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Title

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Permalink

https://escholarship.org/uc/item/86r3h4t9

Journal

American Journal of Nephrology, 45(3)

ISSN

0250-8095

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Publication Date

2017

DOI

10.1159/000455389

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Peer reviewed

Insights from Screening a Racially and Ethnically Diverse Population for Chronic Kidney Disease

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Abstract

Background: The value of chronic kidney disease (CKD) screening in the general population remains unclear but may be beneficial in populations with high disease prevalence. We examined risk factors for albuminuria among participants in a state-wide CKD screening program in Hawaii. ***Methods:*** The National Kidney Foundation of Hawaii Kidney Early Detection Screening (NKFH-KEDS) program held 19 CKD screening events from 2006 to 2012. Participants rotated through 5 stations during which sociodemographic, blood glucose, urine albumin-to-creatinine ratio (ACR), and spot urine albumin data were collected. Multivariate logistic regression analyses (adjusted for age, sex, race/ethnicity, body mass index [BMI]) were used to identify clinical predictors of abnormal ACR (≥ 30 μg/mg) and abnormal spot urine albumin (>20 mg/L) levels. ***Results:*** Among 1,190 NKFH-KEDS participants who met eligibility criteria, 13 and 49% had abnormal ACR and urine albumin levels, respectively. In multivariate logistic regression analyses, participants of older age (>65 years), Asian and Pacific Islander race/ethnicity, BMI ≥ 30 kg/m^2, and with hypertension had higher risk of abnormal ACR. Being of older age; Asian, Pacific Islander, and Mixed race/ethnicity; and having diabetes was associated with higher risk of abnormal urine albumin levels in adjusted analyses. ***Conclusions:*** NKFH-KEDS participants of older age; Asian and Pacific Islander race/ethnicity; and with obesity, hypertension, and diabetes had higher risk of kidney damage defined by elevated ACR and urine albumin levels. Further studies are needed to determine whether targeted screening programs can result in timely identification of CKD and implementation of interventions that reduce cardiovascular disease, death, and progression to end-stage renal disease.

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Introduction

In the United States (US), more than 20 million adults, or 1 in 10 US residents suffer from chronic kidney disease (CKD) [1]. As of 2013, there were 661,648 prevalent cases of end-stage renal disease (ESRD) in the US, among whom 466,607 were receiving dialysis [2]. There were 86,965 dialysis patients as well as an additional 14,541 pre-dialysis CKD patients awaiting kidney transplantation in 2013 with 48,311 active candidates on the transplant list, yet only 17,600 patients received a transplant,

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yielding a waiting list that was 2.7-fold higher than the supply of donor kidneys [2]. Furthermore, the 2013 costs of ESRD patients was $30.9 billion, accounting for 7.1% of the overall Medicare paid claims costs in the fee-for-service system [2]. Although kidney transplantation is more cost-effective than maintaining a patient on dialysis, there is a dearth of viable organs to meet the demands of eligible ESRD patients. Over time, patients have endured longer waiting time intervals for kidney transplantation, and the ever-widening gap between the supply and demand of kidneys has been difficult to close. As efforts to increase organ donation may only minimally impact the insufficient organ supply, the most effective way to address this problem will be to reduce the demands for kidney transplantation. Ultimately, recognition of CKD in its earlier stages and preventing progression toward ESRD will have the greatest impact on addressing the kidney supply–demand mismatch.

To this end, developing screening programs in populations with a high prevalence of kidney disease risk factors using noninvasive, inexpensive, and reliable methods has the potential to identify patients with CKD who may be at risk of developing ESRD. Furthermore, given that markers of early kidney disease (e.g., albuminuria, proteinuria) have demonstrated potent associations with cardiovascular disease and death [3], timely identification and targeted interventions (i.e., administration of angiotensin-converting enzyme inhibitors, blood pressure control, weight loss) may ameliorate the exceedingly high mortality of this population. There is a paucity of data demonstrating the benefit of a one-time screening test for CKD, and it has yet to be shown that screening can improve the outcomes of CKD patients. As such, the American College of Physicians does not support screening for CKD in asymptomatic adults, although the evidence for this recommendation is weak [4].

