Nephrology Care in a Fully Integrated Care Model: Lessons from the Geisinger Health System

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At this time, there is a clear understanding of the need for healthcare reform in our country. The key stakeholders—patients, physicians, health insurers, and the federal government—recognize that changes are needed to improve the quality of care and to contain the cost of care. In particular, >70% of patients are dissatisfied with the systems of care that currently exist—citing, among other factors, poorly coordinated care and excessive costs (1). Purchasers of health insurance are frustrated with the cost of health care and the mediocre performance on key health care metrics that exist in the United States (2). Similar concerns have been expressed in the nephrology arena (3–5). In response to these deficits, the Centers for Medicare and Medicaid Services (CMS) have put forth a "triple aim" for health care reform that includes the following tenets: improving the individual experience of care, improving the health of populations, and reducing the per-capita cost of health care (6).

Although the defects in the current system of care in the United States are multitude, many clearly originate in its disorganization. Poorly coordinated care is inefficient, costly, and prone to medical errors. Re-designing the current healthcare delivery system to one with a greater emphasis on coordination of care may have a major effect on the quality of care (7). With >25 million adults in the United States having CKD and with CKD and ESRD accounting for approximately 10% of the annual Medicare expenditure, improvement in the care of nephrology patients is a high area of focus by many entities (3,5,8,9). An integrated health care system, in part by enhancing coordination of care, may provide opportunities to improve the medical care in this highly complex patient population. The Geisinger Health System is located in northern Pennsylvania, with approximately 3 million people in its service area. Its Danville campus, the main hub with approximately 650 physicians, is a totally integrated model. The system has its own health insurance plan with >290,000 members. There are >60 fully integrated community practice sites. In addition, the system has five other hospitals with variable degrees of integration. The system's medical records are fully electronically connected *via* an electronic health record (EHR). This article summarizes some of the innovations in care for the nephrology patient population that have occurred in the Geisinger Health System as well as other integrated health care systems.

Anemia Management

Anemia constitutes an important and costly component of CKD management. The health care industry needs strategies to provide more effective, safe, and economical ways of managing this deficiency. This is particularly true given the recent US Food and Drug Administration (FDA) recommendations regarding erythropoietin stimulating agent (ESA) therapy in the CKD population. In 2003, the Geisinger Nephrology Department initiated a protocol-driven, pharmacist-managed anemia program responsible for the administration of ESA and iron products in all CKD patients seen in the department. The protocol was co-jointly written by the nephrology and pharmacy departments. The program was similar in design to the already successful program for anticoagulation management that was present within the system and to other reported pharmacist-based medication therapy management initiatives (10,11). Patients in the program had hemoglobin and iron saturations measured monthly. ESA and iron therapy were then coordinated by the pharmacist per protocol. Deviations from the protocol were discussed with the nephrology department by the pharmacist for appropriate therapeutic adjustments, predominantly *via* electronic messages through the EHR. The system provided the financial support for the pharmacist's time that was required for the program. In 2006, a review of the effectiveness of the program was performed, comparing it with similar patients whose ESA and iron product administration were managed *via* usual care by their primary care physicians (PCPs) without benefit of a protocol or pharmacist oversight. The results showed significant improvement in clinical and financial outcomes in the protocol-driven, pharmacist-managed program. In particular, the pharmacist-managed program was associated with a decrease in the number of days required to reach goal (47.5 days versus 62.5 days; P=0.11), as well as significant improvements noted in the percentage of time that hemoglobin was in goal (69.8% versus 43.9%; P=0.001), percentage of time that transferrin saturation was in goal (64.8% versus 40.4%; P=0.04), percentage of time that ESA was administered at home (60.8% versus 41.9%; P=0.03), and percentage of time that expanded dose utilization was able to be done (40.3% versus 16.2%; P=0.002). Furthermore, the average weekly dose used

was significantly reduced, by 45% (P=0.001), from that administered *via* usual care. The program has continued to provide significant improvements in clinical parameters. Before the FDA ruling in 2011, with its inferred narrowing of the desired targeted range, >70% of the hemoglobin measurements obtained were within our desired range of 10–12 g/dl. In 2012, >80% of the time transferrin saturation was kept within our targeted range of 20%–50%. An added benefit has been that approximately 15% of all patients referred to the program were never initiated on ESA therapy, having achieved adequate hemoglobin values solely by more aggressive iron replacement. The program has provided significant cost savings for the system, and all CKD patients with a potential need for ESA therapy have been managed *via* this program since 2006 (12). At this time, >200 patients are actively managed in the program. In addition, the program allows for rapid adjustments needed for management of a costly therapy in response to new regulations. The system provides for the pharmacy support as well as a management fee to the nephrology department for oversight of the program.

