Workplace Outreach Program Improves Management of Chronic Kidney Disease

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Objective: Assess whether an employee outreach program improved management of chronic kidney disease (CKD). Methods: Participants with suspected CKD (eGFR <60 mL/min/1.73m²) identified in employee health assessments in 2017 and 2018 were contacted by phone and offered physician consultation. Subsequent nephrologist visits at 11 months of follow up were compared between those who were (outreach group) and were not (control group) successfully contacted. Results: Most CKD risk factors at baseline were similar in outreach and control groups. At the end of the follow-up, outreach participants had more than 2-fold greater incidence of visiting a nephrologist compared with controls (HR = 2.3; 95% CI 1.2–4.2, P = 0.01), after adjusting for potential confounders. Conclusions: Employee outreach program increased utilization of nephrologist care.

Keywords: chronic kidney disease, prevention, utilization of outpatient nephrologist services, workplace outreach program

Chronic kidney disease (CKD) affects 16.8% of the US adult population and constitutes a substantial health and cost burden. Medicare spent $36.6 billion on patients with end stage renal disease (ESRD) or kidney failure in 2018, an amount comprising approximately 7% of the costs of total Medicare claims. CKD is classified into five stages (G1 through G5), based on assessment of kidney function (estimated glomerular filtration rate [eGFR]) and kidney damage (albuminuria). Overall health, quality of life, and cost burden worsen as CKD progresses. Progression from stage G3 to stage G4–5 is associated with up to a 4-fold increase in annual health care costs. Annual costs associated with ESRD range from $20,110 to $100,593 per patient.

CKD is often asymptomatic and may not be recognized or treated until the disease is at an advanced stage. Fewer than 10% of patients with stage G3 CKD, and less than 50% at stage G4, are aware of their disease. Even among individuals with two to four risk factors for CKD, 84% are unaware of their disease. Among patients with CKD stages G3 to G5, only 14% are identified by primary care physicians. Consequently, referrals to nephrologists are delayed leading to increased length of hospital stays and increased mortality.

Timely referral to outpatient nephrology care can slow progression of CKD, improve outcomes, and reduce treatment costs. Nephrologist care may include interventions aimed at slowing CKD progression such as lifestyle modifications; treatment with angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), and sodium-glucose transporter 2 inhibitors; and control of glucose levels and anemia.

We designed an employer-sponsored workplace CKD outreach program with the goal of improving management of CKD and slowing disease progression. The outreach was prompted by annual laboratory testing that includes measuring serum creatinine, which is used to calculate eGFR. To assess whether the workplace program facilitates improved management of CKD, we used health insurance claims data to prospectively evaluate incidence of outpatient nephrologist care.

METHODS

Study Population

Employees participating in an annual health assessment program were tested for kidney function (eGFR) and assessed for key risk factors for CKD progression. Those with suspected CKD based on confirmed eGFR <60 mL/min/1.73m² in 2016 and 2017 were eligible for the CKD outreach program (n = 398), which was directed toward 2017 and 2018 annual health assessment participants. In 2017, the outreach did not include participants with previously diagnosed CKD (prior CKD) whereas in 2018 some participants with prior CKD (n = 104) were included. All participants were enrolled in an employer’s health plans.

A program coordinator made up to three attempts to contact each eligible employee by phone. If successful, the coordinator provided an explanation of CKD risk and recommended that the participant discuss results further, either with their primary care physician, or through a physician tele-consultation offered as part of the program. Referrals for care, with a primary care physician or a nephrologist, were provided by the consulting physician with urgency based on the CKD stage and the presence of risk factors for CKD progression, or by participants’ primary care physician. The outreach group (n = 156) comprised participants who accepted the phone call. Participants who were not reached by phone (n = 242) served as the control group. Both groups were followed for incidence of nephrologist visits during the 11 months after outreach.

Study participants comprised individuals from 34 states with a diverse range of job functions, including laboratory operations, patient services, sales, analytics, specimen processing and software engineering.

