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## Chronic kidney disease care in the US safety net

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### Abstract

The US health care system provides a patchwork of services, known as the safety-net, for the uninsured, under-insured and indigent populations who would otherwise have little access to health care services. Individuals who rely on safety-net facilities are from racial/ethnic minority groups, have low socioeconomic status and often have low health literacy and/or limited English proficiency. They shoulder a disproportionate burden of chronic kidney disease (CKD) in the United States and experience excess CKD-associated morbidity and mortality. Suboptimal delivery of CKD care may be contributing and is an area of active translational research. Several initiatives that show promise in improving safety-net CKD care delivery include those that enhance diagnostic and management skills of primary care providers, rely on comprehensive care management programs led by non-physicians, and leverage technology to enhance patient access to virtual nephrology expertise. Uncovering better ways to translate scientific evidence into practice for vulnerable patients with CKD is a formidable challenge that will require national surveillance of CKD quality measures across diverse ambulatory health systems, including safety-nets. Only then will the nephrology community be to identify and share best practices to enhance health and mitigate disparities of care among patients with CKD.

### Keywords

safety-net; CKD; kidney disease; quality; vulnerable populations

### What is the United States safety-net?

The US health care system provides a patchwork of services for the uninsured, under-insured and indigent populations who would otherwise have little access to health care

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services. This patchwork, known as the health care safety-net, includes federally and community funded community health centers, county health departments, local access-to-care programs such as homeless health centers and church-based health clinics, and services provided by public hospitals to vulnerable populations.<sup>1</sup> Safety-net facilities provide medical services to all individuals regardless of their insurance or migrant status at no cost or on a sliding scale based on income. As such, they generally operate as nonprofit organizations and rely heavily on public and private funding to subsidize care for the poor. The federal government has traditionally been a strong partner in this regard. In 1991, the Federally Qualified Health Center benefit was added to the Medicare program to enhance the provision of ambulatory care to underserved urban and rural communities. Subsequently, between 1994 and 2001, the federal Consolidated Health Center Program, which pays for primary care and preventive services for underserved populations, grew from covering 7.3 million to 10.3 million individuals. In 2001, capacity to care for the underserved was further expanded by the Health Center Growth Initiative. By 2007, approximately 16.1 million individuals received care from the safety-net. Now, with implementation of the Affordable Care Act and current/expected Medicaid expansion in 25 states and the District of Columbia, the United States is poised to further expand its ability to care for vulnerable populations that depend on safety-net institutions for health care.

### **Sociodemographic characteristics of safety-net patients with CKD**

Individuals who rely on safety-net facilities for medical care often have limited socioeconomic means, are from racial/ethnic minority groups, and have low health literacy and/or limited English proficiency.<sup>2,3</sup> As has been extensively documented throughout this issue, these groups shoulder a disproportionate burden of chronic kidney disease (CKD) in the United States as well as co-morbid conditions that serve as risk factors for CKD development and CKD decline, such as diabetes, obesity and hypertension.<sup>4,5</sup> While there is a paucity of aggregated data from community health centers that provide safety-net care, data from single institutions reinforce the idea that safety-net clinics play a central role in caring for individuals with CKD, particularly among younger, non-white individuals, who are at high risk of experiencing progression of CKD to ESRD.<sup>6,7</sup> Recent data from the San Francisco Health Network, the integrated public health care delivery system for San Francisco's uninsured and underinsured population, for example, describe a CKD population in whom one-half is less than 60 years of age and one-fourth is younger than 50. This is in contrast to estimates from a nationally representative sample of US adults that find CKD to be relatively uncommon among individuals younger than 60 years.<sup>8</sup> Among the San Francisco population with CKD, approximately 70% were members of nonwhite racial/ethnic groups, over 40% were uninsured or enrolled in Medicaid, and 72% were indigent, defined by an annual income <\$15,000.<sup>9</sup> Data from the National Kidney Foundation Kidney Early Evaluation Program (KEEP), a free community-based health screening program that targets populations at high risk for kidney disease, and the National Health and Nutrition Examination Survey (NHANES) suggest similar socio-demographic characteristics among nationally representative uninsured individuals with CKD,<sup>10,11</sup> the majority of whom report seeing a physician within the prior year, presumably from a safety-net provider.

