care is critical to the patient's care. This document completes the cycle:

1. The patient makes an appointment
2. The provider completes a history and physical examination
3. Tests and procedures are ordered
4. The results are analyzed
5. A Treatment Plan and a Plan of Care is prepared
6. This document is given to the patient.
7. This document becomes the foundation of the patient's education and the provider's conversation with the patient about their health and their care.

The following Plan of Care and Treatment Plan is from a real patient who was seen in SETMA's clinic. The patient's identify has been removed.

Renal Follow-Up Note

Treatment Plan and Plan of Care

Patient
Date of Birth
Age 62 years
Ethnicity Caucasian
Sex M

Encounter Date 01/06/10

Follow-Up Care

Your next visit should be scheduled in 3 month(s)

Latest Lab Results

CBC

WBC	9.7 K/uL	01/06/2010
HGB	11.8 g/dL	01/06/2010
HCT	37.9 %	01/06/2010
PLT	390 h/uL	01/06/2010
RBC	4.61 M/uL	01/06/2010
MCV	82.3 fl	01/06/2010
MCH	25.6 pg	01/06/2010
MCHC	31.1 g/dL	01/06/2010
Lymph#	1.4 K/uL	01/06/2010
Lymph%	14.8 %	01/06/2010
Eos#	.1 K/uL	01/06/2010
Eos%	.9 %	01/06/2010

Urinalysis 01/06/2010

Color	Yellow
Clarity	Clear
pH	6.50
Spec Grav	1.025
Glucose	Normal
URO	
Ketones	Negative
Leukocytes	Negative
Nitrates	Negative
Bilirubin	Negative
Blood	Negative
Protein	100

BMP

Na	145 mmol/L	01/06/2010
K	4.4 mmol/L	01/06/2010
Chloride	107 mmol/L	01/06/2010
CO2	30 mmol/L	01/06/2010
Glucose	124 mg/dL	01/06/2010
BUN	16 mg/dL	01/06/2010
Creatinine	.9 mg/dL	01/06/2010

Ca	10.0	01/06/2010
----	------	------------

CMP

ALB	3.1 g/dL	12/10/2009
AST	30 u/L	12/10/2009
ALT	25 u/L	12/10/2009
ALP	159 u/L	12/10/2009
BILI-D	.0 mg/dL	12/10/2009
BILI-T	.0 mg/dL	12/10/2009
TP	6.0 g/dL	12/10/2009

Thyroid

T3	1.34 ng/mL	12/02/2009
T4	6.95 ng/dL	12/02/2009
T7	.14	12/02/2009
TSH	.49 ulu/mL	12/02/2009
T-Uptake	1.97 TBI	12/02/2009

Lipids

Cholesterol	126 mg/dL	12/10/2009
HDL	24 mg/dL	12/10/2009
CHOL/HDL Ratio	5.25	
LDL	135 mg/dL	08/06/2009
Triglycerides	287 mg/dL	12/10/2009

Other

Amylase	80 u/L	12/10/2009
Lipase	368 u/L	12/10/2009
PT	10.1 seconds	12/10/2009
INR	1	12/10/2009
Ferritin	63 ng/mL	11/20/2009
Iron	35 ug/dL	11/20/2009
Glyco Hemoglobin	8.1 %	01/06/2010
Mean Plasma Glucose	211.1 mg/dL	
BNP	615.00 pg/mL	12/10/2009
CPK	58 u/L	12/27/2007
B12	646.80 pg/mL	11/20/2009
Digoxin	.0 ng/mL	03/27/2009
ESR	62 mm/hr	12/02/2009
KOH	.00	05/14/2008
Magnesium	1.3 mg/dL	12/10/2009
Micral Strip	Positive 100mg/L	01/06/2010
Prealbumin	20.40 mg/dL	01/06/2010
PSA	.51 ng/mL	12/10/2009
Rheumatoid Factor	4.51 IU/mL	08/17/2006
Uric Acid	7.0 mg/dL	08/06/2009

Active Medications

The following are the medications which you should be taking. Please notify your provider if you are unable to obtain your medications for any reason. Do not just stop taking your medication without calling your healthcare provider immediately

