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Clinical Guidelines in Practice: How Well are Primary Care Providers Following National
Chronic Kidney Disease Recommendations?

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Abstract

Chronic kidney disease (CKD), prevalent in more than 10% of the United States population is a progressive, degenerative disease affecting the renal function of afflicted individuals. In recent decades CKD has gained awareness among clinicians and medical professionals due to growing concern for the many complications that arise in patients with CKD. For providers, CKD patient populations pose a significant challenge in terms of quality treatment because of the many associated risk factors and co-morbidities associated with a CKD diagnosis. The KDIGO (Kidney Disease; Improving Global Outcomes) 2012 clinical guidelines for the treatment of CKD were published under the sponsorship of the National Kidney Foundation in order to create uniform measures aimed to improve quality care and effective treatment of the CKD population. The purpose of this study is to investigate the extent to which these measures are being implemented and adhered to among providers at the practice level. Analysis of adherence to six specific measures of the KDIGO guidelines offers insight into the areas of implementation strengths and weaknesses. Results of this study indicate a widespread variation in the level of adherence to each measure on the practice level as well as variation among individual providers to each measure. While adherence levels were high among providers for certain measures, high adherence was not uniform across all six measures. Results of this study indicate the potential for improvement in CKD treatment through the use of centralized implementation structures such as practice based research networks (PBRN) or practice facilitation in order to generate higher adherence to all six KDIGO measures.

Introduction

Chronic kidney disease (CKD) is a serious condition affecting the renal function of afflicted individuals and is associated with progression of kidney failure, cardiovascular disease, and premature death (Levey et al., 2005). Kidney function can be assessed on the basis of an estimated glomerular filtration rate (eGFR), which estimates how much blood passes through glomeruli each minute (National Library of Medicine). Glomeruli are components of the kidney that function to filter waste out of blood. CKD can be diagnosed by two eGFR readings of less than 60 milliliters per minute (mL/min) taken more than ninety days apart (Kidney Disease: Improving Global Outcomes [KDIGO]). A diagnosis of CKD is further defined on the basis of the severity of decline in renal function. CKD is a progressive disease with five stages classified by specific eGFR ranges correlating to increasingly severe declines in renal function. Stages one and two are associated with the most mild loss of kidney function. Stage three, consisting of sub-stages 3a and 3b, define moderate loss in kidney function with stage 3b, a eGFR of 44-30 mL/min, considered moderate to severe loss of renal function. A stage four diagnosis is classified by an eGFR reading of 29-15 mL/min and severe loss of function while stage five reflects complete renal failure characterized by an eGFR less than 15 mL/min. A more severe CKD diagnosis carries with it greater risk factors for progression towards end stage renal disease and dialysis. According to estimates published by the Center for Disease Control (CDC) in 2014, more than 10% of the United States population, or 20 million individuals, have CKD. A recent national increase in the prevalence of major risk factors for CKD including obesity, hypertension, and type 2 diabetes has contributed to this large number of CKD cases (Fox et al., 2013). Since CKD patients represent a population at increased risk for renal failure and dialysis, as well as other cardiovascular complications, they pose a number of challenges for providers in

the delivery of care. Implementation of effective treatment plans for patients with CKD holds the potential for improving population health through the elimination of complex medical scenarios that arise with the progression of CKD and, ultimately, renal failure.