However, it has been suggested that the effectiveness of a CKD screening program may vary according to the racial/ethnic background of the source population. Hawaii has the highest prevalence of Asian and Pacific Islanders among whom there is a greater burden of CKD [5, 6]. Indeed, the state of Hawaii has demonstrated a higher incidence and prevalence of ESRD patients receiving dialysis compared to the national average [7]. Although there has been considerable progress in our understanding of the risk factors for and sequelae of CKD among African-Americans and Latin Americans [8, 9], there have been few published studies of CKD in the Asian and Pacific Islander populations to date [6, 10, 11]. For example, while multiple traditional risk factors for

CKD are highly prevalent in Hawaii [6, 7], little is known about the specific risk factors for early CKD (i.e., elevated albuminuria and proteinuria levels) in this under-recognized "high-risk" population. To address this knowledge gap, in 2005, the National Kidney Foundation of Hawaii (NKFH) developed the Kidney Early Detection Screening (KEDS) program with the objective of raising CKD awareness and promoting early kidney disease screening among its residents across the state of Hawaii. In the following study, we aimed to (1) describe the implementation and operational activities of the NKFH-KEDS screening program model, and to (2) examine rich participant-level data collected from a racially and ethnically diverse group of participants during NKFH-KEDS health screening events [10]. In terms of the latter objective, we sought to examine characteristics associated with specific markers of early kidney damage, namely abnormal urine albumin-to-creatinine ratio (ACR) and spot urine albumin levels, among participants in the KEDS program.

Methods

Source Cohort

This is a cross-sectional study of participants in Wave 1 (2006–2009) of the NKFH-KEDS program. Data examined in this study were collected over the course of 19 KEDS health screening events ("KEDS events") conducted at the Hawaii State Capitol grounds and shopping malls, community colleges, community health centers, hospitals, and community centers throughout the state of Hawaii including the islands of Maui, Oahu, Kauai, and the Big Island. These KEDS sites were selected in collaboration with community partners, and site requirements included adequate space availability, affordability, accessibility, and convenience to the public, as well the ability to meet the screening events' logistical requirements. The study was approved by the Institutional Review Boards and Committee on Human Studies at the University of Hawaii and the University of California Irvine Medical Center.

KEDS Events Procedures

Each KEDS event was staffed by approximately 25–45 volunteers affiliated with NKFH. Volunteers consisted of healthcare professionals (physicians, nurses, pharmacists, dietitians, and physical therapists), trainees in the healthcare field, and the lay community who were required to undergo formalized training prior to participation. Initial training was conducted in small groups, and in 2010, a standardized video module was developed to facilitate the training of new volunteers (www.youtube.com/kedsorientation). A second orientation was conducted immediately prior to each KEDS event and included a review of (1) the purpose of the screening events and program procedures, (2) paperwork and documentation, (3) interviewing techniques, (4) equipment protocols for blood testing, (5) physical measurements, (6) urinalysis, and (7) screening follow-up recommendations. Participation was completely voluntary, and those who enrolled were not paid. Upon enrollment, trained volunteers explained the

Fig. 1. Photos from National Kidney Foundation of Hawaii Kidney Early Detection Screening Program events.

rationale for the program, obtained informed consent, and provided a description of the following 5 stations screening participants would rotate through (Fig. 1):

1. Station 1 (registration): participants registered for the event and completed a health assessment form that collected information on sociodemographics (age, sex, self-reported race/ethnicity), comorbidities (hypertension, diabetes, elevated cholesterol, cardiovascular disease, kidney disease), smoking history, family history of comorbidities (hypertension, diabetes, elevated cholesterol, cardiovascular disease, kidney disease), and use of medications for conditions such as hypertension, cholesterol, and kidney disease. Volunteers were available to assist participants with visual impairments or language barriers.
2. Station 2 (physical measurements): volunteers who were students or healthcare professionals performed blood pressure, height, and weight measurements, the latter of which were used to calculate body mass index (BMI).
3. Station 3 (urinalysis): volunteers provided participants with a specimen cup and instructions on how to obtain a "clean-catch" urine sample. Specimens were processed utilizing either a Clinitek 50 or Clinitek Status Analyzer. Bayer/Siemens Diagnostics Microalbumin Reagent test strips were utilized.
4. Station 4 (blood draw): venous or capillary blood specimens were collected by phlebotomy professionals. Venous blood specimens were transported via couriers to local laboratories for processing. For capillary blood specimens, Accu-Check Aviva blood glucose meters and test strips by Roche were used.
5. Station 5 (exit interview): healthcare professionals who included physicians, physician assistants, nurse practitioners, and registered nurses conducted exit interviews with each of the participants, which involved reviewing their screening test results and providing general recommendations and education regarding CKD risk factors. Participants with abnormal, noncritical test results were advised to promptly follow-up with their primary care providers. Results from the venous blood specimen collection were mailed to the participants' homes 7–10 days after screening.