## Health outcomes among safety-net patients with CKD

Data from the 86,000 individuals who presented for a KEEP health screening between 2000 and 2011 demonstrate an increased risk of death among uninsured and publically insured individuals with and without CKD compared to those with private insurance. The uninsured population had much higher odds of death (adjusted odds ratio [AOR]=1.66, 95%CI 1.43–1.94) and the publically insured population had more than a 2-fold higher odds of death (AOR=2.37, 2.01–2.78) compared to those with private insurance. An increased risk of progression to ESRD among the uninsured and publically insured individuals with CKD and an eGFR > 30 ml/min/1.73m<sup>2</sup> compared to those with private insurance was also noted (AOR=2.09, 1.31–3.35 and AOR=3.10, 1.92–5.00, respectively).<sup>10</sup> Similarly, reported incidence rates of ESRD among Hispanic and non-Hispanic Whites were higher in the San Francisco safety-net compared to estimates from a similar geographical population insured by Kaiser Permanente Northern California around the same time period.<sup>6, 9</sup>

## Contributions to adverse health outcomes among safety-net populations with CKD

While it is difficult to disentangle the patient-level, provider-level, and system-level contributions to adverse health outcomes among socially disadvantaged populations, it is clear that elements exist in each of these domains. At the patient level, non-traditional risk factors for CKD progression and mortality have been identified that may compound the increased risk already present from the high prevalence of diabetes, obesity and hypertension in these patient populations. At the provider level, suboptimal knowledge, competing priorities and risk factor management likely play a key role. And at the system-level, delivery of fragmented nephrology care from a paucity of specialists is likely contributing (Figure).

### Patient-level factors

It is widely appreciated that traditional risk factors for CKD progression such as hypertension, diabetes and obesity are more prevalent among populations who receive care from safety-net settings.<sup>12</sup> Exacerbating the issue, however, are highly prevalent, non-cardiovascular conditions like homelessness, depression and periodontal disease that may biologically contribute independently to CKD progression and mortality, as well as non-traditional behavioral and social factors.

**Non-traditional biologic risk factors**—In one study of low-income urban adults with CKD, homeless individuals experienced 28% higher risk of ESRD or death over a median follow-up of 2.6 years compared to housed counterparts, independent of socio-demographic variables, comorbid conditions and laboratory variables (aHR=1.28, 1.04–1.58).<sup>13</sup> Of interest, this association differed by substance abuse status. Among adults without a history of substance abuse, risk of ESRD or death was higher among the homeless compared with housed adults (aHR=1.54, 1.18–2.03). Among adults with a history of substance abuse, there was no difference in ESRD or mortality by housing status, suggesting an independent relationship between substance abuse and ESRD/mortality. The nature of this relationship is

not entirely clear, however. Several studies have demonstrated an increased risk of CKD progression and incident ESRD among individuals who self-report illicit drug use.<sup>14</sup> But, one recent study only found a small association between cocaine use and CKD progression and did not find any association between methamphetamine or heroin use with CKD progression or development of ESRD.<sup>15</sup> Less controversial is the contribution of depression to adverse health outcomes among individuals with CKD. Among veterans with CKD, presence of a major depressive episode has been independently associated with increased hospitalizations (aHR=1.90, 1.23–2.90) and progression to ESRD (aHR=3.51, 1.77–6.97), though not increased mortality (1.52, 0.53–4.34).<sup>16</sup> Similar data have emerged from participants of the African American Study of Kidney Disease (AASK) cohort<sup>17</sup>. The plausible biologic mechanisms underlying the associations between homelessness, addiction and depression and adverse health outcomes may involve inflammation, compromised immunity, and platelet activation from altered serotonin levels.<sup>18–21</sup> Similar mechanisms seem to link periodontal disease, highly prevalent in safety-net populations presumably due to lack of access to dental care,<sup>22</sup> with prevalence of CKD among US adults<sup>23</sup> (aOR=1.51, 1.13–2.02) and CKD progression<sup>24</sup> among older Japanese adults (aOR=2.24, 1.05–4.79), independent of socioeconomic variables and co-morbid conditions.