Managing the CKD Population

Step 1

The direct oversight and management of >25 million adults in the United States with CKD is impossible by nephrologists alone. The same problem exists within the Geisinger Health System, in which there are >15,000 patients with CKD stage 3 or greater. Providing this population with closer to optimal care will require the education of and involvement of the primary care network. Although published evidence-based guidelines exist for many conditions, such as the Kidney Disease Outcomes Quality Initiative (KDOQI) and the Kidney Disease Improving Global Outcomes (KDIGO) for CKD, it is impossible for PCPs to stay current with all guidelines, to recall the specific guidelines that are relevant to each patient, and to act on all relevant guidelines in an appropriate and timely manner. The importance of the EHR in enhancing clinical practice in chronic disease and the means by which it can lead to this enhancement were recently reviewed (13). Utilizing the EHR to embed guideline-based clinical decision support and to assess the response *via* disease-specific all-or-none bundles is one way to facilitate better coordination of care and more optimal care. This bundle concept has been used to "raise the bar" in quality improvement efforts by many large health care systems. Rates of 2.4%–12.8% of patients achieving all seven measures for a diabetes bundle have been reported from major health systems after implementation of the all-or-none bundle, providing evidence of how difficult it is to achieve multiple recommendations in individual patients (14,15). Patient preferences, polypharmacy, medication costs, coverage issues, and appropriate individualization of bundled targets for specific patients by providers are all cited reasons why a higher total percentage achieved, than those referenced above, has not been obtained (16). The bundled care process has been utilized within the Geisinger System for various diseases since 2005, including for diabetes, congestive heart failure, hypertension, and osteoporosis. Initiation of a diabetes bundle within the system has improved the percentage of patients achieving all nine of its measures from 2.4% at its inception to 13.1% 4 years later (16). On the basis of the success that we observed in a nephrology department–specific bundle for CKD implemented in 2006, a system-wide CKD bundle was initiated in 2009. The bundle was based on national guidelines (initially KDOQI and subsequently incorporating KDIGO). It addressed both frequency of assessment as well as specific targets for renal function, proteinuria (and angiotensin converting enzyme or angiotensin receptor blocker utilization when proteinuria was documented), BP, phosphorus, anemia, hyperparathyroidism, immunization (influenza and pneumococcal), and referral to nephrology for CKD stage 4 or greater. Reports on performance in the bundle were distributed monthly to individual providers and their department chairpersons. It is important to note that contrary to some other bundles within the Geisinger System, there was no financial incentive linked for PCPs to performance in the CKD bundle. Despite this, significant improvements in performance in the bundle have occurred with the percentage of patients achieving all 10 measures, increasing from 3.0% at its inception to 14.3% 3 years later.

Step 2

Facilitating referral of all patients with CKD stage 3 or greater is neither cost-efficient nor practical for some patients and practices. It is well recognized that many of these patients will not progress to ESRD (17) and for many, their care may be adequately managed by PCPs, particularly if programs of assistance in this care, such as those mentioned in step 1, are utilized. A significant focus for the Geisinger System has been on the closing of care gaps. The national nephrology guidelines recommend that patients with an estimated GFR (eGFR) <30 ml/min per 1.73 m^2 be referred to a nephrologist to address complications of CKD as well as to begin discussions about long-term therapy, including transplantation or RRT. Unfortunately, despite these guidelines, a large percentage of patients in the United States are not seen until the initiation of dialysis. It is well established that late referrals to nephrologists, within 90 days of initiation of dialysis, are associated with increased costs and decreased patient outcomes (18,19). Our baseline data showed that approximately 70% of patients were late referrals, not seen by us before the start of dialysis or seen for the first time within 90 days of initiation of dialysis. To combat this, we instituted a program mining our EHR to identify patients with CKD stage 4 or greater that had not been seen by the nephrology department. A care gap nurse would then route an unsigned electronic request for a nephrology consultation to the PCP for consideration. The PCP then has the option to sign the order or to discard it. If the PCP signs the order, it is routed back to the care gap nurse who would then contact the patient and review the reason for the upcoming visit. Using this method, we have seen a significant two-fold decrease in the number of late referrals of CKD patients to our nephrology practice. The program has aided us in increasing the number of patients starting hemodialysis with an arteriovenous fistula (AVF) or graft by 26%. It has also assisted in increasing our peritoneal dialysis (PD) population by 180%.

