



Managing Chronic Kidney Disease Populations within an Integrated Health Management Organization Kaiser Permanente Southern California

Setting & Background

Lead Organization: Kaiser Permanente Southern California (KPSC)

Health Care System Structure: KPSC is a large, integrated health maintenance organization with approximately 3.7 million members. It has 14 medical centers and more than 200 satellite ambulatory care clinics. KPSC provides comprehensive health care to its members. Services include primary care, preventive health, optometry, obstetrics, and emergency and hospital services. Additionally, KPSC operates its own laboratories and pharmacies. In 2003, KPSC integrated chronic kidney disease (CKD) into its cardiovascular disease population management systems. This population management system was renamed and revised in 2005 as *Complete Care*. *Complete Care* is a comprehensive delivery system with integrated clinical information systems, decision support, work flows, and self-management support.

Target Population: Adults served by KPSC with:

- CKD; or
- A single abnormal creatinine measurement and no repeat measurement beyond 90 days.

EHR Platform: EPIC

Data Source: A comprehensive EHR system tracks clinical care encounter, pharmacy and medical supply dispensation, and other relevant health management information. The EHR tracks information including age, gender, race/ethnicity, comorbidities, and internal health plan information (e.g., socioeconomic status, insurance status, primary care provider assignment, preferred spoken language, and patient portal registration status).

Patient Portal: The kp.org patient portal is a patient-empowered Internet resource for KPSC members that provides patients with access to their own health information for the management of care.

Time period:

- CKD population management – 1997 to present
- Creatinine SureNet – 2010 to present

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Introduction

A KPSC chronic disease population management system was first developed in the 1990s, when a pharmacy-led population management program was developed to manage patients with diabetes, hypertension, cardiovascular disease, etc. This system predated EHRs, but compiled electronic information from various sources into a searchable database. The KPSC nephrology team was able to work with this established system to begin developing CKD algorithms. The system enabled capture of eGFR and proteinuria. With the development of the 2002 Kidney Disease Outcomes Quality Initiative (KDOQI) CKD definition and staging guidelines, KPSC has modified its CKD population management activities to better match the KDOQI guidelines.

The primary purpose of the population care management system is to offer important information to providers at the point of care. CKD-specific information and advice was integrated into KPSC's *Complete Care* population care management system. This allows providers to address CKD whenever patients come into the health care system. Key activities include:

- Implementation of a CKD staging algorithm;
- Identification of patients at high risk for progression to end-stage renal disease (ESRD); and
- Tracking provision of evidence-based care (e.g., nephrology referral, optimal start of ESRD therapy).

Since the launch of the EHR system in 2005, these activities have been integrated within the EHR system.

In 2010, KPSC launched Kaiser Permanente's **Creatinine SureNet Program**, which uses EHR data to identify individuals with a single abnormal creatinine result and no repeat measurement beyond 90 days. The program aims to ensure all abnormal creatinine values are addressed by creating a parallel system to support clinical practice without interfering with current practice or placing blame.

Methods

Identifying and Staging Patients with CKD

KPSC determines CKD stage based on multiple CKD markers and risk factors, depending on the eGFR range as described in Table 1. Groups identified with the CKD label are included in the KPSC management system.

Table 1: Summary of KPSC CKD Staging System

Stage	eGFR range	Other Criteria
1	≥ 90	Proteinuria/albuminuria (see algorithm)
2	60-89	Proteinuria/albuminuria (see algorithm)
3, chronic 3	30-59	But not meeting criteria for CKD 3 modified
3 modified (high risk)	30-59	One of the following:* <ul style="list-style-type: none"> • Proteinuria/albuminuria (see algorithm) • eGFR + ½ age < 85
4	15-29	--
5 future renal replacement	< 15	--
5 no future renal replacement	< 15	Designation from a nephrologist or care manager of “no future renal replacement”**
5 hemodialysis <u>or</u> 5 peritoneal dialysis	< 15	Designation by the care management system as receiving dialysis
5 renal transplant substage 1, 2, 3, 4, or 5	Substage based on long term GFR range	Designation by the care management system as having received a kidney transplant

**Note: the initial KPSC stage 3 modified group included diabetes mellitus as a criterion.*

***This designation was eliminated and replaced by an option to make this designation for any CKD stage via direct entry in the population management system or by use on the problem list special code “SHARED DECISION MADE TO NOT INITIATE OR TO DISCONTINUE DIALYSIS”. This latter code is then pulled into information to identify these patients. These patients are not eliminated from population management but this status is used to inform population activities.*

The staging process follows the following steps.

