Healthy Behaviors, Risk Factor Control and Awareness of Chronic Kidney Disease

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Abstract

Background/Aims—The association between chronic kidney disease (CKD) awareness and healthy behaviors is unknown. We examined whether CKD self-recognition is associated with healthy behaviors and achieving risk-reduction targets known to decrease risk of cardiovascular morbidity and CKD progression.

Methods—CKD awareness, defined as a "yes" response to "*Has a doctor or other health professional ever told you that you had kidney disease*?", was examined among adults with CKD (eGFR < 60 ml/min/1.73 m^2) who participated in the REasons for Geographic and Racial Differences in Stroke study. Odds of participation in healthy behaviors (tobacco avoidance, avoidance of regular NSAID use, physical activity) and achievement of risk reduction targets (ACEI/ARB use, systolic blood pressure (SBP) control and glycemic control among those with diabetes) among those aware vs. unaware of their CKD were determined by logistic regression, controlling for socio-demographics, access to care and co-morbid conditions. SBP control was defined as < 130 mmHg (primary definition) or < 140 mmHg (secondary definition).

Results—Of 2,615 participants, only 6% (n=166) were aware of having CKD. Those who were aware had 82% higher odds of tobacco avoidance compared to those unaware [adjusted odds ratio =1.82, 95% CI (1.02–3.24)]. CKD awareness was not associated other healthy behaviors or achievement of risk-reduction targets.

Conclusions—Awareness of CKD was only associated with participation in one healthy behavior and was not associated with achievement of risk-reduction targets. To encourage adoption of healthy behaviors, a better understanding of barriers to participation in CKD-healthy behaviors is needed. Keywords: chronic kidney disease, awareness, behaviors, self-management

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Keywords

Chronic kidney disease; awareness; self-management; behaviors

Introduction

Chronic kidney disease (CKD) is common, affecting at least 20 million Americans or up to 11.5% of the United States population.[1] CKD is associated with excess mortality, morbidity and diminished quality of life.[2,3] It is thought that patient adoption of healthy risk-reduction behaviors, such as tobacco avoidance[4] and participating in physical activity[5] may improve health outcomes, particularly by decreasing cardiovascular risk and slowing CKD progression. Recent efforts have focused on encouraging lifestyle changes among patients with severe kidney disease. For example, Medicare currently reimburses clinicians who provide pre-dialysis education[6] focused on such topics as: diet/nutrition, exercise, and managing co-morbid conditions. Such programs were developed because there is evidence that pre-dialysis education leads to delayed initiation of dialysis,[7] improved self-care,[8] and decreased mortality[9] among patients with end stage renal disease (ESRD) receiving dialysis.

Previous studies have reported that self-recognition of moderate CKD is very low,[10] as is actual patient knowledge about kidney disease and its complications.[11] Despite this, few self-management support or educational programs that focus on increasing awareness and self-care have been implemented among patients with early or moderate CKD.[12] The lack of evidence linking CKD awareness and healthy behaviors among individuals with moderate CKD (unlike among individuals with ESRD) may be one barrier to the development of such programs.

The aim of this study was to examine whether a person's awareness of his/her CKD is associated with self-reported healthy behaviors and risk-reduction targets. We hypothesized that CKD awareness among patients with CKD not requiring renal replacement therapy would be associated with participation in behaviors and achievement of risk reduction targets thought to decrease risk of adverse health outcomes. Behaviors included tobacco avoidance,[4] avoidance of regular use of non-steroidal anti-inflammatory drugs[13] (NSAIDs), and increased physical activity[5]; risk reduction targets included systolic blood pressure (SBP) control,[14] use of angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARB),[14] and glycemic control among patients with CKD and diabetes.