Evidence based clinical studies have identified major risk factors associated with the progression of CKD, namely, cardiovascular disease (CVD), use of non-steroidal anti-inflammatory drugs (NSAIDs), and type 2 diabetes. Control of these risk factors presents a target for clinical treatment that has the potential to slow the progression of CKD and reduce the number of CKD patients with severe renal failure. Patients with CKD have been found to be at high risk of developing severe CVD. In fact, CVD has become one of the leading causes of mortality in patients with CKD with 50% of all deaths in patients with end-stage renal disease being a result of CVD (Parikh et al., 2006). Similarly, individuals diagnosed with CKD are more likely to die from these accelerated CVD complications than to reach a stage 5 diagnosis of complete renal failure (Schiffrin et al., 2007). Risk factors associated with CVD are also extremely high in these patients with studies showing high prevalence rates of hypertension, abnormal lipids, and type 2 diabetes in the CKD patient population (Parikh et al., 2006). Previous studies have indicated that increased CVD risk among CKD patients is related to inadequate drug therapy because patients with limited renal function are less likely to receive cardio-protective medications that would otherwise reduce their CVD risk (Schiffrin et al., 2007). In addition to an increased risk for the development of CVD and its associated factors, previous research has indicated a negative correlation between the use of NSAIDs and the progression of CKD. NSAIDs have been shown to have adverse acute effects on kidney function and account for 16% of all cases of drug related renal failure (Ingrasciotta et al., 2015). Recent clinical studies have subsequently identified NSAID use as a contributing factor in chronic

adverse renal effects and the progression of CKD (Ingrasciotta et al., 2015). NSAID drug activity leads to a decrease in renal blood flow, which poses a significant risk for progression of decreased renal function in patients with CKD (Plantinga et al., 2011). In fact, it has been demonstrated that the use of NSAIDs among a population having a baseline eGFR of 60 and 89 mL/minute correlated with a significant increase in risk of progression of CKD (Gooch et al., 2007).

In light of identification of these risk factors associated with the progression of CKD as well as its prevalence as a widespread chronic condition, the 2012 KDIGO clinical guidelines for the treatment of CKD were published under the sponsorship of the National Kidney Foundation. These international, evidence based guidelines were developed to create clinical measures aimed to improve care and outcomes for patients with CKD. Table 1 in Appendix A lists the six 2012 KDIGO guideline measures that were the focus of this study. These include, measure one, proper documentation of CKD diagnosis; measure two, current prescription of an angiotensin-converting enzyme (ACE) inhibitor or an angiotensin receptor blocker (ARB); measure three, discontinuation of NSAID medications; measure four, blood pressure reading less than 140/90; measure five, a lipid panel LDL reading less than 100; and measure six, a hemoglobin A1C reading lower than seven for all diabetic patients with CKD (KDIGO, 2013). Among these six guidelines, measures two, four, and five are aimed to specifically address the increased risk for ischemic heart disease and hypertensive heart disease present in the CKD patient population (KDIGO, 2013). These CVD specific guidelines were created on the basis of the assumption that all CKD patients are considered to be at increased risk for developing CVD (KDIGO, 2013). This assumption is based on clinical studies that indicate a 43% increase in risk of CVD symptoms among stage 3a CKD patients and a 343% increased CVD risk in stage five CKD

patients (KDIGO, 2013). Accordingly, these specific blood pressure and LDL values reflect optimal targets providers should aim for in their CKD patient population in order to better control CVD risk. Administration of ACE inhibitors or ARB's which are used to manage systolic heart failure also reflect this measure of preventative CVD care among CKD patients suggested in the KDIGO guidelines. In addition, the KDIGO included measure six as an aim towards improved control of type 2 diabetes in patients in CKD (KDIGO, 2013) This recommendation specifically addresses the risk of micro-vascular complications associated with uncontrolled diabetes to which CKD patients are more susceptible. Measure three addresses the increasingly problematic use of NSAIDs among CKD patients who often experience other co-morbidities such as hypertension or chronic arthritis. This particular measure aims to address the concern of NSAID use among CKD patients by setting dosage guidelines that allow for the continuation of NSAID pain management treatment while also protecting CKD patients from the adverse effects of these medications. These above recommendations listed in Table 1 were identified as the specific measures from the KDIGO publication that will be the focus of this study, which will analyze provider adherence to these clinically based guidelines.

Specific Aims

Since the publication of these guidelines, little research has been conducted to determine how well physicians are adhering to these clinical measures. Addressing this question could improve patient care and, subsequently, population health by improving clinical treatment at the provider level. The primary goal of this project is to examine the extent to which clinicians in a family medicine practice located in an urban community are following six major clinical measure as presented in the 2012 KDIGO guidelines. The secondary goal of this project is to discover the level of variation that exists among adherence to each of these measures.