**Non-traditional behavioral risk factors**—Behavioral factors also likely contribute to adverse outcomes in safety-net CKD populations. While robust longitudinal data are lacking, suboptimal patient knowledge,<sup>25</sup> medication non-adherence,<sup>26</sup> limited trust with providers/health systems,<sup>27</sup> and poor health literacy,<sup>28</sup> have been cross-sectionally associated with high prevalence of CKD and adverse cardiovascular health. Participation in poor health behaviors, including tobacco use,<sup>29</sup> and sedentary lifestyles<sup>30</sup>, quite prevalent in this population, has been associated with CKD progression.

### Provider-level factors

By definition, safety-net patients with CKD receive the majority of their care from limited networks of health care providers. Data from the nationally representative National Ambulatory Medical Care Surveys suggest that delivery of basic primary care is similar for individuals with private insurance, Medicaid and no insurance, the later two often representing patients cared for in safety-net settings. Specifically, length of primary care visit and receipt of preventive health counseling does not seem to differ by patient insurance status.<sup>31</sup> However, while preventive primary care services may be similar across insurance status and thus health care settings, there is evidence to suggest that CKD awareness among providers and management of CKD risk factors are suboptimal in safety-net settings.

**Under-recognition of CKD**—Provider-level CKD awareness includes general recognition of CKD, understanding of its risk factors and associated complications, and knowledge/belief of patient management strategies. National estimates of CKD awareness among providers, including those that practice in safety-net settings, is low, ranging from 10–60%.<sup>32</sup> Similarly, studies indicate that only 22%–30% of primary care providers are knowledgeable about CKD guidelines, regardless of practice setting. What may distinguish safety-net providers from their counterparts is the reason behind low recognition. Qualitative studies suggest that the need to care for competing and often-symptomatic chronic diseases

and social issues relegates kidney disease lower on the priority list for safety-net providers.<sup>33</sup>

**Suboptimal CKD risk factor management**—Data from NHANES have demonstrated that insurance status is associated with suboptimal CKD management. In one study, using data from 1999–2006, uninsured persons with CKD were 40% less likely to receive hypertension treatment (AOR=0.61, 0.41–0.91) compared to those with private insurance and nearly 40% less likely than those with public insurance (AOR=0.51, 0.31–0.74). Similarly, uninsured individuals with CKD were less likely to receive an angiotensin converting enzyme inhibitor (ACEi) or angiotensin receptor blocker (ARB) compared to those with private or public insurance (AOR=0.45, 0.27–0.76 and 0.45, 0.25–0.82, respectively).<sup>11</sup> It is important to note, however, that uninsured individuals who participate in NHANES may not have access to medical care, so these statistics may not fairly depict the actual delivery of safety-net CKD care in the United States. Examining “real-world” delivery of safety-net CKD care is challenging, since CKD metrics are not routinely measured or reported by FQHCs nor are they part of the Healthcare Effectiveness Data and Information System (HEDIS) reporting requirements for health plans.<sup>34</sup> However, a large study in 2007 examined the quality of diabetes and hypertension care among community health centers across the US. In that study, the authors found that over 70% of diabetic patients with proteinuria were prescribed an ACEi/ARB.<sup>35</sup> These data were extended in a more recent study that demonstrated that primary care providers in FQHCs display greater adherence to established quality measures compared to primary care providers who work in private practice settings,<sup>36</sup> particularly for measures that emphasize appropriate use of pharmaceuticals for coronary artery disease and congestive heart failure and appropriate use of screening tests. One would expect, then, that similar results would extend to care for all patients with CKD regardless of the etiology of kidney disease. While not extensive, studies from individual community health centers or systems provide a more nuanced picture of ambulatory CKD care delivery among safety-net populations. For example, among individuals with CKD in the San Francisco safety-net between 2003–2010, nearly 25% had uncontrolled blood pressure, defined by > 140/90 mmHg, compared to national estimates of 22%, a difference largely driven by individuals with moderate-severe CKD. Adjusted prevalence of uncontrolled blood pressure was 18% among those with CKD stages 1 and 2 compared to 22% nationally; adjusted prevalence of uncontrolled blood pressure was 28% among those with CKD stages 3 and 4, compared to 23% nationally.<sup>37</sup> By contrast, data from 212 patients with and without CKD who receive care from one FQHC in Ingham County Michigan demonstrated that 62% of patients had uncontrolled blood pressure compared to national estimates of 50% in a similar population.<sup>38</sup>