Methods

Study Design

We used data previously collected from the NIH-funded REasons for Geographic And Racial Differences in Stroke (REGARDS) study cohort. The purpose of REGARDS was to identify factors that contribute to the excess stroke mortality among black individuals and residents of the Southeastern United States. Methods for recruitment in REGARDS have been described elsewhere.[15] By design, the REGARDS study cohort was restricted to adults 45 years of age. Black individuals (42% of the final cohort), as well as individuals who live in the "stroke buckle" (coastal North Carolina, South Carolina, and Georgia) or the "stroke belt" (remainder of North Carolina, South Carolina and Georgia as well as Tennessee, Mississippi, Alabama and Arkansas), were oversampled. Residents of the stroke belt/buckle comprised 56% of the final cohort; the other 44% of the study cohort resided in the remaining continental US.

Overall, 30,239 participants were recruited between January 2003 and October 2007. A question about awareness of CKD was added to the baseline REGARDS study questionnaire in May 2004 and was available for 21,658 participants. We further restricted our analysis to REGARDS study participants with an estimated glomerular filtration rate (eGFR) 15–59 ml/min/1.73m^2 (n=3,020, 14% of those asked about awareness of CKD). We excluded participants who had missing data about CKD awareness, laboratory and health behavior data (n=405, 13% of study participants with eGFR 15–59 ml/min/1.73m^2), resulting in a final study population of 2,615 participants. The REGARDS study protocol was approved by Institutional Review Boards governing research in human subjects at participating centers. All participants provided informed consent.

Data collection

Trained interviewers conducted computer-assisted telephone interviews (CATI) to obtain participants' socio-demographic data (age, sex, race, social support, income, education), information about access to care (insurance status, last visit with a physician), and self-reported diagnoses of co-morbid conditions, including CKD, diabetes, hypertension, coronary heart disease (history of coronary artery bypass, angioplasty or stent placement) and stroke.

Health professionals conducted in-home baseline study visits that included a physical examination, collection of either fasting (>90%) or non-fasting blood samples, random (non-first morning) urine samples, and an inventory of current medications. BP was measured two times during the exam following a standardized protocol; the mean of the measurements was used. An electrocardiogram (ECG) was performed. Serum creatinine assays were calibrated with an isotope dilution mass spectroscopic standard. Urinary albumin was measured using the BN ProSpec Nephelometer from Dade Behring (Marburg, Germany). Urinary creatinine was measured with a rate-blanked Jaffé procedure, using the Modular-P analyzer (Roche/Hitachi; Indianapolis, IN) and calibrated to an isotope-dilution mass spectroscopy standard; urine albumin:creatinine ratio (UACR) results were expressed in mg/g.

Definitions

Hypertension was defined by self-reported use of antihypertensive medications or a SBP/DBP 140/90 mmHg. Diabetes was considered present if self-reported or if the participant reported use of oral-hypoglycemic medications or insulin, or had a fasting serum glucose 126 mg/dL or, for non-fasting participants, a serum glucose 200 mg/dL. Coronary heart disease was defined by self-report or if there was evidence of a previous myocardial infarction on ECG. Stroke was self-reported. The CKD-EPI equation[1] was used to estimate GFR; CKD was defined by the Kidney Disease Outcomes Quality Initiative staging guidelines.[16]

Predictor

The primary predictor was individual awareness of CKD. Participants who responded "yes" to *"Has a doctor or other health professional ever told you that you had kidney disease?"* were defined as being aware of their CKD.

Outcomes

Self-reported health behaviors thought to influence risk of adverse health outcomes were obtained during the CATI interview. Current tobacco avoidance was defined by a "no" answer to "Have you smoked at least 100 cigarettes in your lifetime" or a "yes" answer to that question, followed by a "no" response to "Do you smoke cigarettes now, even occasionally?" Chronic NSAID use was defined by a "yes" reply to "Are you currently

taking Nonsteroidal Anti Inflammatory agents on a regular basis, that is at least two times each week?" after an exhaustive list of NSAID examples were provided. Frequency and chronicity of NSAID use was self-reported, as data obtained from the medication inventory might misclassify sporadic NSAID use. Physical activity was determined by the question "How many times per week do you engage in intense physical activity, enough to work up a sweat?" Answers were categorized into 3 groups: none, occasional (1–3 times per week) and frequent (4+ times per week).