Specific Aim One:

To determine the number measures this practice and its individual providers are adhering to in the treatment of at least 50% of their CKD patient population.

Specific Aim Two:

To determine the variation in percentage of patients treated appropriately for each measure on a practice and provider level. This will assess the level of variation in quality care within the practice.

Specific Aim Three:

To use analysis of this data to determine areas of strength and weakness in terms of accordance to specific guideline measures.

These specific aims will aid in my examination of adherence to KDIGO clinical guidelines as a means of quality improvement and improved patient outcomes.

Methods

In the present study, my methodology will consist primarily of a review of 835 patient charts using the Allscripts electronic medical records system. The 835 patients included in this data set and identified as subjects of this study are all individuals from a single family medicine practice located in an urban community. Each of these patients has had at least one recorded eGFR reading less than 60 mL/min. A single eGFR reading less than 60 mL/min identifies the possibility of a CKD diagnosis. A second eGFR reading less than 60 mL/min more than 90 days after the first reading confirms this diagnosis. The purpose of this chart review will be to first determine, for each of the 835 patients, whether or not the patient has a diagnosis of CKD, as indicated by a second eGFR reading less than 60 mL/min taken at least 90 days after the initial reading. Once CKD patients have been identified from this set of 835 individuals, further chart

review will be used to determine how well the primary care provider for each CKD patient is following the six specific KDIGO measures previously discussed.

Adherence to measure one, proper documentation of CKD diagnosis, is met if a CKD diagnosis appears in the patient's medical record. Measure two, prescription of ACE inhibitors or ARB medications, is met if a medication of either one of these categories is listed as an active prescription on the patient medication list. Adherence to measure three, non-prescription or discontinuation of NSAID medication, is met if all medications that act as NSAIDs do not appear on the active patient medication list. Aspirin, for the purposes of this study and in accordance to the KDIGO guidelines, is not considered to have adverse effects on CKD patients when prescribed up to 81 mg. Adherence to measure three, therefore, will still be met in the presence of an active aspirin prescription on the medication list as long as its dosage does not surpass 81mg. Measure four, a blood pressure reading less than or equal to 140/90, will be met if the most recent blood pressure reading in the patient's chart is less than or equal to this value. Measure five, an LDL less than or equal to 100, will be met if the lipid panel results from the most recent blood testing present in the patient's chart is less than or equal to this value. Finally, adherence to measure six, a hemoglobin A1C (HbA1C) less than or equal to seven for diabetic patients, will be met if the most recent HbA1C reading present in the chart of a CKD patient, who has been identified as a diabetic, is less than or equal to seven. This chart review process will be conducted for each individual of the data set of 835 who are identified as CKD patients. During this review process the primary care provider for each CKD patient will be identified. This information allow the final set of a accumulated data to be analyzed on a provider by provider level in addition to an overall practice level analysis.

Once this chart review has been completed, adherence to each measure will be scored on a scaled system to identify low, moderate, and high adherence on a practice level basis. These scores will be given based on the percentage of cases, out of the total CKD patients in this practice, that are being treated appropriately for each of the six measures. Percentage values from 0-33.3% will be categorized as low adherence, percentage values from 33.4-66.6% will be categorized as moderate adherence, and percentage values from 66.7-99.9% will be categorized as high adherence. According to these graded levels of adherence I will identify the measures to which the practice is performing the best in terms of adherence to guidelines as well as those measures the practice is adhering to less optimally.

After scoring measures on the basis of low, moderate, and high adherence on the practice level, individual provider performance will be assessed by comparing each provider's results to the average practice percentages for each measure. Adherence to guidelines will again be measured by calculating the percentage of CKD patients, treated by a particular provider, of the total number of CKD patients the provider treats who are receiving the appropriate treatment for each measure. These percentages will be graded 'above' or 'below' average by comparing each with the practice level percentages determined in the first phase of analysis. These above and below grades will be further characterized on the basis of deviation from the practice level average. These comparative results will indicate the spread in level of adherence to guidelines that exists among providers for each measure. This will aid in determining the level to which consistency in adherence to specific guidelines exists among providers in this practice.