Step 3

Development and implementation of processes that will be able to identify those patients at greatest risk for progression and where nephrology input would assist in minimizing risk of progression are clearly needed. Two such noteworthy programs have been developed and reported in the literature. In the United Kingdom, Rayner *et al.* interrogated an electronic database on a weekly basis (20). Diabetic patients aged ≤65 years with a eGFR ≤50 ml/min per 1.73 m^2 and who were not receiving renal replacement therapy (RRT) or who had attended the predialysis specialist clinic were identified. In addition, a graph of all eGFR values over the previous 10 years was generated for each patient from the database. On the basis of these findings, communication with the patient's PCP was made to advise them on appropriate actions or to request a referral to the diabetes-kidney clinic. As a result of this program, Rayner *et al.* saw the number of patients beginning RRT fall by 30% below the projected rate and the proportion of patients starting RRT with either a renal transplant or on PD or hemodialysis with an AVF increase by 29%. Lee and Forbes at Kaiser Permanente in Hawaii have taken this concept one step further (17). Using an electronic database they assessed patients on a weekly basis for a variety of factors known to be associated with risk of progression of CKD or complications thereof, including eGFR, proteinuria, hemoglobin, potassium, BP and potential adverse medication prescription. By developing an electronic database that would "flag" predetermined parameters, they are able to efficiently scan >10,000 patients with CKD for potential areas of concern, such as increase in proteinuria, decrease in GFR, development of hyperkalemia, on a weekly basis. By utilizing this program and the EHR to effectively communicate to the PCP, they have been able to avoid unnecessary referrals by 25%, decrease late referrals of appropriate patients by 20%, increase the proportion of patients starting hemodialysis with a mature AVF by 18%, and increase the proportion of patients that began hemodialysis as an outpatient by 21%.

The EHR at Geisinger currently has >15 years of patient data including histories, medications, problem lists, and imaging and laboratory results. We plan to develop a computer program (Table 1) that will allow the nephrology care team to identify patients on the basis of clinical parameters that place them at risk for CKD progression or complications associated with their CKD. A team approach will then be needed to review the reports, which should assist in identifying at-risk patients or developing clinical scenarios, and to allow this population to be more optimally assessed and managed. The predominant barriers to this project are competing needs for information technology resources to develop the tool and development of the infrastructure to manage the tool when it is completed.

Table 1. Factors for consideration when mining the EHR for patients at risk of CKD progression

NSAID use
Metformin use in patients with a diminished eGFR
Inadequate BP control
Progressive decline in eGFR from baseline
Acute decline in eGFR by predetermined parameters
Doubling in degree of proteinuria over a defined window
Initiation of ACE inhibitor or ARB and no follow-up BMP 1 mo after initiation
Recurrent hyperkalemia >6 mmol/L
Recurrent CHF admissions
Hemoglobin <9 g/dl and no referral to the anemia management program
eGFR < 25 ml/min per 1.73 m^2 and no referral to the nephrology department

The target population includes patients with an eGFR ≤45 ml/min per 1.73 m^2 or patients with proteinuria >500 mg/24 h. EHR, electronic health record; NSAID, nonsteroidal anti-inflammatory drug; eGFR, estimated GFR; ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; BMP, basic metabolic panel; CHF, congestive heart failure.