Fliers and radio/newspaper advertisements were primarily used to notify the community of the KEDS events. For screenings held in larger communities, interested participants were allowed to walk-in without an appointment or pre-register by phone. KEDS events held in smaller rural communities required word-of-mouth communication by leaders in the community, placement of banners, and other grassroots tactics, given that radio/newspaper

advertisements were not as successful in disseminating screening event information. Community members who were interested in undergoing screening during the KEDS events were enrolled in the program irrespective of health insurance, health conditions, sex, and race/ethnicity, and each KEDS event had the capacity to accommodate up to 150 participants.

Statistical Analysis

Descriptive statistics were estimated to examine KEDS participants' sociodemographics. Participants' race/ethnicity was categorized as White, Asian, Pacific Islander, Black, American Indian, and Mixed race/ethnicity. Participants who had at least 50% Pacific Islander race/ethnicity were categorized as "Pacific Islander." Those who listed 2 or more race/ethnicities were categorized as "Mixed," unless they indicated they were at least 50% Pacific Islander in background. Given the very small number of Black ($n = 6$) and American Indian ($n = 6$) participants, participants of these racial/ethnic backgrounds were included in sensitivity analyses but excluded from the primary analyses.

We first examined the association between the participants' sociodemographics and clinical characteristics with 2 co-primary outcome measures which included (1) urine ACR and (2) spot urine albumin levels. Based on Kidney Disease Improving Global Outcome definitions, ACR was reported as normal (ACR <30 μg/mg), presence of microalbuminuria (ACR 30–300 μg/mg), and presence of macroalbuminuria (ACR >300 μg/mg), and spot urine albumin levels were reported as normal (urine albumin <20 mg/L) and abnormal (urine albumin ≥20 mg/L) [12–14]. Given the sparse numbers of participants with non-normal ACR levels, we conducted univariate logistic regression analyses to examine characteristics associated with an ACR dichotomized as normal (ACR <30 μg/mg) vs. abnormal (ACR ≥30 μg/mg). Multivariate logistic regression models were also used to determine characteristics independently associated with abnormal ACR and spot urine albumin levels, which included the following covariates: age (dichotomized as >65 vs. ≤65 years), sex, race/ethnicity, and BMI (dichotomized as ≥30 vs. <30 kg/m²). Complete case analysis was used for the multivariate regression models.

We then compared clinical characteristics among participants with normal vs. abnormal ACR levels using *t* tests, chi-square, and Fisher exact tests, depending upon data type. Analogous analyses were conducted for normal vs. abnormal spot urine albumin levels. Data were analyzed using Excel, SPSS version 22 (IBM, Armonk, NY, USA), SAS version 9.4 (SAS Institute Inc., Cary, NC, USA), and Stata version 13.1 (Stata Corporation, College Station, TX, USA).

Results

Description of Study Population

There were 1,277 participants in the NKFH-KEDS program among whom the mean ± SD age was 55.7 ± 16.4 years and 62% were female. The racial/ethnic distribution of the cohort was as follows: Asians (43%), Whites (23%), Pacific Islanders (13%), Mixed race/ethnicity (11%), Black (<1%), American Indian (<1%), and unknown race/ethnicity (10%). The mean ± SD BMI was

28.0 ± 6.5 kg/m², with 29% and 14% of participants meeting criteria for obesity (BMI ≥30 kg/m²) and morbid obesity (BMI ≥35 kg/m²), respectively.