Start Date	Brand	Dose	Sig Desc
01/06/2010	Augmentin	875-125mg	one by mouth twice daily
01/06/2010	Tussionex	10-8mg/5ml	1/2 to 1 tsp every 12hrs
12/28/2009	Fluoxetine Hcl	20mg	Take one capsule by mouth daily
12/28/2009	Lisinopril	40mg	1 tab po once a day
12/28/2009	Diovan	160mg	1 tab po each monring
12/28/2009	Metoprolol Tartrate	25mg	one by mouth twice daily
12/28/2009	Aspirin Ec	81mg	1 by mouth daily
12/28/2009	Crestor	20mg	1 tab po once a day
12/28/2009	Levemir	100/ml	0175 units sub q in the morning and 85 units in the evening

12/28/2009	Novolog	100/ml	45 units with meals
12/28/2009	Nitrostat	0.4mg	take one tablet under tongue to dissolve, every 5 minutes up to 3 times a day
12/28/2009	Lasix	20mg	Take one tablet by mouth daily
12/28/2009	Plavix	75mg	1 tab po daily
12/28/2009	Vicodin Es	7.5-750mg	1 tab q4-6h as needed for pain

Please review this list of your medications. If any medication you are taking is missing -- if you have medications which are not listed please bring that to your healthcare provider's attention.

Stage of Renal Disease

According to your most recent laboratory evaluation, you have Stage 1 renal disease.

Hydration

Risk Factors for Dehydration Present

Recent infection - Lungs

Diabetes Mellitus, Patient on diuretics, Age over 60 years,

Physical Signs and Symptoms of Dehydration Present

Skin Turgor - good, Buccal Mucosa - moist,

Chemical and Metabolic Indicators of Dehydration

Urine Spec Grav - .000

Glucose - 357.0 mg/dL

Sodium - 140.0 mg/dL

Potassium - 3.7 mmol/L

Chloride - 100.0 mmol/L

HCO₃ - 30.0 mmol/L

Blood Urea Nitrogen - 12 mg/dL

Creatinine - .8 mg/dL

BUN/Creatinine Ratio - 15.0

Serum Osmolality - 311.5

Serum Osmolarity - 304.1

Anion Gap - 10.0

Est. Creatinine Clearance - 113.9

Hydration Status - Marginal

Hypertension

You have high blood pressure. Your last blood pressure was 138 / 50 mmHg . Your blood pressure places you into a High-Normal (Pre-Hypertensive) and into a Group C - High Risk Risk group and risk category. Hypertension (elevated blood pressure) is both a cause of kidney disease and it is caused by kidney disease. To decrease the rate of decline of your kidney function, your blood pressure must be controlled. The most effective ways of doing this is by losing weight, decreasing the salt content of your diet, increasing your exercise and by taking your medication as directed. Other methods will be discussed with you by your healthcare provider.

Diabetes

You have diabetes mellitus which is one of the most common causes of kidney disease. Controlling your blood sugar is critical to decreasing the rate of decline of your kidney function.

Your Last Hemoglobin A1C was 8.1 %. The ideal result is below 6.0%. You need to take measures to maintain your Hemoglobin A1C at or below 6.0%

Cardiovascular Disease

You have been diagnosed with cardiovascular disease. Controlling your heart disease includes controlling your blood pressure, your diabetes, your weight and maintaining an active life style with regular, daily exercise. Your healthcare provider will discuss other steps to help control your heart disease.

Protein in the Urine

You have protein in your urine. This is the earliest evidence of kidney disease and needs to be treated. The best treatment is a class of medications call ACE Inhibitors or ARBs. You are currently on an ARB, DIOVAN, and should continue that medication.

Anemia

Your most recent hemoglobin is 11.8 g/dL. This shows that you are not anemic.

Smoking

Smoking is harmful to every system of your body and particularly to your kidneys. Our records indicate that you smoke. You must stop. Remember, you can smoke or you can live; you just can't do both.

Elevated Cholesterol

Your last lipid analysis shows that your total cholesterol was 126 mg/dL, your good cholesterol (HDL) was 24 mg/dL and your bad cholesterol (LDL) was 135 mg/dL. These values place you at high risk of cardiovascular disease and at increased risk of worsening of your kidney disease.