### System-level factors

**Poor access to nephrology care**—Despite these differences in estimates of blood pressure control, which may result from differences in study methodologies (using single vs. multiple BP measures per person, for example), sample sizes, and/or patient demographics, the aforementioned data paint a picture of a population of individuals with CKD at high risk of adverse health outcomes that is not receiving guideline-concordant CKD care. Limited access to nephrologists in safety-net health systems may be contributing to this problem.<sup>39</sup>

Optimal timing for nephrology referral remains uncertain, but nephrologist involvement in CKD care has been associated with slower CKD decline and more optimal blood pressure control and prescription of ACEi/ARB.<sup>40, 41</sup> Nephrologists thus play an important role in early CKD care. Qualitative studies suggest that patients who receive medical care in community health centers have difficulty accessing services that are not directly provided by the health center, such as specialty care.<sup>42</sup> In a study of predictors of specialty referral, payor status was a significant determinant of a patient obtaining a specialty referral in a primary care setting, with uninsured status having nearly a 40% lower odds of referral than the privately insured (AOR=0.58, 0.41–0.82).<sup>43</sup>

Similarly, in a 2003 survey of all 101 medical directors of California's federally qualified health centers, 85% reported that their uninsured patients "often" or "almost always" had problems obtaining specialty care and 40% reported that their Medicaid patients "often" or "almost always" had problems accessing specialists.<sup>44</sup> Indeed, wait times for specialty appointments for patients in safety-net settings have been documented as long as 6–12 months.<sup>45</sup>

**Fragmentation of health care delivery**—Contributing to this issue is the inefficiency of the primary–specialty care interface<sup>46, 47</sup> which relies on overworked primary care providers who must plead to have patients seen in an expedited fashion and a limited network of specialists, including nephrologists, who care for uninsured and Medicaid patients. The current referral system often results in duplicate testing and delayed diagnoses, leading to inefficient use of scarce specialty resources<sup>48</sup> and unnecessary costs. Furthermore, as patients gain and lose insurance based on temporary changes in employment and financial eligibility, continuity of care with generalist and specialty providers can be lost. This piecemeal coverage may translate into missed opportunities for CKD management.

## Current initiatives to enhance safety-net CKD care

Current initiatives at improving safety-net CKD care mirror the national push for the delivery of high-access, high-quality, patient-centered nephrology care within the context of the Chronic Care Model. These initiatives can be grouped into three broad categories: expanding the diagnostic and management skills of primary care providers, creating comprehensive CKD management programs embedded in primary care which address patient-level factors, and leveraging technology to streamline the referral process and enhance patient access to nephrology expertise (Figure).

Automated eGFR reporting has improved recognition of CKD among vulnerable populations<sup>49</sup> and has been associated with increased proteinuria quantification and increased nephrology referrals.<sup>50</sup> Despite these improvements, however, identification of CKD remains suboptimal, suggesting that other approaches are needed. Disease registries, which are information platforms that enhance chronic disease management through targeted alerts, have been piloted in numerous systems across the United States to enhance health outcomes among complex patients. Often embedded within electronic medical records, their implementation has been associated with decreased glycosylated hemoglobin levels, systolic blood pressure and cholesterol levels among patients with diabetes<sup>51</sup> and greater receipt of

beta-blockers among patients with congestive heart failure.<sup>52</sup> They have also shown some promise in enhancing CKD management in safety-net primary care. One CKD registry implemented in two urban, underserved primary care clinics in NY state, for example, was associated with increased diagnosis of CKD (from 21 to 79%,  $p<0.001$ ) and decreased use of metformin and NSAIDs ( $p<0.001$  for both).<sup>53</sup> A similar registry in San Francisco aims to more efficiently enhance outcomes by empowering non-clinician members of the health care team in addition to primary care providers, to highlight gaps in CKD care during patient visits and to contact CKD patients who have fallen out of care.<sup>33</sup> This approach, using standard orders to engage non-physicians in care delivery has improved immunization rates among non-CKD adults who receive care in the community clinics that comprise the Denver safety-net.<sup>54</sup> Moving forward, CKD registries will be also tasked to provide local surveillance -- to identify individuals with CKD based on laboratory data, automatically track patient-level data over time and provide decision-support to all members of the health care team, allowing for proactive management of patients at point-of-care or via outreach.