Baseline characteristics of participants with ACR data examined in primary analyses ($n = 1,178$) overall and stratified according to ACR level are shown in Table 1. In the overall cohort, the following comorbidity prevalences were observed: hypertension (41%), elevated cholesterol (30%), diabetes (26%), cardiovascular disease (5%), and kidney disease (3%). Approximately 7% of participants reported active smoking. A large proportion of the participants reported having a family history of diabetes (42%), heart disease (31%), and kidney disease (11%), while <1% of participants reported having a family history of hypertension. Compared to participants with normal ACR levels (<30 μg/mg), those with abnormal ACR levels (≥30 μg/mg) were less likely to be White and more likely to be Asian or Pacific Islander; were more likely to have hypertension, diabetes, and elevated cholesterol; and were more likely to have a family history of diabetes.

Urine ACR Levels

ACR data were available among 1,190 participants, among whom the distribution of values was as follows: normal (ACR <30 μg/mg; $n = 1,030$), presence of microalbuminuria (ACR 30–300 μg/mg; $n = 147$), and presence of macroalbuminuria (ACR >300 μg/mg; $n = 13$; Fig. 2a).

In primary analyses (overall cohort $n = 1,178$), we found that being of older age (>65 years), Asian and Pacific Islander race/ethnicity, and having obesity (BMI ≥30 kg/m²), hypertension, diabetes, and elevated cholesterol were associated with higher risk of having abnormal ACR levels using univariate logistic regression (online suppl. Table 1; for all online suppl. material, see www.karger.com/doi/10.1159/000455389). Following adjustment for case-mix characteristics in multivariate logistic regression analyses, participants of older age (>65 years), Asian and Pacific Islander race/ethnicity, obese BMI, and with underlying hypertension persisted in having a higher risk of abnormal ACR (Table 2). In sensitivity analyses that included Black ($n = 6$) and American Indian ($n = 6$) participants (overall cohort $n = 1,190$), we observed the same pattern of associations (data not shown).

Spot Urine Albumin Levels

Spot urine albumin data were available among 1,190 participants, among whom the distribution of values was as follows: normal (urine albumin <20 mg/L; $n = 606$) and abnormal (urine albumin ≥20 mg/L; $n = 584$; Fig. 2b).
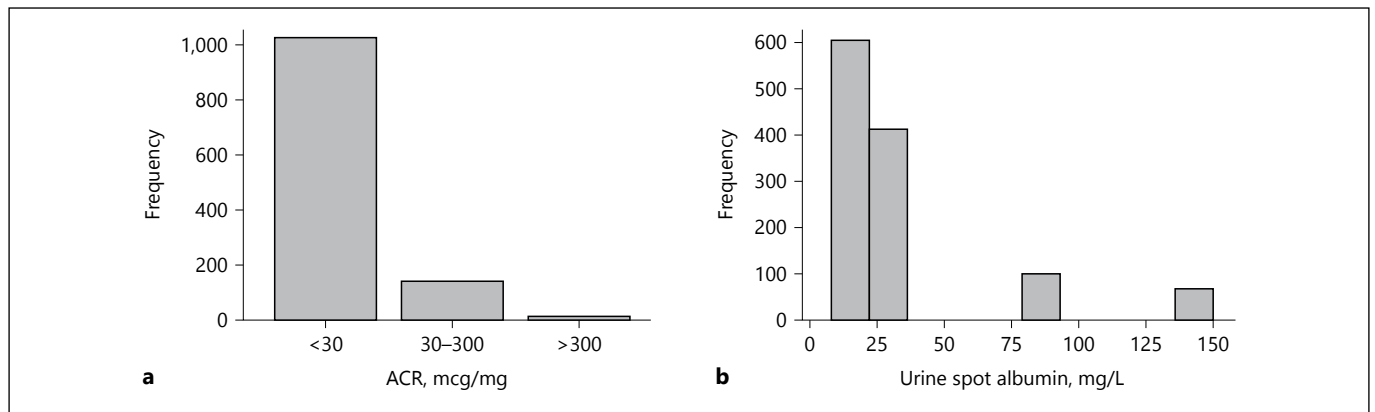
Fig. 2. Distribution of urine albumin-to-creatinine (**a**) and spot urine albumin (**b**) levels among 1,190 KEDS participants.