Nutrition

While excessive weight is detrimental to your kidney's health, so is malnutrition. While controlling your weight, or even losing weight if you are obese, is important in improving your kidney function, malnutrition is not. With your BMI you should typically be taking in 100 gms of protein each day and 2332 calories of food. However, the National Kidney Foundation's recommendation for protein intake for a person with Stage I renal disease is 63 grams/day with a recommended caloric intake of 2943 calories/day.

The decrease in protein may improve your kidney function by decreasing the demand to clear waste products of protein metabolism from the blood while the increase in calories reflects the need to make sure that your nutrition level is maintained and that you do not become malnourished. Because of the recommend increase in calories with kidney disease, increase in the amount and consistency in the regularity of exercise are important parts of your protection of your kidneys.

A blood test called "prealbumin" assesses your current state of nutrition. Your most recent value was 24. This indicates that your calorie intake is adequate. Remember, your calorie intake needs to be properly balanced between fats, protein and carbohydrates. You should decrease your intake of simple carbohydrates such as white bread, white rice, mashed potatoes, etc. and increase your intake of complex carbohydrates which will be found in fresh vegetables an in whole fruits.

Diet

Other conditions which can contribute to the worsening of your kidney function are a:

1. High Phosphate Diet

Phosphate is found in association with protein, especially in milk and cheese. Only a few other foods contain a lot of phosphate like wholegrain cereals, baking powder, shellfish. Other sources are convenience foods which have phosphates added by food manufacturers. The following foods are high in phosphate and should be avoided.

1. Soft drinks, soda drinks, especially cola or coke and fizzy lemonade
2. Cordials/fruit syrup beverages
3. Chocolate, sweets, candy, and anything else with a high citric acid and sugar content

4. Ice-cream
5. Skim milk powder (often added to processed foods)
6. Biscuits, cookies, cakes from the supermarket
7. Tomato ketchup
8. Mayonnaise
9. Fish fingers
10. Processed cheese, especially soft cheese spread
11. Frozen pizzas
12. Hot dogs
13. Processed meats
14. Baking powder and self-raising flour often contains phosphate aerator
15. Avoid all foods that list as an ingredient mineral salts, emulsifiers and lecithin.

2. High Protein Diet

While your BMI would suggest that you need 100 grams/day of protein and 2332 calories/day, as your kidney function decreases you will need to decrease your protein intake. The National Kidney Foundation recommendation for protein intake for a person with Stage 1 renal disease is 63 grams/day with a recommended caloric intake of 2943 calories/day. From the brief list below, you can see how you will need to modify your diet to reach these goals.

1. Soy protein isolate - 80 grams protein per 100 grams
2. Soybeans, dry, roasted - 89.6 grams protein per 100 grams
3. Peanuts (raw) - 55 grams protein per 100 grams
4. Hamburger patty, 4 oz - 28.5 grams protein
5. Steak, 6 oz - 42 grams
6. Most cuts of beef - 7 grams of protein per ounce
7. Chicken breast, 3.5 oz - 30 grams protein
8. Chicken thigh - 10 grams (for average size)
9. Drumstick - 11 grams
10. Wing - 6 grams
11. Chicken meat, cooked, 4 oz - 35 grams

A professionally trained nutritionist will help plan a diet and moderate your protein intake in order to slow the rate of decline of your kidney function.

Lifestyle Changes

Because so many of these risk factors are associated with your diet, we have referred you to Medical Nutrition Education for explanation of the following dietary approaches to improving your kidney function, your weight and your overall health. SETMA's registered nutritionist will discuss with you:

Cholesterol Control
 Moderation of Salt Intake
 Moderation of Protein Intake
 Dietary Implications of Kidney Disease
 DASH Diet (Dietary Approach to Stop Hypertension)
 Weight Maintenance

Immunizations

Because Hepatitis B and other viral infections also contribute to kidney disease, it is imperative for you to get your immunizations. Our records show that the following immunizations are out of date:

Hepatitis

Please ask your health care provider to order these immunizations for you at your next visit or call the clinic and ask to have them done.