Risk reduction targets were ascertained during the in-home study visit. Current ACEI/ARB use (yes/no) was determined during the medication inventory. SBP control was defined in two ways given the current debate on target SBP control among patients with CKD[16]: mean SBP < 130 mmHg (primary definition) or < 140 mm Hg (secondary definition).

Among individuals with CKD and self-reported hypertension, ACEI/ARB use and SBP control were examined. Among individuals with CKD and self-reported diabetes, ACEI/ARB use and glycemic control were examined. Because we did not have access to glycosylated hemoglobin data, glycemic control was defined by a pre-prandial blood glucose < 130 mg/dL, per American Diabetes Association recommendations.[17]

Statistical Methods

Differences among participants with complete data and missing data were calculated and compared using chi-squared tests. Among participants with complete data, differences between those aware and unaware of CKD were calculated using chi-square tests. Multivariate logistic regression models were used to examine the independent association between CKD awareness and the aforementioned outcome variables. The interaction terms awareness*income and awareness*education were initially included in models to explore whether socioeconomic status modified the association between CKD awareness and healthy behaviors/risk reduction targets. These terms were non-significant (p>0.2 for all unadjusted models) and thus dropped from the final models. Analyses were adjusted for covariates in an incremental fashion, resulting in 3 models, adjusting for the following: (1) socio-demographics only (age, race, gender, marital status, income, education, region); (2) socio-demographics and co-morbid conditions (high blood pressure, diabetes, stroke and coronary heart disease); (3) socio-demographics, co-morbid conditions and CKD severity (eGFR and UACR, both modeled as categorical variables). Similar incremental analyses were performed in two subgroups defined *a priori*: participants with CKD and hypertension and participants with CKD and diabetes. Analyses were conducted using SAS v. 9.3 (Cary, NC).

A sensitivity analysis was performed using the Modified Diet in Renal Disease (MDRD) study equation to calculate eGFR,[18] as this equation was commonly used in practice to determine CKD severity during the time of REGARDS participant recruitment.

Results

Participants

Our study population consisted of 2,615 individuals with CKD, among whom 6.3% (n=166) were aware of their CKD. These individuals differed from study subjects with missing data (n=405), in that those with missing data tended to be younger (p=0.02), of Black race (p=0.001), had more proteinuria (p=0.002) and lower eGFR (p=0.03). The two populations did not differ in regards to CKD awareness (p=>0.05).

Roughly one-half of the study sample was older than 70 years, with fairly even distribution with respect to gender and race (white and black). (Table 1) The majority of the study

sample had access to health care, with 97% reporting having medical insurance and 79% having seen a physician within the past year. Nearly 80% of the study sample had hypertension and 33% had diabetes.

Individuals aware of their CKD with complete data were younger and more likely to be male than their counterparts unaware of CKD (Table 1). Mean age among those aware and unaware of their CKD was 67.7 years [standard deviation (SD)=9.3)] and 72.6 years (SD)=8.7, respectively. There was no statistically significant association between CKD awareness and household income (p=0.15) or race (p=0.09). Modest, non-significant higher CKD awareness was present among individuals with co-morbid conditions, particularly among those with diabetes [adjusted odds ratio (AOR) for awareness=1.43, 95% CI 0.96–2.12] and stroke (AOR=1.45, 0.89–2.38). Mean (SD) glucose values were not statistically different across both groups of study participants [unaware, 138.7 mg/dl (61.7); aware, 123.9 mg/dl (71.1); p=0.81], however, a significantly greater percentage of those aware of their CKD required insulin to manage their diabetes (61.4%) versus those who were unaware of their CKD (38.1%) (p<0.001). Awareness was higher among individuals with greater albuminuria and lower levels of eGFR (p<0.001 for both).