- 1. Estimation and staging of GFR.** GFR is estimated from serum creatinine using the isotope dilution mass spectrometry- (IDMS) calibrated Modification of Diet in Renal Disease (MDRD) Study equation. When available, the race field from the demographics file is used in GFR estimation. KPSC members with at least one decreased GFR value are categorized by GFR range based on KDOQI guidelines. No individual with a long-term eGFR ≥ 60 mL/min/1.73 m² is classified by the algorithm as having CKD unless an additional marker of kidney disease is present.
- 2. Determination of chronicity.** Members with at least one decreased GFR value who do not have GFR estimates separated by at least 90 days are labeled as “chronicity unknown” as decreased value(s) less than 90 days apart may signify acute rather than chronic kidney injury. These individuals are excluded from the population management system but can be identified by the nephrology department.
- 3. GFR stage reassignment.** After the initial GFR range assignment, CKD stage may be reassigned when two eGFR measurements separated by at least 90 days fall into the eGFR range for a different stage, as described in Box 1.
- 4. Assessment of proteinuria.** For CKD stages 1 and 2, proteinuria—or another marker of kidney disease—is required in order to classify a patient with CKD. KPSC departed from the KDOQI guideline to use macroproteinuria rather than microalbuminuria. The KPSC definition for proteinuria is defined in Box 2.

Box 1: Chronic GFR Stage Range Reassignment

<p>Computer variable definitions:</p> <ul style="list-style-type: none">• <i>Recent</i> is most recent GFR in laboratory system• <i>ThreeMonthsAgoGFR</i> is GFR \geq 3 mo earlier than <i>RecentGFR</i>• <i>CurrentStage</i> is stage that the patient currently is in• <i>GFRRange</i> is the GFR range of a given stage
<p>Steps to reassign to a lower (better) CKD stage using the minimum eGFR to reclassify more conservatively (i.e., closer to current stage).</p> <p>If <i>CurrentStage</i> = CKD stage 2 through 5 and if <i>RecentGFR</i> and <i>ThreeMonthsAgoGFR</i> are both $>$ <i>GFRRange</i> of <i>CurrentStage</i>, then take the minimum of (<i>RecentGFR</i> and <i>ThreeMonthsAgoGFR</i>):</p> <ul style="list-style-type: none">• minimum \geq 90 \rightarrow CKD stage 1• $60 \leq$ minimum $<$ 90 \rightarrow CKD stage 2• $30 \leq$ minimum $<$ 60 \rightarrow CKD stage 3• $15 \leq$ minimum $<$ 30 \rightarrow CKD stage 4
<p>Steps to reassign to a higher (worse) CKD stage using the maximum eGFR to reclassify more conservatively (i.e., closer to current stage).</p> <p>If <i>CurrentStage</i> = CKD stage 1 through 4 and if <i>RecentGFR</i> and <i>ThreeMonthsAgoGFR</i> are both $<$ <i>GFRRange</i> of <i>CurrentStage</i>, then take the maximum of (<i>RecentGFR</i> and <i>ThreeMonthsAgoGFR</i>):</p> <ul style="list-style-type: none">• $60 \leq$ maximum $<$ 90 \rightarrow CKD stage 2• $30 \leq$ maximum $<$ 60 \rightarrow CKD stage 3• $15 \leq$ maximum $<$ 30 \rightarrow CKD stage 4• maximum $<$ 15 \rightarrow CKD stage 5