Table 1. Baseline characteristics in the overall cohort and according to ACR level

Characteristic	ACR, μg/mg			*p* value
	overall cohort	ACR <30	ACR ≥30	
Number (%)	1,178 (100)	1,019 (87)	159 (13)	N/A
Age, years, mean ± SD	55.9±16.3	55.6±16.2	57.9±17.0	0.116
Female, %	61	62	58	0.381
Race, %				0.009
White	25	27	17	
Asian	48	48	50	
Pacific Islander	15	14	22	
Mixed race/ethnicity	12	12	11	
BMI, kg/m^2, mean ± SD	28.1±6.5	28.0±6.3	28.8±7.4	0.138
HTN, %	41	38	56	<0.001
Diabetes, %	26	25	33	0.027
Elevated cholesterol, %	30	29	40	0.007
Cardiovascular disease, %	5	5	6	0.892
Kidney disease, %	3	3	5	0.067
Smoking, %	7	7	6	0.600
Family history of HTN, %	<1	<1	<1	0.500
Family history of diabetes, %	42	41	45	0.358
Family history of cardiovascular disease, %	31	31	32	0.991
Family history of kidney disease, %	11	11	11	0.843

BMI, body mass index; HTN, hypertension; ACR, albumin-to-creatinine ratio.
p value calculated by *t* test or Kruskal–Wallis test.

In primary analyses (overall cohort *n* = 1,178), we found that being of Pacific Islander race/ethnicity, obese BMI (≥30 kg/m^2), and having diabetes was associated with higher risk of having abnormal urine albumin levels using univariate logistic regression (online suppl. Table 2). Following adjustment for case-mix characteristics in multivariate logistic regression analyses, participants of older age (>65 years); Asian, Pacific Islander, and Mixed race/ethnicity; and with underlying diabetes had a higher risk of abnormal urine albumin levels (Table 3). In sensitivity analyses that included Black (*n* = 6) and American Indian (*n* = 6) participants (overall cohort *n* = 1,190), we observed the same pattern of associations (data not shown).

In crude analyses examining urine albumin levels according to sociodemographic and clinical characteristics

Table 2. Characteristics associated with an abnormal urine ACR level (ACR ≥30 µg/mg) using multivariate logistic regression models

Characteristic	OR	95% CI	*p* value
Age >65 years	**1.59**	**1.07–2.35**	**0.021**
Sex, female	0.83	0.57–1.21	0.331
Asian*	**1.87**	**1.11–3.14**	**0.019**
Pacific Islander*	**2.66**	**1.44–4.93**	**0.002**
Mixed race/ethnicity*	1.58	0.76–3.28	0.219
BMI ≥30 kg/m²	**1.54**	**1.01–2.33**	**0.043**
HTN	**1.59**	**1.09–2.33**	**0.016**
Diabetes	1.21	0.81–1.82	0.354
Elevated cholesterol	1.33	0.90–1.96	0.149
Cardiovascular disease	0.89	0.39–2.05	0.791
Kidney disease	1.32	0.48–3.66	0.595
Smoking	0.80	0.37–1.74	0.576
Family history of HTN	4.72	0.46–48.45	0.192
Family history diabetes	1.08	0.74–1.57	0.695
Family history of cardiovascular disease	1.04	0.69–1.56	0.859
Family history of kidney disease	0.89	0.49–1.59	0.685

* Reference group: Whites.

BMI, body mass index; HTN, hypertension; ACR, albumin-to-creatinine ratio.

Analyses adjusted for age (dichotomized as ≤65 [reference] vs. >65 years), sex, race/ethnicity (White [reference], Asian, Pacific Islander, Mixed), BMI (<30 [reference] vs. ≥30 kg/m²).

Bold estimates indicate significant predictors of abnormal urine ACR level.