Association of CKD awareness and healthy behaviors/risk reduction targets

The overall prevalence of healthy behaviors ranged from 24.0% (frequent physical activity) to 89.4% (tobacco avoidance), with non-significant differences among those aware versus those unaware of their CKD. Achievement of risk reduction targets ranged from 49.3% (SBP < 130 mmHg) to 72.5% (SBP < 140 mmHg), again with non-significant differences between those aware and unaware of their CKD. (Figure 1)

CKD awareness was not associated with participation in healthy behaviors. Adjusted for socio-demographic variables, CKD awareness was not associated with tobacco avoidance, NSAID avoidance or increased physical activity. After adjustment for co-morbid conditions and CKD severity, those who were aware of their CKD were more likely to report avoidance of tobacco (AOR=1.82, 1.02–3.24). However, odds of NSAID avoidance and participation in increased physical activity were not different among those aware versus unaware of their CKD. Also, CKD awareness was not associated with higher use of ACEI/ARB or achievement of SBP control. (Table 2)

Similar results were found when examining the association between CKD awareness and risk-reduction targets in two subpopulations (Table 3). Among participants with CKD and hypertension (n=2,102), CKD awareness was not associated with SBP control or ACEI/ARB use. Among study participants with CKD and diabetes (n=933), neither glycemic control (AOR=1.05, 0.65–1.69) nor ACEI/ARB use (AOR=0.91, 0.55–1.52) differed among individuals aware vs. unaware of their CKD, after adjusting for socio-demographic characteristics, co-morbid conditions, and CKD severity.

Sensitivity analysis

Using the MDRD equation, 2,656 participants with complete data had eGFR 15–59 ml/min/1.73m^2, of which 172 individuals (6.5%) demonstrated CKD awareness. The overall prevalence of healthy behaviors differed slightly when using the MDRD equation to determine eGFR. Prevalence of moderate and frequent physical activity were 31% and 24% respectively. Unadjusted prevalence of NSAID avoidance was 86%, with a statistically significant difference among those aware vs. unaware of their CKD (p=0.007). Prevalence of tobacco avoidance was 94%. Achievement of risk reduction targets ranged from 52% (SBP < 130 mmHg), to 57% (use of ACEi/ARB) to 74% (SBP < 140 mmHg), with

significant differences between those aware and unaware of their CKD with respect to SBP
< 140 mmHg (p=0.05) and ACEi/ARB use (p=0.03).

However, after adjusting for socio-demographic variables, co-morbid conditions and CKD
severity, CKD awareness was not associated with participation in healthy behaviors or
achievement of risk-reduction targets, when using the MDRD study equation to calculate
eGFR, with the exception of tobacco avoidance. (Supplementary Tables S1 and S2)

Discussion

Our main finding is that, contrary to our hypothesis and regardless of the equation used to
calculate eGFR, CKD awareness was associated with participation in only one healthy
behavior thought to reduce the risk of adverse health outcomes among patients with CKD.
CKD awareness appeared to be associated with higher odds of tobacco avoidance but not
NSAIDS avoidance or participation in physical activity. Additionally, we found that an
individual's awareness of having CKD was not associated with achievement of risk
reduction targets, including SBP control, among individuals with CKD with or without
hypertension. Among individuals with CKD and diabetes, CKD awareness was not
associated with higher odds of ACEI/ARB use or glycemic control. These latter results are
consistent with data from the National Health And Nutrition Examination Survey
(NHANES)[19] that suggest that CKD awareness is not associated with receipt of guideline-
concordant care. This study adds to the literature by confirming the data from prior studies
using a different question to ascertain CKD awareness: *"Has a doctor or other health
professional ever told you that you had kidney disease?"* vs. *"Have you ever been told you
have weak or failing kidneys (excluding kidney stones, bladder infections, or
incontinence)?"* It also extends knowledge further by focusing on the association between
awareness of kidney disease and healthy behaviors, a potential mediator between awareness
and improved health.