SETMA's Chronic Kidney Disease Treatment Audit

Has the patient's urinary protein been assessed within the last year? Yes

Has the stage of the patient's renal disease been assessed within the last year? Yes

Has the patient been referred to Medical Nutrition Therapy at least once? Yes

Has the patient had lipid panel within the last year? Yes

Has the patient had a prealbumin test within the last year? Yes

Has the patient received a personalized exercise prescription within the last year? Yes

Has the patient received a weight management assessment including BMI, BMR and how to change both within the last year?
Yes

If the patient smokes, have they received counseling as to stopping and been given methods of doing so? Yes

Has the patient received an immunization for influenza? Yes

Has the patient received an immunization for pneumonia? Yes

Has the patient received an immunization for Hepatitis B? No

Has the renal treatment and plan of care document been generated within the last year? Yes

PCPI Chronic Kidney Disease Measures Group

Applies to only Stage 4 and 5

Laboratory Testing

Patient not eligible for submittal of CKD measures.

Blood Pressure

Patient not eligible for submittal of CKD measures.

Blood Pressure Plan

Patient not eligible for submittal of CKD measures.

Influenza Immunization

Patient not eligible for submittal of CKD measures.

Referral for AV Fistula

Patient not eligible for submittal of CKD measures.

Elevated Hemoglobin for Patients Receiving ESA Therapy

Patient not eligible for submittal of CKD measures.

Not applicable. Patient not on ESA therapy.

Not applicable. Patient not on ESA therapy.

Lab Order Today

BMP CBC
Glycohemoglobin
Micral Strip
Occult Blood
Prealbumin
Urinalysis
Urine, Albumin/Creatinine Ratio

Conclusion

The three most important things for you to do in order to support the health of your kidneys are:

1. Strict control of your blood sugar
2. Strict control of your blood pressure
3. ACE Inhibitors or ARBs medications

You can live successfully with kidney disease. It is a progressive condition but the earlier you begin aggressive treatment, the longer you will remain healthy.

Bring this document with you to your next visit and ask your healthcare provider to explain anything that you do not understand.

James L. Holly MD

Southeast Texas Medical Associates, LLP

Plan of Care and Treatment Plan
Chronic Renal Disease
By James L. Holly, MD
Your Life Your Health
The Examiner
January 21, 2009

If you go to the nursing section of a health profession's book store, you will find volumes on "Treatment Plans and Plans of Care." Those books will define and describe the importance of a written, personalized plan for how to proceed with the care of a patient. In hospice, home health, physical therapy, nursing homes, rehabilitation, psychiatric hospitals and other specialty-care facilities, "treatment plans" and "plans of care" are a part of the patient's record.

While it is beginning to change, this is not the case with clinic medical records, physician hospital records and other notes written by physicians. Notwithstanding, it is possible to discern many elements of a "treatment plan" and/or a "plan of care," in the records of physicians' care. The diagnoses are there; the medications prescribed and continued are there; the laboratory and procedures ordered are documented; the instructions for referrals, returned visits are there; often activity levels, dietary instructions and other daily habits are documented. However, these elements are not aggregated into a single statement but are scattered throughout the record. And, they are rarely, if ever shared with the patient in a written form.

As medicine is moving toward care driven by Patient-Centered Medical Home, which requires the patient not only to be knowledgeable about their care, but actually to be in charge of that care, it is critical that physicians prepare a "treatment plan" and a "plan of care," which they can deliver to their patient. This document becomes the means of communication between the provider and the patient. It actually becomes their "contract" of what they both agree is a positive, valid, understandable and understood, plan for the patient's care over the next several months.

Due to the growing complexity of healthcare, the importance of this written and shared document is increasing. And, because many patients are being treated for multiple, inter-related conditions, it is important that a plan of care and a treatment plan be integrated across various disease processes.

There are other circumstances which make a plan of care and a treatment plan more difficult for physicians and other healthcare professionals. One is that the ideal of modern health care is that it needs to be interdisciplinary. There are many healthcare professionals who contribute uniquely and critically to the care of a patient, and their contribution needs to be included in a plan of care and a treatment plan. There was a time, for instance, when the nursing literature declared that nurses have nine independent functions and one dependent function. The dependent function was, "To carry out the doctor's orders." When I first read that statement thirty years ago, I thought it was condescending at best and today I think it is devaluing the important skills and abilities of nurses and other health professionals.