Geisinger's ProvenHealth Navigator

Geisinger has developed a care re-engineering program known as the ProvenHealth Navigator (PHN). Although it is not a nephrology-centered program, it deserves mention here because it has affected the care of our nephrology patients and components of it, such as the bundle mentioned above and the care manager discussed later, have been incorporated in quality innovations by the nephrology department. The key components of the PHN include the following: patient-centered primary care (physician-led, team-delivered care; chronic disease and preventive care optimized *via* the EHR); integrated population management (population segmentation and risk stratification identification *via* an electronic database, and utilization of embedded case managers for identified high-risk patients); medical neighborhood (360° care systems, facilitating transitions of care between skilled nursing facilities, emergency departments, hospitals, etc.); quality initiatives (comprehensive chronic disease bundles); and value-based reimbursement (fee for service with value-based incentive payments). The implementation of the PHN within Geisinger has had significant clinical and financial benefits. Healthcare Effectiveness Data and Information Set performance measures are significantly better in most categories over that seen in non-PHN sites (Geisinger Health Plan, unpublished data); admission and readmission rates are better than that experienced in non-PHN sites (21), risk declined for microvascular complications of amputation and ESRD (22), and the return on investment has been positive and with a progressive upward trend (23). The nephrology group and the system's CKD population have been aided by the care gap measures and the CKD bundle of the PHN as mentioned above. The CKD and ESRD populations have been particularly aided by the embedded case managers who have greatly assisted in the transitions of care and coordination of care between the various segments of the medical neighborhood with which our patients interact. Specifically, from a nephrology perspective, they have helped to keep the nephrology group abreast about changes in health status and therapeutic interventions in our patient population in a timely fashion,

predominantly through electronic messaging in the EHR. From a nephrology standpoint, the death-censored odds ratio of developing ESRD has decreased from a baseline of 1.00–0.688 (95% confidence interval, 0.52–0.92; P=0.01) over a 4-year span for patients in the PHN (23). In addition, 30-day re-admission rates for dialysis patients followed by the Geisinger nephrology group, who in general are assisted in their management by components of the PHN, are much lower than that seen with dialysis patients managed by non-Geisinger nephrology groups within the same geographic area, who are in general not assisted by components of the PHN, such as the embedded case manager (12.8% versus 33.0%; case mix index, 2.00 versus 2.01, respectively).

Specialty-Specific Case Management

An analysis of the Geisinger PHN suggests that a key component to its success lies in the embedded case management program. Whether incorporation of a similar process could lead to similar benefits when dedicated to the CKD or ESRD population has recently been evaluated by several different entities. In the CanPrevent study, 474 CKD patients (median eGFR 42 ml/min per 1.73 m^2) were randomized to usual care (PCP) versus usual care plus a nurse-coordinated care focused on risk factor modification (24). Patients were followed a median of 742 days. Although there was no significant difference in the clinical end points (mortality, cardiovascular outcomes, complications from diabetes, and renal outcomes) the group that had nurse-coordinated care had lower hospital admissions (number of days hospitalized in 2 years, 0.16 in intervention group versus 0.21 in control group; P=0.08), shorter hospital length of stay (hospitalization days; 1.12 in intervention group versus 2.60 in control group; $P<0.01$), lower incidence of intensive care unit (ICU) admissions (ICU days, 0.06 in intervention group versus 0.28 in control group; $P<0.01$), and lower overall costs (incremental savings with intervention group, $2441; $P<0.05$). In addition, the group that had nurse-coordinated care had a higher percentage of patients with BP within goal (63.2% versus 47% in control group; P=0.76), a higher incidence of patients using renin-angiotensin-aldosterone system blockers (78% versus 66% in control group; P=0.06), and lower LDL cholesterol levels (LDL in goal, 63.9% in intervention group versus 59.4% in control group; P=0.74) (25).