Table 3. Characteristics associated with an abnormal urine microalbumin level (>20 mg/L) using multivariate logistic regression models

Characteristic	OR	95% CI	*p* value
Age >65 years	**1.38**	**1.03–1.83**	**0.028**
Sex, female	0.80	0.62–1.04	0.092
Asian*	**1.50**	**1.09–2.06**	**0.012**
Pacific Islander*	**1.58**	**1.03–2.43**	**0.038**
Mixed race/ethnicity*	**2.32**	**1.44–3.72**	**0.001**
BMI ≥30 kg/m²	1.31	0.97–1.77	0.075
HTN	1.03	0.79–1.35	0.824
Diabetes	**1.42**	**1.06–1.91**	**0.021**
Elevated cholesterol	1.03	0.78–1.37	0.836
Cardiovascular disease	0.76	0.44–1.34	0.344
Kidney disease	1.02	0.47–2.23	0.956
Smoking	0.75	0.45–1.25	0.268
Family history of HTN	1.83	0.25–13.31	0.553
Family history diabetes	1.16	0.89–1.51	0.271
Family history of cardiovascular disease	1.05	0.79–1.39	0.752
Family history of kidney disease	1.39	0.93–2.08	0.111

* Reference group: Whites.

BMI, body mass index; HTN, hypertension.

Analyses adjusted for age (dichotomized as ≤65 [reference] vs. >65 years), sex, race/ethnicity (White [reference], Asian, Pacific Islander, Mixed), BMI (<30 [reference] vs. ≥30 kg/m²).

Bold estimates indicate significant predictors of abnormal urine microalbumin level.

(overall cohort n = 1,178), we observed that participants who were age >65 years; with a BMI ≥30 kg/m^2; with underlying hypertension, diabetes, or high cholesterol; or Pacific Islander race/ethnicity had higher mean urine albumin levels compared with those who did not have these characteristics (online suppl. Table 3). In contrast, White participants had lower mean urine albumin levels compared to non-White participants.

Discussion

By leveraging rich participant-level data collected from the KEDS screening outreach program, we have had the opportunity to (1) describe NKFH's procotolized approach in implementing screening events among a racially and ethnically diverse community; (2) report the benefits of these far-reaching screening efforts in identifying early stages of CKD among high-risk communities across the state of Hawaii; and (3) examine the dominant factors associated with early kidney damage (i.e., elevated ACR and albuminuria) in this study population.

In this study, we observed that 13% and 49% of community participants who attended KEDS health screening events were found to have abnormal ACR and urine albumin levels, respectively. Those who were identified to have risk factors or abnormal tests at screening were encouraged to follow-up with their primary care providers and were enrolled in a follow-up educational program (Kidney Interactive Workshop and Information). We additionally observed that a large proportion of the cohort had obesity and morbid obesity (29% and 13%, respectively). Our crude analyses demonstrated that participants of older age; Asian and Pacific Islander race/ethnicity; and with underlying obesity, hypertension, diabetes, and elevated cholesterol had higher risk of abnormal ACR levels. After accounting for differences in case-mix characteristics, logistic regression analyses demonstrated that older age, Asian and Pacific Islander race/ethnicity, obese BMI, and underlying hypertension were independently associated with higher risk of abnormal ACR. Similarly, adjusted analyses demonstrated that older age, Asian and Pacific Islander and Mixed race/ethnicity, and diabetes were independently associated with higher risk of abnormal urine albumin levels.

Examination of data collected by the NKFH-KEDS program provides the unique opportunity to understand the characteristics of a racially and ethnically diverse group of CKD health screening participants across the state of Hawaii, which has a high prevalence of Asians,

Pacific Islanders, and Mixed Racial/Ethnic groups [15]. Hawaii has a higher incidence and prevalence rate of patients with ESRD on dialysis compared to the national average; among these patients, over 60% have diabetes [6, 7]. With the intention of focusing upon community members at "high-risk" for developing CKD, the unrestricted KEDS screening cohort (n = 1,277) was comprised of racially/ethnically diverse participants who, compared to the broader Hawaii population [16], had a lower prevalence of White participants (23% vs. 44%, respectively) but a similarly high prevalence of Asians (43% vs. 56%), Pacific Islanders (13% vs. 11%), and those of Mixed race/ethnicity (11% vs. 23%). Compared to the state-wide population [16], the unrestricted KEDS cohort had a higher prevalence of diabetes (9% vs. 26%), higher prevalence of hypertension (32% vs. 40%), and a similar prevalence of obesity (23% vs. 29%).