5. **Identifying stage 3 patients at high risk for progression.** KPSC divides stage 3 patients into groups at low risk (stage 3) and high risk (stage 3 modified) for cardiovascular complications or progression to ESRD. Patients are classified as stage 3 modified if they have two or more eGFRs between 30 and 59 separated by 90+ days and one of the following additional criteria:
 - Proteinuria (see Box 2 for definition)
 - $eGFR + \frac{1}{2} \text{ age} < 85$ (To approximate 2 standard deviations below the mean for age and exclude low risk elderly patients with an eGFR at the upper end of the CKD 3 range.)
6. **Addition of unidentified patients with CKD.** A small population of patients with stage 1, 2, or 3 modified CKD are not detected by the automated registry. Nephrologists may manually enter stage 1, 2, or 3 modified patients who do not meet the outlined criteria but have been identified to have kidney damage through other data (e.g., kidney biopsy, kidney imaging).

Box 2: KPSC Definition of Proteinuria

SignificantProteinuria is true if *FirstProteinuria* and *SecondProteinuria* below are true:

1. *FirstProteinuria* is true if any of the following are true:
 - Protein on urinalysis is $\geq 1+$ or ≥ 30 mg/dL
 - Random microalbuminuria ≥ 300 μg per mg of creatinine
 - 24-h microalbuminuria ≥ 300 mg
 - 24-h urine total protein ≥ 300 mg
 - Random urine protein-creatinine ratio $\cdot 1,000 \geq 200$

2. *SecondProteinuria* is true if any of the following are true:
 - Random microalbuminuria ≥ 300 μg per mg of creatinine
 - 24-h microalbuminuria ≥ 300 mg
 - 24-h urine total protein ≥ 300 mg
 - Random urine protein-creatinine ratio $\cdot 1,000 \geq 200$

Tracking Targeted CKD Populations

KPSC targets CKD population management efforts to groups with high risk of negative outcomes, thereby ensuring efforts yield the largest possible impact. Only high-risk groups are automatically included in the population management system. For example, members in the stage 3 modified group are targeted for population management while members in stage 3 group are not. However, the KPSC nephrology group can identify all individuals with reduced GFRs.

To track targeted patients within the EHR, KPSC began using the EHR's questionnaire function, which allows providers to enter categorical patient data. KPSC developed the Renal Patient Life Course Questionnaire to store CKD patient data within the medical record, rather than in an outside database. By storing the data within the EHR, it remains accessible to all providers.

CKD Capture

The CKD capture program identifies patients with stage 4 and 5 CKD who have not been seen by nephrology. These patients are flagged for the primary care provider to ensure the lack of referral to nephrology was intentional and based on a decision by the patient and provider not to seek aggressive management. Primary care providers are then encouraged to label these patients as “no future renal replacement” to stop outreach for a nephrology appointment.

The Optimal Start Initiative

The Optimal Start initiative—a key KPSC population management effort—was launched to address the large number of patients beginning ESRD therapy with a central venous catheter for hemodialysis. The program uses the Optimal ESRD Therapy Starts metric to track the number of new patients with ESRD therapy previously classified as CKD stage 4 or 5 future renal replacement therapy (denominator) who start peritoneal dialysis directly, start hemodialysis with an AV fistula, or receive a preemptive kidney transplant (numerator). The denominator excludes patients who recover enough kidney function within 3 months to get off dialysis, and the numerator allows for up to 10% of hemodialysis starts through an AV graft. Stage 4 patients have also been subdivided by GFR level into three groups: stage 4a (eGFR = 25 to 29), 4b (eGFR = 20 to 24), and 4c (eGFR = 15 to 19), allowing initial optimal start efforts to focus on the stage 4c group, who are most likely to progress to dialysis. The metric helps focus the KPSC nephrology team on identifying, educating, and preparing patients for a smooth

transition to renal replacement therapy. The Optimal ESRD Therapy Starts metric drives upstream care for CKD and has been adopted as an endorsed measure by the National Quality Forum.

To help ensure more patients achieve an optimal start, KPSC uses a section of their Renal Patient Life Course Questionnaire to track the status of patient preparation for renal replacement therapy (e.g., whether the patient has attended an educational class on renal replacement therapy options, whether the patient has made a modality decision with the nephrologist, whether the fistula has matured, etc.). From the questionnaire, Optimal Start Preparation reports are generated for care management teams on a monthly basis to show level of patient preparation by stage and to encourage nephrologists to update the data if needed.