Through this gathering of data via chart review and the analysis of these results this study hopes to reveal areas of strengths and weaknesses in terms of clinical adherence to KDIGO guidelines three years after their initial publication. These results will serve as a basis from

which new methods of quality improvement may emerge to better implement those measures that are not being followed as well as others.

Results

After conducting the chart review, 291 of the 835 patients from the original data set were identified as having CKD. At the practice level, adherence to guideline recommendations in at least 50% of the CKD patient population was met for five of the six measures analyzed as shown in Table 2. At the practice level, 229 or 78.70% of these patients had appropriate documentation of CKD diagnosis on their problem list, giving measure one a score of high adherence. Measure two received a score of moderate adherence as only 53.20% or 152 total CKD patients were prescribed ACE inhibitors or ARB's. Measure three was given a score of high adherence with 241 patients, 82.80%, currently not taking NSAIDs. Measure four received a practice level score of high adherence as 79.70%, or 231 of the 290 patients with documented blood pressure readings available, were at goal of less than or equal to 140/90. The one CKD patient without a documented blood pressure reading available was not considered for this measure. A moderate adherence score was given to measure five as only 143 of the 264 CKD patients with documented blood tests available, 53.40%, had LDL equal to or below 100. The 23 patients who did not have blood test labs available were not considered for the measure. Of the 153 total diabetic CKD patients in this study, only 152 had documented HbA1c measurements available for analysis. Of these 152 patients, only 68 or 44.74% were at goal of equal to or less than seven. Accordingly, measure six received a moderate adherence score as well. This was the only measure, on the practice level, of the six in which appropriate adherence was not met in the treatment of at least 50% of CKD patients. Overall, the practice received moderate adherence

scores for three measures, high adherence scores for three measures, and received no low adherence scores.

Eight individual providers were identified during the chart review as primary care physicians for 258 of the CKD patients. There were 33 patients without a specific primary care physician listed in their chart. These patients were placed collectively in the ‘unknown physician’ category for purposes of carrying out a provider level analysis. This category is designated as provider nine in the data analysis. The average adherence percentages for each measure for these nine providers were; measure one, 77.31%; measure two, 51.23%; measure three, 86.67%; measure four, 79.49%; measure five, 52.97%; and measure six, 41.13% (Table 4). These averages can be further categorized as high adherence for measures one, three, and four and moderate adherence for measures two five and six. These averages align closely with the results obtained for practice level adherence and provide average achievement levels to which performance of each individual provider can be compared and measured. Table 3 indicates both the total number of CKD patients and the number of diabetic CKD patients treated by each of the nine providers. These values were used to calculate the adherence levels for each of the nine providers based on the specific patient population each treated. Each provider’s percentage level adherence to each of the six measures was compared to the average adherence percentages found in Table 4. These comparisons are shown in Table 5, which illustrates the difference in percentage values between each individual provider and the provider averages for each measure. Each difference was categorized as below or above average performance indicated by negative and positive values, respectively. According to these results it was determined that above average performance was seen in five providers for measures one, two, four, and six. Above average performance was seen among six providers for measures three and five. None of the

providers achieved above average performance in all six measures nor did any provider receive below average scores for all six measures.

Also presented in Table 5 is the variation in level of adherence among the nine providers as well as among the six measures for each individual provider. These results indicate a significantly large variation among providers in adherence levels for each of the six measures when compared to the practice average percentages. Table 5 also displays the significant variation in individual adherence levels to the six measures. As illustrated, the extent to which each individual provider performed above or below the practice average for each of the six measures varied substantially. None of the nine providers were found to have either above average or below average performance for all six measures. Instead, adherence levels varied for each provider depending on the specific measure being assessed. Variation in adherence among measures for each individual provider are evident throughout the results of this study and indicate the possibility of an inconsistency in the overall implementation of each of these six KDIGO measures among providers within practices.