Another complicating factor is that no single definition of a plan of care and a treatment plan exists. Often the best we can find is a description of the elements of both. As a result, we are often partially in the dark about how best to create this extremely powerful tool of healthcare delivery which is particularly a powerful tool of the continuity of that care, which is made possible by a personalized, written plan of care and treatment plan.

Let me illustrate this. One of SETMA's partners was formerly involved in a large, multi-specialty clinic in another community. He was and is very interested in diabetes and lipid management. During a conference, he asked a visiting lecturer what he did when he needed diabetes, dietary and/or lipid education for a patient. The visitor said, "I send them down the hall to the education department." This was frustrating because our partner wanted to practice first class medicine, but his group did not have an education department.

This exposes another complexity of a plan of care and of a treatment plan. In order to produce an effective tool, there must be other services available to the provider in order to plan effectively and to execute excellently a strategic and tactical plan to improve the health of those who entrust us with their care. Without physical therapy, medical nutrition therapy, certified diabetes self management education, follow-up call nurses, preventive health and health screening standards, laboratory and diagnostic capabilities, administrative support for measuring patient satisfaction and provider performance, it is not possible to execute a robust, comprehensive plan of care and treatment plan. even if you want to do so.

And, these are only some of the complex issues. A plan of care and a treatment plan must also include the ability to audit the provider performance and the standard of care the patient is receiving and it must include the ability to communicate that auditing result to the patient, to the provider and even to the public.

With these concepts in mind, SETMA has developed written, personalized treatment plans and plans of care for each of the disease management tools which we use in our EMR. The following is an example of a treatment plan and of a plan of care on a real patient for a real encounter, in regard to the management of chronic kidney disease which affects a significant number of SETMA's patients. Review this introduction and then review the content of the plan of care and treatment plan presented below and see if SETMA meets the standard of excellence to which we aspire. You be the judge.

Renal Follow-Up Note Treatment Plan and Plan of Care (the material in italics is not a part of the treatment plan but is explanation for this article)

Following the patient's identification information on the treatment plan and plan of care, there is a statement of the patient's:

Follow-Up Care -- Your next visit should be scheduled in 3 months.

Latest Lab Results -- a complete list of all laboratory values is placed here.

Active Medications – all of the patient's medications and a description of how they are to be taken is given here.

The active medication list is accompanied by the following instructions:

- The following are the medications which you should be taking. Please notify your provider if you are unable to obtain your medications for any reason. Do not just stop taking your medication without calling your healthcare provider immediately.
- Please review this list of your medications. If any medication you are taking is missing -- if you have medications which are not listed please bring that to your healthcare provider's attention.

Because this plan of care and treatment plan relates to Chronic Renal Disease and because many of the quality measures requires the provider and the patient to know the patient's renal condition, the Stage of Renal Disease is documented: Stage of Renal Disease -- According to your most recent laboratory evaluation, you have Stage 1 renal disease.

Hydration

The human body requires water to function properly. However, patients with chronic renal disease can have too much water in their body or too little. As a result, SETMA has devised a tool for the evaluation of the state of a patient's hydration. This tool includes the patient's risk of hydration problems, their physical signs of hydration problems and their metabolic and/or chemical evidence of hydration problems. This is listed in the Plan of Care and the Treatment Plan under "hydration." At the end the state of hydration is given, which in this patient's case was "marginal." This alerts the patient and the provider to be attentive to the patient's state of hydration.

Risk Factors for Dehydration Present

Recent infection - Lungs

Diabetes Mellitus, Patient on diuretics, Age over 60 years,

Physical Signs and Symptoms of Dehydration Present

Skin Turgor - good, Buccal Mucosa – moist.

Chemical and Metabolic Indicators of Dehydration

Urine Specific Gravity – 1.008

Glucose - 357.0 mg/dL

Sodium - 140.0 mg/dL

Potassium - 3.7 mmol/L

Chloride - 100.0 mmol/L

HCO₃ - 30.0 mmol/L

Blood Urea Nitrogen - 12 mg/dL

Creatinine - .8 mg/dL

BUN/Creatinine Ratio - 15.0

Serum Osmolality - 311.5

Serum Osmolarity - 304.1

Anion Gap - 10.0

Est. Creatinine Clearance - 113.9

Hydration Status - Marginal

Following this evaluation, the related specific conditions for which this patient is being treated and which relate to the status or the progression of kidney disease are documented. These will change from patient to patient, but many patients with kidney disease will have these same conditions. Following the documentation of the condition, a statement appears which discusses this condition in relationship to the presence of Chronic Renal Disease. At the same visit, the patient may receive a treatment plan and a plan of care for Chronic Kidney Disease hypertension, cholesterol abnormality, diabetes and other conditions.