These findings are an important addition to scarce existing literature on risk factors for CKD in Hawaii. While native Hawaiians, Pacific Islanders, and Asians have a higher risk of developing CKD compared to White counterparts [17, 18], there is limited understanding of the underlying risk factors specific to this population. A large body of evidence has shown that native Hawaiians and Pacific Islanders in both the CKD and non-CKD populations have a higher prevalence of diabetes, hypertension, and obesity compared to other racial/ethnic groups [5, 6]. While diabetes and hypertension have been recognized as major risk factors for CKD in the native Hawaiian/Pacific Islander population, our study demonstrates that obesity is independently associated with higher risk of kidney damage, manifested as abnormal ACR levels, in this population. A large body of evidence has shown that obesity leads to the development of incident CKD via direct mechanisms including increased glomerular hyperfiltration and alterations in renal hemodynamics, inflammatory cytokines, adipokine production, and transforming growth factor-beta production [19]. In addition, obesity may indirectly lead to CKD development and progression vis-à-vis increased hypertension, diabetes, and atherosclerosis. Recent data have shown that interventions targeted at reducing obesity may reverse or retard CKD progression. For example, two large case series have shown that bariatric surgery among severely/morbidly obese patients resulted in improvement in estimated glomerular filtration rates and/or abnormal ACR levels [20, 21]. Notably, we observed that there was a disproportionate prevalence of CKD risk factors (e.g., diabetes, hypertension) relative to the proportion of participants with high ACR levels. Given that the study was conducted amongst com-

munity members who volunteered to participate in the NKFH-KEDS screening events, it is possible that these participants may have been healthier compared to the general population (i.e., despite having a high prevalence of CKD risk factors, this cohort may have had better access to care, adherence to lifestyle and pharmacotherapeutic interventions, and more well-controlled diabetes and hypertension) and that the scope of early CKD in Hawaii may be greater than observed in this cohort. Thus, implementing screening events in communities with a high prevalence of obesity, as well as interventions targeting weight management, may have important implications upon the kidney health of these populations.

By identifying modifiable factors associated with abnormal levels of ACR and urine albumin (e.g., obesity, hypertension), our findings may provide insights into potential interventions that can ameliorate the substantially high burden of cardiovascular mortality (i.e., second leading cause of death) among high-risk populations in Hawaii [22]. Epidemiologic data have shown that incrementally higher levels of albuminuria are associated with increasing risk of all-cause and cardiovascular mortality [3]. Given the high prevalence of abnormal ACR and urine albumin levels observed in the KEDS cohort (i.e., 13 and 49%, respectively), screening events targeted at high-risk communities may additionally lead to early identification and interventions toward cardiovascular risk factors with potential downstream effects upon reducing cardiovascular disease and death in this population.

Several limitations of the study bear mention. First, while KEDS events were open to all community members, participants who chose to attend health fairs and screenings may have been inherently different compared to the general population, resulting in potential selection bias. Second, the study is also limited by reliability upon participants' self-report of medical history and family history of comorbidities. Third, we lacked data on the proportion of participants who completed the entire screening process (as opposed to partial completion), as well as the duration of time required to complete screening activities. A fourth limitation of the study includes its collection of ACR and urine albumin data at a single point in time. As there may be variations in specimen collection and machine calibration, one-time measurements of these values may not capture participants' typical or longitudinal values. Lastly, data linkage to subsequent medical care and long-term follow-up information were not available.

Despite these limitations, this study represents a first-time examination of a very large and racially/ethnically diverse cohort of participants who underwent CKD screening throughout the state of Hawaii. While there may be limited evidence to support the screening of the general population for CKD, targeting a high-risk population (i.e., high prevalence of Asian and Pacific Islanders, obesity, diabetes, and hypertension) may have potential value. Further studies are needed to determine whether screening programs targeted at Hawaii residents with a high prevalence of CKD risk factors can reduce the overall burden of ESRD in this population.

Grant Support

Disclosure Statement

None of the authors have disclosures to report.

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