The lack of association between CKD awareness and healthy behaviors, with the possible
exception of tobacco avoidance, is concerning. Our finding that CKD awareness is
independent of chronic NSAID use, the only CKD-specific behavior that we examined, is
similar to results from previous studies that examined self-reported NSAID use among
patients with CKD.[20] Among NHANES participants with eGFR 30–59 cc/min/1.73 m^2,
use of prescription NSAIDS and those available over-the-counter (OTC) was estimated to be
0.3% and 5.5%, respectively. NSAIDs are often distributed with written information
describing the risks associated with chronic NSAID use. Limited health literacy, which is
quite prevalent among patients with CKD,[11] limits the usefulness of such written
pamphlets.[21] NSAID avoidance by patients with CKD may thus rely heavily on adequate
verbal information transfer between health care providers and patients. We were unable to
differentiate between OTC and prescription NSAID use, but our results suggest that
providers may fail to convey relevant information about CKD-specific preventive behaviors
to patients when discussing CKD. This may be particularly true among generalists, who care
for the majority of patients with CKD and do not often engage in conversations about CKD
risk factors or CKD prevention.[22] The patient-provider interaction may thus be the most
important unmeasured confounder in this study.

Interestingly, CKD awareness was associated with tobacco avoidance but was not associated
with increased physical activity, two healthy behaviors that are not CKD-specific, but are
emphasized for cardiovascular risk prevention. The discordant results may stem from
unmeasured variables that lead to impaired physical functioning and disability among
individuals with CKD.[23] While unable to discern from this study, it is possible that CKD

awareness is associated with behaviors associated with improved cardiovascular risk profiles but not with CKD-specific preventative behaviors.

Results may also be explained by misclassification of CKD awareness. In this study, CKD awareness is ascertained by a question similar to one used in the Kidney Early Evaluation Program cohort study[24]: *"Has a doctor or other health professional ever told you that you had kidney disease?"* Individual CKD awareness in NHANES is determined with a different question: "*Have you ever been told you have weak or failing kidneys (excluding kidney stones, bladder infections, or incontinence)?"* While data from both sources suggest a similar low prevalence of CKD awareness,[10] neither question has been validated among patients with and without CKD. It is plausible that an individual with albuminuria or decreased eGFR understands the extent of her kidney damage and the importance of participation in healthy behaviors to prevent further renal damage, without recognizing her *kidney disease* or *failing kidneys*. Similarly, the terminology in the aforementioned questions may not be consistent with terminology used by providers who describe CKD to patients. With on-going debates about the definition of CKD in the nephrology community,[25] accurate ascertainment of CKD awareness may not be possible at this time.

More speculative explanations may also account for the lack of association between CKD awareness and participation in healthy behaviors. Perhaps individuals with CKD do not engage in healthy behaviors despite knowledge because of the silent nature of kidney disease until its progression to ESRD. This is consistent with data suggesting that individuals aware of hypertension, another "silent disease", do not engage in healthy lifestyles within the first two years after diagnosis, with the exception of tobacco cessation. [26] Additionally, high prevalence of depression among patients with CKD is well established,[27] but the extent to which CKD awareness is associated with denial, worry, or resignation has not been thoroughly explored.

This study has several limitations. Because of the cross-sectional design of the study, causal inferences cannot be made. We also relied on single measurements for eGFR and albuminuria, possibly resulting in misclassification of individuals with CKD. While it was not possible to exclude individuals with acute kidney injury (AKI) from this analysis, it is unlikely that many individuals had AKI rather than CKD, given that individuals were recruited from home, not a hospital setting. Additionally, with the low percentage of participants aware of CKD, we may lack adequate power to detect statistically significant differences among patient groups. It is important to note that modeling the impact of CKD awareness on tobacco avoidance became statistically significant only after adjustment for albuminuria and eGFR, which, though unlikely, may represent over-adjustment. Lastly, we did not have information about participant-provider relationships, participant health literacy, and provider interventions, such as prescribing ACEI/ABR or giving subjects information about healthy behaviors.

Our results suggest that the link between CKD awareness and healthy behaviors is not straightforward. While increasing CKD awareness among individuals with kidney disease should empirically reduce complications of CKD, additional research is needed to determine how best to raise awareness of CKD and translate that awareness into improved health outcomes. Next steps could include identification of terminology used by providers and patients to describe kidney disease as well as barriers to patient adoption of CKD-healthy behaviors. Meanwhile, clinicians who discuss CKD with patients may need to include concrete information about behaviors thought to slow CKD progression and prevent its cardiovascular consequences. In turn, this may lead to healthier lifestyles and better health outcomes among patients with CKD.