Hypertension

You have high blood pressure. Your last blood pressure was 138 / 50 mmHg . Your blood pressure places you into a High-Normal (Pre-Hypertensive) and into a Group C - High Risk Risk group and risk category. Hypertension (elevated blood pressure) is both a cause of kidney disease and it is caused by kidney disease. To decrease the rate of decline of your kidney function, your blood pressure must be controlled. The most effective ways of doing this is by losing weight, decreasing the salt content of your diet, increasing your exercise and by taking your medication as directed. Other methods will be discussed with you by your healthcare provider.

Diabetes

You have diabetes mellitus which is one of the most common causes of kidney disease. Controlling your blood sugar is critical to decreasing the rate of decline of your kidney function. Your Last Hemoglobin A1C was 8.1 %. The ideal result is below 6.0%. You need to take measures to maintain your Hemoglobin A1C at or below 6.0%

Cardiovascular Disease

You have been diagnosed with cardiovascular disease. Controlling your heart disease includes controlling your blood pressure, your diabetes, your weight and maintaining an active life style with regular, daily exercise. Your healthcare provider will discuss other steps to help control your heart disease.

Protein in the Urine

You have protein in your urine. This is the earliest evidence of kidney disease and needs to be treated. The best treatment is a class of medications call ACE Inhibitors or ARBs. You are currently on an ARB – DIOVAN -- and should continue that medication.

Anemia Your most recent hemoglobin is 11.8 g/dL. This shows that you are not anemic.

Smoking Smoking is harmful to every system of your body and particularly to your kidneys. Our records indicate that you smoke. You must stop. Remember, you can smoke or you can live; you just can't do both.

Elevated Cholesterol Your last lipid analysis shows that your total cholesterol was 126 mg/dL, your good cholesterol (HDL) was 24 mg/dL and your bad cholesterol (LDL) was 135 mg/dL. These values place you at high risk of cardiovascular disease and at increased risk of worsening of your kidney disease.

Nutrition

While excessive weight is detrimental to your kidney's health, so is malnutrition. While controlling your weight, or even losing weight if you are obese, is important in improving your kidney function, malnutrition is not. With your BMI you should typically be taking in 100 gms of protein each day and 2332 calories of food. However, the National Kidney Foundation's recommendation for protein intake for a person with Stage I renal disease is 63 grams/day with a recommended caloric intake of 2943 calories/day.

The decrease in protein may improve your kidney function by decreasing the demand to clear waste products of protein metabolism from the blood while the increase in calories reflects the need to make sure that your nutrition level is maintained and that you do not become malnourished. Because of the recommend increase in calories with kidney disease, increase in the amount and consistency in the regularity of exercise are important parts of your protection of your kidneys.

A blood test called "prealbumin" assesses your current state of nutrition. Your most recent value was 24. This indicates that your calorie intake is adequate. Remember, your calorie intake needs to be properly balanced between fats, protein and carbohydrates. You should decrease your intake of simple carbohydrates such as white bread, white rice, mashed potatoes, etc. and increase your intake of complex carbohydrates which will be found in fresh vegetables an in whole fruits.

Diet -- Other conditions which can contribute to the worsening of your kidney function are a:

1. High Phosphate Diet

Phosphate is found in association with protein, especially in milk and cheese. Only a few other foods contain a lot of phosphate like wholegrain cereals, baking powder, shellfish. Other sources are convenience foods which have phosphates added by food manufacturers. The following foods are high in phosphate and should be avoided.