Discussion

The findings of this study provide important information regarding current clinical treatment of CKD. Based upon the findings of this study several conclusions can be drawn regarding the level of adherence to KDIGO clinical based guidelines. On the practice level, adherence to guidelines in at least 50% of the CKD patient population was met for five out of six measures. Of these five, practice adherence to three measures- one, three, and four- was greater than 75% with the greatest percentage of overall practice adherence being for measure three, patients with CKD not being prescribed NSAIDs. These high levels of adherence to measures three and four both of which are address CVD risks associated with CKD suggest an elevated

level of provider awareness to CVD risks in this patient population. Although measures two, five, and six received moderate rather than high adherence scores, these values were still above the low adherence threshold. While these values indicate significant room for improvement, it is also clear that implementation and attention to these recent guidelines are not falling in the lowest range adherence. These results offer an important justification of the KDIGO measures as guidelines that are readily applicable at the practice level clinical treatment of CKD.

The extent of variation in adherence among specific measures and providers was another important finding garnered from this study. Although, as indicated above, there are areas of high performance on the practice level in terms of implementation of certain measures, the variation in level of adherence that exists among providers suggests a weakness in the implementation of KDIGO guidelines. As shown in Table 6, for each measure, variation in adherence to guidelines spans a range of at least 26.1 percentage units. In the case of four of the measures, the range of values is greater than 30 units. This widespread variation in adherence found for each measure indicates that while performance for a particular measure may be high for one individual provider, this high performance is not maintained evenly throughout the practice. Rather, there is a large divide among providers in a single practice in terms of level of adherence to these guidelines. This finding reveals a larger implication regarding clinical care, namely, that treatment of CKD is not consistent within a single practice.

This inconsistency is also illustrated in the variation of individual provider adherence to each of the six measures. None of the nine providers had above average performance for all six measures. Even more surprisingly, however, was the deviation in each provider's performance levels for the six measures. Although these ranges were significantly smaller than those found when comparing all nine providers to one another, the discrepancy in adherence for the same

provider to different measures indicates another level of weakness in the implementation of KDIGO guidelines. While an individual provider may be aware and attentive to one or a few of the major KDIGO guidelines, these findings indicate that providers are not consistently adhering to all six measures equally. Since each of these six measures were designed by the KDIGO guidelines to bring about the greatest level of quality care for CKD patients, implementation of these measures should be uniform throughout individual provider care as well as on the practice level as a whole. This study, therefore reveals important information by revealing areas of strength in guideline implementation as well as areas of weakness that are in need of improvement.

Before highlighting specific areas of weakness and tools necessary to improve implementation of these measures it is important to note the areas of success revealed by the findings of this study. As previously noted measures one, three, and four all received high adherence scores on the practice level as well as in terms of average adherence percentages. These results indicate that there are areas of high performance in providing quality care in the treatment of CKD for a large proportion of this patient population. These successes also suggest that the measures created by the KDIGO guidelines are, in fact, applicable and translatable to the everyday setting of the clinical practice.

While these successes are important to note and provide support for the legitimacy of implementing guideline standards into clinical care, the weaknesses of implementation, illustrated by low adherence values and high variability among provider adherence to each measure, are significant findings that provide important information as well. Moderate adherence levels for measures two, five and six provide evidence for the need to improve implementation efforts of these guidelines at the practice level. Providing the best quality of care requires

adherence to all of the KDIGO measures rather than a select few. Therefore measures must be taken to improve adherence levels across the board. Provider awareness of these particular guidelines and measures is essential in the implementation of appropriate treatment. Recent studies have indicated the success of practice based research networks (PBRNs) in creating practice environments where implementation of more effective and efficient quality care is better achieved (Mold et al., 2014). The structure of PBRNs, which allow for communication between academic researchers providing practice performance feedback, practice facilitators (PFs), and practice clinicians and staff, creates a practice environment better equipped to implement new measures of quality care (Mold et al., 2014). According to the findings of this study, the use of centralized intervention programming such as the PBRN model accelerates the implementation of clinical measures and guidelines. Moving forward, the use of PBRNs in conjunction with practice facilitation has the potential to improve the CKD guideline implementation process by better assuring that each provider becomes more well equipped to address all six measures of the KDIGO guidelines. Through this facilitation, one could reasonably expect a drop in variation among providers' adherence levels due to increased practice-wide awareness of each CKD treatment measure. Additionally, moving forward, more publications supporting the efficacy of these particular measures in improving CKD patient health would generate more widespread attention and subsequent adherence to these guidelines thereby increasing performance levels.