This study was conducted in accordance with the HIPAA Privacy Rule (Title 45 Code of Federal Regulations, Section 164.514e), which governs research conducted by Covered Health-care Entities and allows retrospective analysis using a limited data set without requiring an Institutional Review Board approval.
Data Collection
Kidney function was assessed with eGFR using the CKD-EPI creatinine Eq. (2009).32 CKD stages were defined according to KDIGO guidelines as follows: stage 3, eGFR 59 to 30 mL/min/1.73m²; stage 4, eGFR 29 to 15 mL/min/1.73m²; or stage 5, eGFR <15 mL/min/1.73m².33 Additional measurements performed annually on all study participants included body weight, waist circumference, BMI, systolic and diastolic blood pressure, creatinine, fasting glucose, HbA1C, triglycerides, total cholesterol, LDL cholesterol, HDL cholesterol, complete blood count, uric acid, total iron, and cotinine. Risk factors for CKD progression were defined as high blood pressure (systolic ≥130 mm Hg or diastolic ≥80 mmHg), presence of diabetes (fasting glucose ≥126 mg/dL), hemoglobin A1c ≥6.5%, treated with anti-glycemic medication), dyslipidemia (LDL cholesterol >130 mg/dL), smoking status (cotinine positive), uric acid >6 mg/dL, anemia (hemoglobin <13.0 g/dL in men; <12.0 g/dL in women), ferritin <30 ng/mL mean corpuscular volume <80 fl) and a rapid and substantial annual eGFR decline >5 mL/min/1.73m².24 33 Laboratory testing was performed by Quest Diagnostics.

Study Outcomes
Incidence of nephrologist care was assessed from claims data. For outpatient nephropathologist care we prospectively explored association of the outreach during an 11-month follow-up period. As scheduling a visit for a specialist physician in the US typically takes 24 days,35 nephrology visits were counted between days 25 and 365. An annual eGFR decline of >5 mL/min/1.73m² was assessed from an eGFR measurement at the subsequent annual health assessment.

Statistical Analysis
Cox proportional hazard models adjusted for age, sex, BMI, and change in outreach participation status were used to estimate the effect of outreach, which was assessed by a follow-up time within 11 months for the first visit of the participant to a nephrologist. In the Cox models, prior CKD, year of engagement, and outreach status (outreach or control group) were time-dependent covariates to account for a subset of participants (n = 12) who were in the control group in 2017 and in the outreach group in 2018. In all other analyses, this subset of participants was treated as independent subjects appearing in both the outreach and control groups. Analyses stratified by prior CKD were presented as unadjusted estimates. Logistic regression models that adjusted for age, sex, BMI, and participation status were used to estimate the association of the CKD outreach with annual changes in eGFR levels >5 mL/min/1.73m².

Model 1 was adjusted for the presence of prior CKD and for the change in outreach participation status. Model 2 was adjusted for demographic variables (age and sex) in addition to those used in Model 1. Model 3 used an additional adjustment for BMI, a variable that was identified as a potential confounder in both 2017 and 2018.

Kaplan–Meier (K-M) curve analysis was performed to estimate cumulative incidence of the nephrologist visits during the follow-up period. Analyses were performed using SAS version 9.4. Student’s t-test and Chi square tests were used to assess differences between clinical characteristics of outreach and control groups.

RESULTS
Baseline Characteristics of Study Participants
The demographic and clinical characteristics at baseline were similar between outreach and control participants in both 2017 and 2018 (Table 1). However, there were fewer males in the control groups (P < 0.05 for both) and individuals in the control groups had greater body mass index (BMI) than those in the outreach groups: +3 kg/m² in 2017 and þ2 kg/m² in 2018 (P < 0.05 for both). Most participants (97%, n = 386) had stage G3 CKD, 2% (n = 7) had stage G4 CKD, and 1% (n = 4) had stage G5 CKD. In both groups, HbA1C levels consistent with diabetes (about 16%) and prediabetes (about 30%) were observed, about 49% of participants were obese