1. Soft drinks, soda drinks, especially cola or coke and fizzy lemonade
2. Cordials/fruit syrup beverages
3. Chocolate, sweets, candy, and anything else with a high citric acid and sugar content
4. Ice-cream
5. Skim milk powder (often added to processed foods)
6. Biscuits, cookies, cakes from the supermarket

7. Tomato ketchup
8. Mayonnaise
9. Fish fingers
10. Processed cheese, especially soft cheese spread
11. Frozen pizzas
12. Hot dogs
13. Processed meats
14. Baking powder and self-raising flour often contains phosphate aerator
15. Avoid all foods that list as an ingredient mineral salts, emulsifiers and lecithin.

2. High Protein Diet

While your BMI would suggest that you need 100 grams/day of protein, The National Kidney Foundation recommendation for protein intake for a person with Stage 1 renal disease is 63 grams/day. From the brief list below, you can see how you will need to modify your diet to reach these goals.

1. Soy protein isolate - 80 grams protein per 100 grams
2. Soybeans, dry, roasted - 89.6 grams protein per 100 grams
3. Peanuts (raw) - 55 grams protein per 100 grams
4. Hamburger patty, 4 oz - 28.5 grams protein
5. Steak, 6 oz - 42 grams
6. Most cuts of beef - 7 grams of protein per ounce
7. Chicken breast, 3.5 oz - 30 grams protein
8. Chicken thigh - 10 grams (for average size)
9. Drumstick - 11 grams
10. Wing - 6 grams
11. Chicken meat, cooked, 4 oz - 35 grams

A professionally trained nutritionist will help plan a diet and moderate your protein intake in order to slow the rate of decline of your kidney function.

Lifestyle Changes

Because so many of these risk factors are associated with your diet, we have referred you to Medical Nutrition Education for explanation of the following dietary approaches to improving your kidney function, your weight and your overall health. SETMA's registered nutritionist will discuss with you:

- Cholesterol Control
- Moderation of Salt Intake
- Moderation of Protein Intake
- Dietary Implications of Kidney Disease
- DASH Diet (Dietary Approach to Stop Hypertension)
- Weight Maintenance

Immunizations

Because Hepatitis B and other viral infections also contribute to kidney disease, it is imperative for you to get your immunizations. Our records show that the following immunizations are out of date:

Hepatitis

Please ask your health care provider to order these immunizations for you at your next visit or call the clinic and ask to have them done.

SETMA's Chronic Kidney Disease Treatment Audit

- Has the patient's urinary protein been assessed within the last year? Yes
- Has the stage of the patient's renal disease been assessed within the last year? Yes
- Has the patient been referred to Medical Nutrition Therapy at least once? Yes
- Has the patient had lipid panel within the last year? Yes
- Has the patient had a prealbumin test within the last year? Yes
- Has the patient received a personalized exercise prescription within the last year? Yes
- Has the patient received a weight management assessment including BMI, BMR and how to change both within the last year? Yes
- If the patient smokes, have they received counseling as to stopping and been given methods of doing so? Yes
- Has the patient received an immunization for influenza? Yes
- Has the patient received an immunization for pneumonia? Yes
- Has the patient received an immunization for Hepatitis B? No
- Has the renal treatment and plan of care document been generated within the last year? Yes

PCPI Chronic Kidney Disease Measures Group

Applies to only Stage 4 and 5

- Laboratory Testing Patient not eligible for submittal of CKD measures.
- Blood Pressure Patient not eligible for submittal of CKD measures.
- Blood Pressure Plan Patient not eligible for submittal of CKD measures.
- Influenza Immunization Patient not eligible for submittal of CKD measures.
- Referral for AV Fistula Patient not eligible for submittal of CKD measures.
- Elevated Hemoglobin for Patients Receiving ESA Therapy Patient not eligible for submittal of CKD measures.
Not applicable. Patient not on ESA therapy.
Not applicable. Patient not on ESA therapy.

Lab Ordered Today

BMP, CBC, Glycohemoglobin, Micral Strip, Occult Blood, Prealbumin, Urinalysis, Urine Albumin/Creatinine Ratio

Conclusion

The three most important things for you to do in order to support the health of your kidneys are:

1. Strict control of your blood sugar
2. Strict control of your blood pressure
3. ACE Inhibitors or ARBs medications

You can live successfully with kidney disease. It is a progressive condition but the earlier you begin aggressive treatment, the longer you will remain healthy. Bring this document with you to your next visit and ask your healthcare provider to explain anything that you do not understand.