Chronic disease management programs further expand on these concepts of patient identification and population health to include patient self-care elements. Disease management programs typically include the following components: population identification, evidence-based practice guidelines, collaborative practice models that embrace non-physician leaders, patient self-management education, process and outcomes measurement and routine feedback.<sup>55</sup> Initially developed for patients with diabetes, disease management programs for other chronic diseases, such as congestive heart failure and CKD, have recently been piloted in safety-net clinics. For example, the Louisiana State University Health Care Services Division, which is the largest provider of health care to Louisiana's uninsured citizens, achieved great success with their diabetes disease management program. Among patients with diabetes, the percentage of patients with glycosylated hemoglobin levels  $< 7\%$  increased from 44 to 54% and the percentage with a renal assessment increased from 52 to 74% ( $p<0.05$  for both comparisons). Similar increases were noted among the uninsured diabetic population, suggesting that an integrated approach to complex disease management can improve care among the most vulnerable individuals. A congestive heart failure program was subsequently added and demonstrated a reduction in racial and gender disparities with respect to CHF mortality.<sup>56</sup> A CKD management program has recently been added to the LSU Health Care Services Division.<sup>57</sup> Results and program evaluation are eagerly anticipated to identify elements that can be disseminated to other systems.

In an attempt to increase coordination among primary care and nephrology services and enhance CKD care delivery in the underserved population of Dallas County, Texas, Vazquez and colleagues are implementing a model of joint primary and nephrology care. This model relies on a robust, health information technology-enabled program that harnesses the electronic medical record to provide specific nephrology decision support to all providers in the system and monitor the delivery of evidence-based practice, such as ACEi/ARB administration and timely placement of vascular access.<sup>58</sup> As such, this technology allows collaboration among clinicians to slow CKD progression and ensure optimal preparation for renal replacement therapy among a high-risk, traditionally underserved population. A different model of enhancing the primary care-nephrology care interface to enhance access to nephrology expertise relies on a "medical neighborhood" of



nephrologists who can offer timely and efficient consultations, diagnostic services and needed treatments.<sup>59</sup> Such a network requires a seamless exchange of information and a shared understanding among primary care clinicians and nephrologists about responsibility. While tenets of the medical neighborhood have been operationalized differently in large safety-net systems, such as those in Chicago, Los Angeles and San Francisco, they do share some similar characteristics, including referral guidelines that guide clinicians on initial diagnosis, management and pre-referral workup and bi-directional electronic communication among primary care providers and nephrologists.<sup>60, 61</sup> This allows for a wide spectrum of virtual nephrology care, ranging from pre-consultative exchange, ensuring complete patient evaluations prior to a specialty clinic visit and rendering that visit most efficient, to virtual co-management by nephrologists on a one-time basis or on a longitudinal basis, simultaneously expanding scope of practice among PCPs and increasing access to nephrology expertise. While not specific to nephrology, such systems have improved access to specialty care, increased PCP and specialist satisfaction and enhanced communication among safety-net providers.<sup>61–63</sup>

### Measuring the quality of CKD care

These differing approaches to enhance safety-net delivery of nephrology care are currently being tested. Results and best practices are eagerly anticipated prior to more widespread dissemination across other US safety-net systems. But how we determine the success of such initiatives remains uncertain. As previously mentioned, metrics for successful delivery of nephrology care have not been included in FQHC or HEDIS reporting requirements for health plans. More generally, there are few ambulatory measures that pertain to specialty care, with the exception of cardiovascular quality measures such as administration of a beta blocker after a myocardial infarction, or aspirin use.<sup>34</sup> With health care reform, organizations and health care plans, in particular, are being held even more accountable for the quality of care they provide and the health outcomes of their populations. This will likely hold true for safety-net institutions and safety-net providers, even for those patients who remain uninsured. Identifying who is accountable for patients with CKD in fragmented safety-net systems is undoubtedly more challenging than in integrated health systems, because patients often access primary and specialty care sporadically and lack continuity of care. Nevertheless, current FQHC funding is contingent on reporting outcomes data and participating in quality improvement projects. Proposed metrics that can be used to evaluate the quality of ambulatory CKD care are outlined in Table 1. These include metrics from several different domains: prevention and counseling, monitoring and treatment, experience of care/patient-centeredness and access to specialty care. Consistent with the current goals of the federal FQHC funding programs, these measures should be reported among all populations, as well as among sub-groups to assess for disparities of care.