Table 1. Baseline Characteristics of Eligible Participants in 2017 and 2018: Outreach Compared with Control Groups

| Characteristic Mean ± SD, or (IQR) | 2017 (n = 81) | 2018 (n = 75) | 2017 (n = 79) | 2018 (n = 163) | P |
|-----------------------------------|---------------|---------------|---------------|---------------|---|
| Age, years                        | 58.7 ± 9.0    | 58.7 ± 6.6    | 60.1 ± 8.5    | 57.8 ± 9.2    | 0.06 |
| Body mass index, kg/m²            | 30.6 ± 5.9    | 33.8 ± 9.7    | 29.2 ± 6.2    | 31.2 ± 7.7    | 0.03 |
| Waist circumference, inches       | 38 ± 5        | 40 ± 7        | 37 ± 6        | 38 ± 6        | 0.30 |
| Blood pressure- diastolic, mmHg   | 79 ± 12       | 77 ± 9        | 77 ± 9        | 78 ± 11       | 0.44 |
| Blood pressure- systolic, mmHg    | 132 ± 18      | 127 ± 18      | 126 ± 15      | 129 ± 18      | 0.19 |
| Glucose, mg/dL                    | 102 ± 29      | 98 ± 21       | 103 ± 29      | 101 ± 26      | 0.52 |
| HbA1c, %                          | 5.7 ± 0.9     | 5.8 ± 1.0     | 5.9 ± 1.2     | 5.9 ± 1.3     | 0.99 |
| LDL cholesterol, mg/dL            | 105 ± 32      | 112.3 ± 35.3  | 110 ± 37      | 111 ± 38      | 0.73 |
| eGFR (in 1st year), mL/min/1.73m² | 53 ± 8        | 53 ± 6        | 48 ± 9        | 48 ± 10       | 0.79 |
| Change in eGFR (2nd year), mL/min/1.73m² | 0.2 ± 5.4 | 0.2 ± 5.4 | 0.37 | 0.2 ± 5.4 | 0.79 |
| Uric acid, mg/dL                  | 6.1 ± 1.6     | 6.5 ± 1.4     | 6.4 ± 1.6     | 6.5 ± 1.5     | 0.58 |
| Hemoglobin g/dL                   | 13.8 ± 1.8    | 13.7 ± 1.7    | 13.7 ± 1.5    | 13.3 ± 1.9    | 0.76 |
| Red blood cell count, million/mL  | 4.7 ± 0.6     | 4.7 ± 0.6     | 4.7 ± 0.5     | 4.6 ± 0.6     | 0.15 |
| Mean corpuscular volume, fL        | 88.6 ± 6.3    | 89.3 ± 5.6    | 87.6 ± 5.9    | 87.8 ± 6.7    | 0.10 |
| Total iron, mg/dL                 | 100 ± 38      | 87 ± 28       | 90 ± 30       | 85 ± 30       | 0.29 |
| Education, College graduate or above | 39 (51)     | 39 (49)       | 39 (53)       | 73 (45)       | 0.06 |
| Smoking                           | 37 (46)       | 22 (28)       | 32 (43)       | 55 (34)       | 0.05 |
| CKD stages                        |              |               |               |               | 0.20 |
| Stage 3 (eGFR 30–59 mL/min/1.73m²) | 80 (99)       | 78 (99)       | 73 (97)       | 152 (93)      | 0.40 |
| Stage 4 (eGFR 15–29 mL/min/1.73m²) | 0 (0)         | 1 (1)         | 1 (1)         | 9 (5)         | 0.05 |
| Stage 5 (eGFR <15 mL/min/1.73m²)  | 1 (1)         | 0 (0)         | 1 (1)         | 2 (1)         | 0.10 |

Values are means ± SD.

eGFR, estimated glomerular filtration rate; HbA1c, hemoglobin A1c; HDL, high-density lipoprotein; LDL, low-density lipoprotein; NA, not applicable.
A total of 354 study participants were analyzed, including 144 individuals that were solely in the outreach group and contributed 43,156 days (1438 months) of follow-up, 198 individuals that were solely in the control group and contributed 70,932 days (2364 months) of follow-up, and 12 participants that participated in both the outreach and control in different years of the outreach and contributed 8064 days (134 months) of follow-up to both the outreach group and the control group.

**Association of CKD Outreach with Utilization of Outpatient Nephrologist Care**

At the end of the follow-up period, participants in the outreach group had had about 2-fold greater utilization of outpatient nephrologist care compared with controls. In the model fully adjusted for prior CKD and change in outreach participation status (Model 3), the hazard ratio (HR) for those in the outreach group was 2.3 (95% CI 1.4–4.2, P = 0.01), compared with the control group (Table 2, Model 3, Fig. 1). The estimates were similar in two other models: in Model 1 adjusted for prior CKD and change in outreach participation status and in Model 2 adjusted for age and sex, in addition to adjustments used in the Model 1 (Table 2, Model 1 and 2).