Limitations and Suggestions

This study is not without limitations and constraints. Since this study was restricted to a single practice of providers serving a particular demographic of the CKD population its results are limited and reflective only of a single practice. Expanding this study to include a larger sample of practices from a variety of different regions has the potential extend this analysis to a

greater population of the providers, which could lead to significant results. Additionally, given the results gathered from this study, further designs could be established to evaluate the effectiveness of PBRN implementation programs aimed to generate greater adherence. An ancillary study that re-evaluates adherence levels in this practice post practice-facilitation efforts to better implement guideline measures could determine how successful such facilitation is based on changes in practice adherence levels.

Appendix A

Identification of KDIGO Measures	
Measure 1	Appropriate documentation of CKD diagnosis on patient problem list
Measure 2	Prescription of ACE inhibitor or ABR medication
Measure 3	Patient not prescribed NSAID medications
Measure 4	Blood pressure less than or equal to 140/90
Measure 5	LDL less than or equal to 100
Measure 6	HbA1c less than or equal to 7 for CKD patients with diabetes

Table 1: Description of each of the six specific KDIGO measures analyzed in this study.

Practice Level Adherence to Guidelines		
Measure	Percentage	Adherence Score
1	78.70%	High
2	53.20%	Moderate
3	82.80%,	High
4	79.70%	High
5	53.40%,	Moderate
6	44.07%	Moderate

Table 2 : Practice adherence to each of the six KDIGO measures represented as percentage of total patients with CKD who received appropriate treatment for each measure.

Provider	Total Number of CKD Patients	Total Number of CKD Patients with Diabetes
1	44	19
2	47	28
3	46	26
4	41	27
5	8	5
6	2	0
7	63	30
8	7	2
9	33	16
Totals:	291	153

Table 3: Number of CKD patients treated by each primary care physician in this practice as well as the number of those patients who have also been diagnosed with diabetes.

Average Adherence Percentages		
Measure	Percentage	Adherence Score
1	77.31%	High
2	51.23%	Moderate
3	86.67%	High
4	79.49%	High
5	52.97%	Moderate
6	41.13%	Moderate

Table 4: Average provider adherence to guideline percentages for each of the six measures and adherence scores.

Individual Provider Deviation from Average Adherence Percentages						
Provider	Measure 1	Measure 2	Measure 3	Measure 4	Measure 5	Measure 6
1	-1.40%	11.40%	8.10%	-0.20%	0.40%	2.70%
2	10.60%	-13.90%	-1.90%	5.40%	-2.20%	-19.70%
3	14.80%	-8.70%	-8.90%	0.70%	5.70%	9.10%
4	9.10%	8.78%	-12.10%	5.70%	7.10%	-0.30%
5	-3.70%	-14.70%	4.70%	-4.70%	6.60%	-4.70%
6	-28.70%	-2.20%	17.20%	20.30%	-3.40%	N/A
7	-26.30%	3.40%	4.50%	4.40%	4.00%	8.60%
8	7.00%	4.90%	17.20%	-8.30%	3.70%	5.30%
9	6.10%	2.30%	5.10%	-25.20%	-25.80%	11.60%

Table 5: Difference in percentage adherence values among providers for each measure as compared to the provider average adherence values. Green shading indicates above average performance and red shading indicates below average performance. Shows only difference in adherence percentages between provider and average values; not indicative of actual adherence percentages, which are shown in Figures 1-6.

Range of Adherence Percentages Among Providers	
Measure 1	43.5
Measure 2	26.1
Measure 3	29.3
Measure 4	45.5
Measure 5	32.9
Measure 6	31.3

Table 6: Range values of provider adherence percentages for each of the six measures. These ranges illustrate the amount of variation among provider adherence levels.

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