Fair comparisons of these proposed metrics and others across health care institutions will require appropriate case-mix adjusters. In addition to the traditional adjusters such as age, socioeconomic status, insurance status and co-morbid conditions, it will be imperative to include non-traditional case-mix adjusters that render safety-net nephrology care delivery that much more difficult. Percent of patients who speak a non-English language, have limited health literacy, have a marginal housing situation or are homeless, and percentage of

patients who suffer from co-morbid mental illness, are some examples. Having a national CKD surveillance system that can report quality measures across diverse ambulatory health systems, including safety-nets, will enable the nephrology community to share best practices and identify the best way to translate scientific evidence into practice for all of patients with kidney disease.

## Conclusion

Current data suggest that our most vulnerable populations with CKD are not receiving the nephrology care that they deserve. Several initiatives that show promise in improving safety-net CKD care delivery include those that enhance diagnostic and management skills of primary care providers, address patient-level barriers to adoption of healthy behaviors, and enhance patient access to virtual nephrology expertise. With health care reform underway and additional disruptive innovations expected, many other opportunities will arise. Uncovering better ways to translate scientific evidence into practice for patients with CKD is a formidable challenge in all environments. Let's rise to that challenge to enhance health and quality of life and mitigate disparities of care among our most vulnerable patients with CKD.

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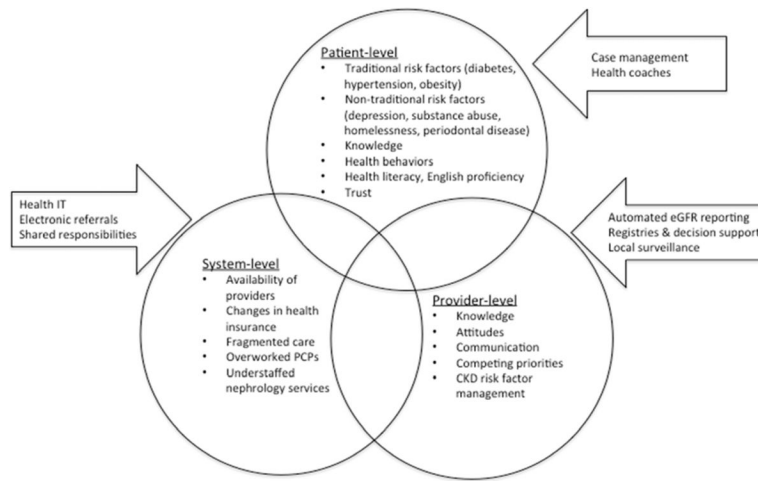
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**Clinical Summary (2–4 bullets)**

- Individuals who rely on safety-net facilities for medical care shoulder a disproportionate burden of CKD and experience excess associated morbidity and mortality.
- Several initiatives show promise in improving safety-net CKD care delivery: enhancing diagnostic and management skills of primary care providers; providing comprehensive care management programs led by non-physicians; leveraging technology to enhance patient access to virtual nephrology expertise
- Uncovering better ways to translate scientific evidence into practice for vulnerable patients with CKD will require a national database of CKD quality measures across diverse ambulatory health systems, including safety-nets.



**Figure.** Barriers in access to high-quality CKD care in US safety-net health systems and current initiative that aim to address those barriers.

**Table 1**

Proposed chronic kidney disease quality metrics, by domain.

Quality metrics	Data source
<b>Prevention and screening</b>	
Assessment of smoking status and cessation advice	EMR
Avoidance of NSAID prescription	EMR
Pneumovax	EMR
Hepatitis B vaccine among individuals with eGFR < 30ml/min/1.73m <sup>2</sup>	EMR
<b>Monitoring and treatment</b>	
Use of ACEi/ARB in patients with hypertension, proteinuria, diabetes	EMR
Lipid profile	EMR
Statin prescription	EMR
Assessment of anemia and iron studies	EMR
Assessment of Metabolic Bone Disorder parameters	EMR
Delivery of pre-ESRD education	Scheduling system
<b>Experience of care</b>	
Patient care coordination perception	Patient satisfaction surveys
<b>Access to specialty care</b>	
Time to next new nephrology appointment	Scheduling system
Availability of virtual nephrology consultation or co-management	EMR

Abbreviations: EMR=electronic medical record; NSAID=non-steroidal anti-inflammatory drug; ESRD=end-stage renal disease