When considering only participants with prior CKD (n = 104), the rate of nephrologist visits was greater in the outreach group, compared with the control group: HR = 2.3 (95% CI 1.0–4.8, P = 0.04). In those without prior CKD (n = 294), HR = 2.1 (95% CI 0.7–6.4, P = 0.18), after adjusting for sex, age and BMI (Table 2, Model 3, Fig. 2).

At the end of the follow-up, the cumulative incidence of outpatient nephrologist care among those with prior CKD, was 38.7% (95% CI 24.1–54.0%) in the outreach group and 24.6% in the control group (95% CI 16.3–36.2%, Fig. 2A), while in those with newly identified suspected CKD, incidence of outpatient nephrologist care was 7.2% (95% CI 3.8–19.8%) in the outreach group and 3.0% (95% CI 1.3–7.1%) in the control group (Fig. 2B).

Outreach group participants had non-significant lower odds of having consistent annual decline in eGFR of >5 mL/min/1.73m², compared to controls: odds ratio (OR) 0.6 (95%CI 0.3–1.1, P = 0.12) after adjusting for potential confounders (Table 2, Model 3).

**DISCUSSION**

We analyzed the association between participation in a workplace CKD outreach program and utilization of the nephrologist care. Workplace participants who participated in the CKD outreach had about 2-fold greater utilization of the outpatient nephrologist care than those who were eligible but did not respond to requests to participate. The 40% reduction in odds of having annual eGFR decline >5 mL/min/1.73m² did not reach significance in our study (P = 0.12). This may be due to the sub-optimal 42% power to detect the association of the program with annual eGFR decline with the observed effect size of 0.6. Extending the program to include more participants will improve the power for this endpoint and will likely to provide clarification on the impact of the program on annual decline in eGFR levels.

The 2-fold increase in referral to a nephrologist in response to outreach is clinically important. Delayed referral to a nephrologist has been shown to be associated with greater risk of ESRD and renal death. In fact, late referral to a nephrologist is a major cause of unplanned urgent-start dialysis, a procedure associated with poor patient outcomes, frequent hospitalizations, and higher medical costs. In contrast, timely referral to outpatient nephrology care slows CKD progression and enables optimal-start dialysis in an outpatient setting, thus slowing CKD progression to ESRD, preventing CVD events and hospitalizations, and reducing medical costs.

The observed association of employer-sponsored CKD outreach program with increased utilization of nephrologist care reported herein is supported by previous reports. Other health and behavioral counseling programs have been reported to reduce risk factors for chronic diseases, reverse metabolic syndrome, slow CKD progression, and reduce medical costs. By increasing utilization of nephrologist visits, the outreach program demonstrates the importance increasing employees’ engagement in health outreach programs.
Organizational senior leadership support for health promotion, communication of value of health programs, and broader organizational support for employee health and wellbeing, are important factors that improve employees’ engagement in wellness programs, perceived job stress levels, and health behaviors.\textsuperscript{51–54} In order to increase employee engagement in health programs, efforts directed at increasing leadership support are warranted. Ultimately, both the employee and organization benefit through improved employee health and reduced health care costs.

**Limitations of the Study**

Our study had two limitations. First, the nonrandomized nature of the outreach and control groups can introduce unobserved differences between the groups that can bias the result. For example, participants motivated to respond to the outreach may also be more inherently motivated to take charge of their healthcare and follow-up than the control group. Secondly, although efforts were made to offer the program to diverse employees, the study was underpowered for testing the association of the CKD outreach in different racial and ethnic groups.

**CONCLUSIONS**

A workforce CKD outreach program improved timely utilization of the nephrologist care. Efforts to engage more employees at risk of CKD progression are likely to be beneficial.
ACKNOWLEDGMENTS
The authors thank Jim Devlin, Dov Shiffman, Harvey Kaufman, Michael McPhaul, Wendi Mader, Tom Pela and Jeff Radcliff for their contribution to this work.

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