CMS recently completed a demonstration project for ESRD patients with three disease management organizations (26). The projects used as part of their armamentarium case managers to assist in coordination in care as well as transitions of care. Patient interventions occurred both by direct patient contact and *via* telephonic contact. The results achieved with the project included lower use of central venous catheters, improvements in immunization, improvements in diabetes screening, improvements in medication adherence, decreases in hospitalizations, and apparent decreased cost. The Carolinas HealthCare System in Charlotte, North Carolina, began a telephonic ESRD case management system in 2007 (27). The system reviewed their baseline data to identify ESRD patients at greatest risk for poor compliance and readmissions. On the basis of that review, patients aged 25–70 years with three unplanned hospitalizations or emergency department visits within 90 days and otherwise not receiving skilled nursing care through another setting were included. To date, 107 patients have been enrolled in the program. The case management team included both nurses as well as social workers. Patients were contacted based on a scoring mechanism to determine the necessary frequency of telephonic interaction. The results showed a 14% decrease in re-admissions from that experienced by patients not enrolled in the program. We recently began a similar type of program within the Geisinger System for our ESRD population, although contrary to the Carolinas HealthCare program, there were no exclusion criteria for enrollment. A nurse case manager was employed to assist with transitions of care and continuity of care of all ESRD patients with Geisinger Health Insurance whose dialysis care was provided by the Geisinger nephrology group at the Danville campus. Similar to the CMS demonstration project, patient interventions have occurred both by direct patient contact and *via* telephonic contact. The nurse manager oversees the care of approximately 50 dialysis patients. The nurse manager meets with each patient in person one time per month, typically at the patient's dialysis unit. More frequent interactions, typically by telephone or by electronic messaging, occur as needed. If a patient is hospitalized, the nurse manager has contact with the patient within 48 hours of discharge, then weekly for 4 weeks, and then every other week for 2 months. More frequent interactions again occur if needed. The nurse managers meet with each nephrologist about their individual patients on a weekly basis. In addition, the nurse manager meets with the director of the program weekly to discuss admissions that have occurred for potential future remediation efforts, as well as other aspects of the program (Figure 1). The nurse manager was paid for by the health plan and the nephrology department has been paid a management fee for oversight of the program. Although the program is still fairly new, results for the first 6 months show a substantial reduction in total admissions from the baseline rate (Table 2). At the current rate of improvement, a positive ROI would occur for the health plan with 28 patients enrolled.

Reporting Structure and Additional Management Strategies

Efficient population-based care removes variation and applies best practice standards. As a means of increasing our home dialysis population as well as the AVF rates, we instituted a monitoring initiative to diminish the variation in referral for dialysis options orientation and dialysis access placement (Figure 1). Biweekly, our clinic nurse extracts an electronic list of patients with an eGFR <22 ml/min per 1.73 m^2 who had not attended a dialysis options class. After confirming appropriateness with the physician, the nurse contacts the patients and schedules them for the educational session. One week after the class, our nurse contacts the patients to reinforce the education and determine if they have a modality preference. If the patient selects PD, the PD nurse will contact and meet with the patient to provide further education. If hemodialysis is selected, the physician is electronically messaged with an

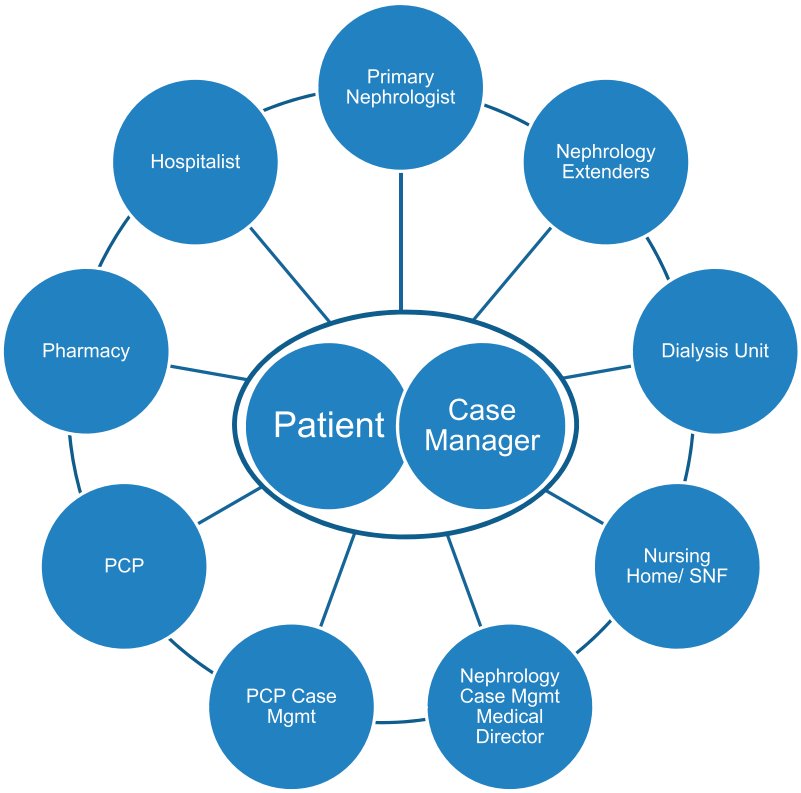

Figure 1. | **Reporting structure of the ESRD transitions of care program**. PCP, primary care provider; SNF, skilled nursing facility.