The Creatinine SureNet Program

KPSC's Creatinine SureNet seeks to confirm or rule out CKD in people with a single abnormal creatinine measurement and no repeat measurement beyond 90 days. The Creatinine SureNet Program is a multidisciplinary program staffed by a project manager, a regional SureNet licensed vocational nurse, and nursing and physician champions. The program involves several phases:

1. **Identification of patients.** The project manager uses the KPSC Online Interactive Network Tool to identify individuals aged 18 or older who meet the following criteria:
 - A single creatinine level equating to an eGFR <60 mL/min/1.73 m²;
 - No repeat measurement in the subsequent 90 days or more; and
 - eGFR + 1/2 age <85 (meaning that members aged more than 50 years require progressively lower eGFRs to be included – e.g., members aged 60, 70, and 80 years would need eGFR <55 , <50 , and <45 mL/min/1.73 m², respectively).
2. **Verification of patients.** The project manager uses the EHR to verify that there is no interim repeat creatinine measurement and screens to determine appropriateness for SureNet (e.g., removing patients who are enrolled in palliative/hospice care programs or have severe dementia with a life expectancy less than 6 months).
3. **Ordering the repeat creatinine.** The list of verified patients is sent to the regional KPSC SureNet licensed vocational nurse, who enters an order for the repeat creatinine measurement in the EHR and sets for the authorizing physician to sign.
4. **Patient follow-up to achieve creatinine result.** A letter is sent to the patient instructing him/her to go to any KPSC laboratory for a serum creatinine measurement. Additional letters are sent and the tests are reordered if the individual does not follow up with the repeat creatinine measurement.
5. **Patient follow-up regarding CKD diagnosis.** If the second creatinine measurement establishes CKD in a patient, the EHR is used to track clinicians documentation of the CKD diagnosis. Scheduled visits with a nephrologist also are evaluated.

Outcomes

Registry-enabled Initiatives

Development of the CKD registry has enabled implementation of point-of-care and quality assessment initiatives.

Providing CKD Information at the Point-of-Care

A CKD care management summary is included as a tab in the EHR for all patients within the CKD registry. To reduce the number of messages for patients with multiple chronic conditions, CKD messages have been integrated by algorithm with messages for other chronic conditions.

Assessing Quality Indicators. The registry enables several quality indicators (e.g., patient awareness of CKD status, absent or low hemoglobin, hospitalization, nephrology referral, participation in education classes) to be continuously tracked for patients with CKD over 12-month periods. Dialysis access type (e.g., AV fistula, AV graft, catheter) is also tracked for patients beginning ESRD therapy. Specific outcomes of note include:

- **Impact on nephrology referral.** Patients with lower risk chronic 3 are seen at a low rate by nephrology (12% ever seen by nephrology) compared to modified CKD 3 (41% ever seen by nephrology). This suggests the registry—combined with nephrology referral suggestions—may help ensure higher-risk patients are seen by nephrologists. Overall, 45% of prevalent KPSC CKD 1, 2, 3 modified, 4, and 5 (non-dialysis stage 5) and 94% of CKD 4 and 5 (non-dialysis) have been seen by nephrology.
- **Impact on optimal starts.** Data analysis enabled by the registry corrected the misperception among nephrologists that unrecognized CKD with acute renal failure accounts for a high percentage of the new ESRD therapy population. The analysis demonstrated that the majority of patients entering ESRD therapy were identified with a long-term (> 3 months) eGFR < 30 mL/min/1.73 m² prior to starting therapy (76%), indicating there is a greater amount of time to prepare patients for ESRD than may be acknowledged by nephrologists. Sixty-five percent of CKD stage 4 and 5 patients (and 51% of all patients starting ESRD (regardless if had prior known CKD) are achieving an optimal start of dialysis.