Acknowledgments

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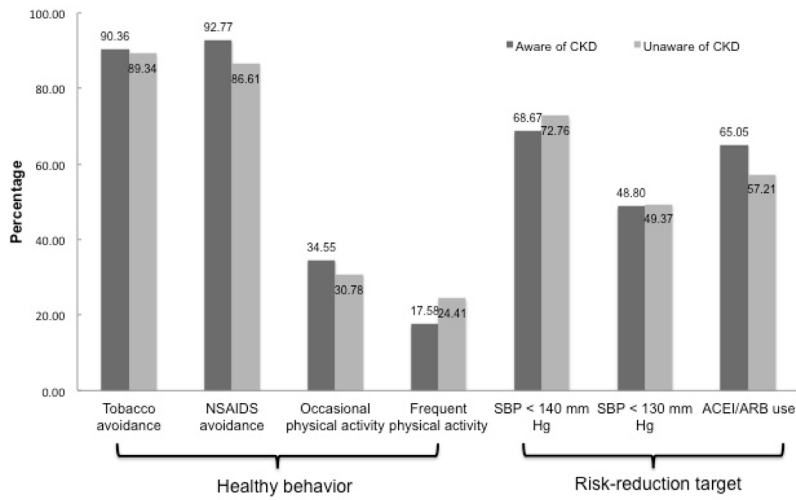
The REGARDS Investigators

FIGURE 1.
Prevalence of healthy behaviors and achievement of risk reduction targets among
REGARDS participants with CKD, by awareness. (p>0.05 for all unadjusted comparisons).

Table 1

Characteristics of REGARDS study participants by CKD awareness

	Not aware of CKD N=2,449	Aware of CKD N=166	OR* (95%CI) for Awareness
	N (%)		
Age			
45–59	164 (6.7)	31 (18.6)	ref
60–69	649 (26.5)	64 (38.6)	0.43 (0.25, 0.74)
70–79	1046 (42.7)	51 (30.7)	0.23 (0.13, 0.42)
80+	590 (24.1)	20 (12.1)	0.17 (0.08. 0.33)
Gender			
Female	1353 (55.3)	70 (42.2)	ref
Male	1096 (44.8)	96 (57.8)	1.67 (1.10, 2.53)
Race			
White	1461 (59.7)	88 (53.0)	ref
Black	988 (40.3)	78 (47.0)	0.78 (0.51, 1.17)
Marital status			
Married	1218 (49.7)	70 (42.2)	ref
Not Married	1231 (50.3)	96 (57.8)	1.00 (0.66, 1.52)
Education < high school	454 (18.5)	37 (22.3)	1.23 (0.76, 1.98)
Income < $20,000 per year	574 (23.4)	47 (28.3)	1.02 (0.65, 1.60)
Insurance status			
no	71 (2.9)	8 (4.8)	ref
yes	2376 (97.1)	158 (95.2)	1.32 (0.50, 3.49)
Did not report seeing a physician this past year	464 (20.5)	33 (22.2)	1.02 (0.66, 1.58)
Body Mass Index kg/m² (SD)			
18.5–24.9	544 (22.7)	31 (18.9)	1.10 (0.65, 1.84)
25.0–29.9	936 (39.0)	54 (32.9)	ref
30.0–34.9	534 (22.3)	38 (23.2)	0.98 (0.60, 1.61)
35.0–39.9	227 (9.5)	29 (17.7)	1.75 (1.0, 3.08)
40	158 (6.6)	12 (7.3)	1.07 (0.51, 2.22)
Hypertension	1969 (80.4)	144 (86.8)	1.11 (0.66, 1.87)
Diabetes	784 (32.0)	90 (54.2)	1.43 (0.96, 2.12)
Coronary Heart Disease	764 (31.2)	70 (42.2)	1.22 (0.83, 1.79)
Stroke	288 (11.8)	29 (17.5)	1.45 (0.89, 2.38)
Urine albumin:creatinine ratio mg/g			
<30	1640 (67.0)	60 (36.1)	ref
30–299.9	572 (23.4)	54 (32.5)	1.87 (1.22, 2.87)
300	237 (9.7)	52 (31.3)	2.14 (1.26, 3.61)
eGFR ml/m/1.73 m²			
45–59	1729 (70.6)	58 (34.9)	ref
30.0–44.9	577 (23.6)	59 (35.5)	1.46 (1.91, 4.40)