Table 2. ESRD Case Manager Pilot: September 30, 2012

Population	Admissions (*n*)	Patient-Months (*n*)	Admissions (Patient-Months)	Admissions (Patient-Years)	Reduction from Baseline (%)[a]
1-yr baseline before pilot (50 patients; April 1, 2011–March 30, 2012)	54	498	0.108	1.3	
Pilot (49 patients; April 1, 2012–September 30, 2012)	17	283	0.06	0.72	45

[a]P=0.04.

unsigned request for a consultation for the patient to see an access surgeon. If the physician defers or if the patient is hesitant on a modality, the nurse adds the patient to a tickler file and follows up with the physician monthly. In the past year, 81 patients have been referred to the program, with a 9% no-show rate noted. Instituting this program has assisted in increasing the percentage of patients, who have been seen by us at least 90 days before initiation of dialysis, beginning hemodialysis with an AVF or graft from 56% to 71%.

Summary

Despite heavy expenditures, care for chronic illnesses remains poor—treatments known to be beneficial are provided only about 50% of the time and ineffective treatments may be given 20%–30% of the time (13). With increased scrutiny of clinical outcomes and need for increased cost containment, the motivation for practitioners and systems of care to change has never been greater. A robust EHR allowing for longitudinal patient history and data, decision support, clinical reminders and alerts, and provider-to-provider communication is a required tool to improve population outcomes. It is clear, however, that an electronic resource is insufficient to achieve improved chronic disease population-based targets unless an EHR is coupled with dedicated patient management strategies. A team-based approach to close gaps in care, track and measure outcomes, and provide progress on feedback is needed to broadly achieve quality-driven targets (13). Most systems of care fall short of providing the necessary support.

The optimal approach to management of CKD and ESRD care, in particular, remains challenging. Health care systems, like Geisinger, with their integrated EHRs, integrated care delivery, and focus on re-engineering of care, place their nephrology departments in a unique position to significantly affect CKD and ESRD patient outcomes. All-or-none disease-specific bundles can assist in achieving optimal outcomes for the overlapping metabolic disease syndromes that erode the health of our nephrology patient population. Additional infrastructure of care gap nurses, dedicated nephrology pharmacists, and specialty-specific care managers allow the health care team to identify patients who are at high risk and close gaps in their care. Although a global measure of the ROI for all nephrology projects is not available, the improvements in patient outcomes and cost savings of individual projects such as the Anemia Management Program at Geisinger and the previously cited case management programs are in line with the CMS triple aim.

Although many of the programs discussed have been implemented in a health care system, many also can be applied in nonintegrated systems. For example, incorporation of a CKD disease bundle has led to significant improvements in clinical performance measures within nephrology and PCP sites at Geisinger. Implementation in nonintegrated nephrology practices, either alone or in conjunction with referring PCP sites, may lead to improvements in their patients' clinical parameters and assist those practices in the documentation of quality outcomes that is frequently requested by accountable care organizations, and so forth. Second, utilization of case managers has the potential of improving care and cost in nonintegrated systems and can assist practices in their negotiations with health insurance plans, accountable care organizations, and hospitals that are looking to partner with practices that can demonstrate both quality outcomes and cost containment.

Finally, although the care initiatives that have been mentioned at Geisinger and other institutions have appeared to have improved quality parameters and in some cases cost of care, questions remain to be answered. These include what components of the KDOQI and/or KDIGO guidelines provide the most benefit to patient care and which of these parameters, when addressed, are most cost-effective. In addition, further assessment of the components of integrated health systems, such as alignment of financial incentives, effective sharing of disease-specific knowledge across the continuum, and value-based reimbursement, need to be interrogated as to their relative benefit in improving patient care.

Disclosures

E.N. serves as a paid consultant to Fresenius Medical Care, working on their Medical Advisory Board as well as on their Physician Technology Leadership Group.

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