Creatinine SureNet Implementation

Of the 12,396 individuals that met the SureNet criteria between February 1, 2010 and March 1, 2014, 51.8% eventually had a repeat creatinine measurement as a direct result of the SureNet Orders. Of these, CKD was established in 52.5%.

Challenges & Solutions

Quality limitations of data in the EHR. Errors (e.g., incorrect/missing variables, data lag) are inherent to any patient list identified through the EHR. To help resolve discrepancies, nephrologists are given the ability to correct data within the system to help ensure accuracy. For example, missing race values create a challenge for estimation of GFR for African American patients. There has been a gradual improvement in availability of race designation over time as providers have recognized the discrepancy and updated the system.

Gaining provider trust regarding accuracy of the CKD registry. Champions of the KPSC registry provide local lectures, emails, and symposia targeted to primary care providers to help introduce CKD management into usual practice and make clinicians comfortable with the registry. Additionally, KPSC has systems in place to enable data managers to address feedback and questions from clinicians, which helps clinicians recognize that data managers are responsive to clinician concerns.

Ongoing revision of care management lists. Initially, the KPSC system allowed providers to download lists of patients meeting certain criteria, but providers were not able to update these lists with new patient data. Though the Epic EHR provides a list function, KPSC has not been able to integrate the list functionality with the CKD registry to automatically create and maintain CKD patient lists within the EHR. To address this, KPSC began using the questionnaire function within the EHR, which allows categorical data to be entered, stored, and accessed via the EHR.

Facilitators

Targeting population management activities to patients who can most benefit from intervention. This allows for resources to be focused on those most in need. Additionally, more narrowly targeting groups can facilitate buy-in for program implementation. For example, given the challenges around achieving optimal ESRD starts for all ESRD patients, limiting the Optimal ESRD Therapy Starts metric to CKD stage 4 and 5 patients who would have sufficient opportunity for an optimal start rather than all starts of ESRD.

Integrating CKD population management efforts with existing efforts for other chronic diseases. Rather than starting from scratch, this helps avoid overlapping or conflicting reminders to primary care physicians (thereby reducing “pop-up fatigue”). This also allows the system to remind patients about care management needs for CKD when they are visiting for an unrelated condition.

Establishing strong connections between the end-users (clinicians) and the staff generating data and reports (data managers). This has created greater trust of the data among clinicians and has enabled clinicians to explain nuances of the data to the data managers so that data are managed appropriately. Several committees established by the KPSC renal management group have helped establish and maintain connections between clinicians, care managers and data analysts. Also, KPSC culture in the nephrology program supports personal connections between clinicians and data analysts, so that clinicians feel comfortable reaching out directly to data managers, and vice versa.

Inclusion of race data alongside lab values. Estimated GFR reporting did not give two values for black and non-black race but instead made use of the known race from data systems. Having one value for GFR is important for registry purposes.

Establishing a robust registry system independent from the EHR with dedicated staff to manage and report data. Data errors can occur as information is generated in the EHR (e.g., inadvertent change of a laboratory code). Having a separate data management system with dedicated staff who can attend to data issues and report back to clinicians is critical to managing CKD populations.

Clearly defining chronicity to limit inclusion of patients with kidney injury. KPSC set a definition for chronic disease requiring two reduced eGFRs separated by at least 90 days to ensure patients with acute injury weren't inappropriately labeled with CKD.

Next Steps

Expanding the CKD capture program to address high risk patients at earlier CKD stages.

Initial efforts have focused on patients with stages 4 and 5 CKD. KPSC plans to focus future efforts on systematically capturing patients with earlier stages of CKD who are at high-risk for rapid progression to ESRD (e.g., patients with more than 3 g urine protein) to ensure these patients are referred to nephrology.

Changing systems to focus on CKD risk rather than stage. KPSC hopes to enable improved management of high-risk patients using risk models rather than CKD stage. Similarly, KPSC hopes to encourage clinicians to focus on risk rather than stage in discussing CKD with patients.

Continuing to track care of the SureNet cohort. Future efforts include evaluation of comparative outcomes such as health use, hospitalizations, progression of CKD, and mortality.

Additional Resources

To be added.

References

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