	Not aware of CKD N=2,449	Aware of CKD N=166	OR* (95%CI) for Awareness
	N (%)		
15–29.9	143 (5.8)	49 (29.5)	7.06 (4.21, 11.83)

*adjusted for all co-variates listed and region of residence; reference not listed for: education: > high school; income: 20,000/year N=2615 for all rows except: health insurance (n=2414); bmi (n=2613); hypertension (n=2563).

CKD = chronic kidney disease; REGARDS= REasons for Geographic And Racial Differences in Stroke

Table 2

Odds ratios for of participation in risk reduction behaviors and achievement of risk reduction targets if aware vs. unaware of CKD

Behavioral outcome or risk reduction target	Adjusted OR (95%CI)		
	Model 1	**Model 2**	**Model 3**
Tobacco avoidance	1.51 (0.88, 2.61)	1.48 (0.85, 2.59)	1.82 (1.02, 3.24)
NSAIDS avoidance	1.72 (0.94, 3.16)	1.73 (0.94, 3.19)	1.35 (0.72, 2.53)
Occasional physical activity (vs. none)	0.97 (0.67, 1.39)	1.10 (0.74, 1.54)	1.21 (0.83, 1.78)
Frequent physical activity (vs. none)	0.59 (0.38, 0.93)	0.66 (0.42, 1.03)	0.76 (0.48, 1.21)
SBP < 140 mmHg	0.82 (0.58, 1.16)	0.87 (0.61, 1.23)	1.10 (0.74, 1.63)
SBP < 130 mmHg	0.99 (0.71, 1.36)	1.08 (0.77, 1.50)	1.30 (0.91, 1.86)
ACEI/ARB use	1.37 (0.98, 1.91)	1.04 (0.73, 1.50)	1.10 (0.76, 1.60)

Model 1: adjusted for age, race, gender, marital status, income, education, region

Model 2: adjusted for Model 1 + co-morbid conditions (high blood pressure, diabetes, stroke, coronary heart disease)

Model 3: adjusted for Model 2 + estimated glomerular filtration rate and urine albumin:creatinine ratio

Table 3

Odds ratios for achieving risk-reduction targets if aware vs. unaware of CKD

Among those with CKD and self-reported hypertension (n=2,102)	Model 1	Model 2	Model 3
SBP < 140 mmHg	0.82 (0.57, 1.18)	0.83 (0.57, 1.20)	1.06 (0.71, 1.57)
SBP < 130 mmHg	0.99 (0.79, 1.39)	1.00 (0.71, 1.43)	1.27 (0.87, 1.85)
ACEI/ARB use	1.31 (0.90, 1.92)	1.13 (0.76, 1.67)	1.27 (0.84, 1.91)
Among those with CKD and self-reported diabetes (n=933)			
Fasting blood sugar <130 mg/dL	1.05 (0.67, 1.63)	1.08 (0.69, 1.70)	1.05 (0.65, 1.69)
ACEI/ARB use	0.83 (0.52, 1.34)	0.81 (0.50, 1.33)	0.91 (0.55, 1.52)

Model 1: adjusted for age, race, gender, marital status, education, income, region

Model 2: adjusted for Model 1 + co-morbid conditions (high blood pressure, diabetes, stroke, coronary heart disease)

Model 3: adjusted for Model 2 + estimated glomerular filtration rate and urine albumin:creatinine ratio