## RESEARCH LETTER

# Incident Albuminuria and Ethnicity Among Adults With Diabetes in an Integrated Health Care System in the United States

*To the Editor:*

Albuminuria is an early sign of diabetic kidney disease (DKD)[1,2] and an independent predictor of cardiovascular mortality.[3] However, few studies have examined the progression to albuminuria in ethnically diverse US populations. Among adults with diabetes and preserved kidney function, we observed higher albuminuria prevalence among Asian or Pacific Islander (PI) adults in aggregate, with prevalence higher for Filipino and Native Hawaiian or Pacific Islander (NHPI), similar for Chinese and Southeast Asian, but lower for Japanese and South Asian adults than for White adults.[4] Using longitudinal data, we now examine racial and ethnic variation in albuminuria over 4 years among those without baseline albuminuria.

This retrospective cohort study was conducted in Kaiser Permanente Northern California (KPNC) and approved by the KPNC Institutional Review Board with waiver of informed consent. Among adults aged 45-74 years with diabetes, normal urinary albumin-to-creatinine ratio (UACR < 30 mg/g), and preserved estimated glomerular filtration rate (eGFR ≥ 60 mL/min/1.73 $m^2$) in 2015,[4] presence of albuminuria (UACR ≥ 30 mg/g) over 4 years (using the lowest UACR each year) was examined among the 87.0% with UACR measured in 2019 (Fig S1).

Self-reported race and ethnicity were categorized as non-Hispanic White (NHW), Black/African American (Black), Hispanic, Asian/PI, other/unknown, and Asian/PI subgroups: Chinese, Filipino, Japanese, South Asian, Southeast Asian, and NHPI.[4] Baseline covariates included age, sex, diabetes duration, HbA1c, diagnosed hypertension, body mass index, smoking, and neighborhood deprivation index, as previously reported.[4] Angiotensin-converting enzyme inhibitor or angiotensin receptor blocker treatment (2015-2018) was defined by ≥2 filled prescriptions per year. Because kidney function is a predictor of albuminuria, we also examined eGFR in 2019 (available for 98.2%).

Repeated measures analysis that included UACR in each follow-up year was performed using modified Poisson regression with robust variance, adjusting for covariates. Multivariable models reported relative risks (RRs) with 95% confidence intervals.

The cohort included 53,676 adults with diabetes, preserved eGFR, and UACR < 30 mg/g in 2015. The mean age was 60.1 ± 7.3 years; 28,602 (53.3%) were men; 21,416 (39.9%) were NHW, 5,153 (9.6%) Black, 11,540 (21.5%) Hispanic, and 14,084 (26.2%) Asian/PI race and ethnicity; and 40,038 (74.6%) had hypertension. The baseline characteristics are shown in Table 1. Overall, 7,229 (13.5%) had albuminuria in 2019, including 1,468 (12.7%) Hispanic, 674 (13.1%) Black, 2,890 (13.5%) NHW, and 1,999 (14.2%) Asian/PI, the latter comprising 164 (11.4%) South Asian, 395 (13.1%) Chinese, 101 (14.6%) Southeast Asian, 72 (14.5%) NHPI, 87 (14.9%) Japanese, and 911 (16.4%) Filipino among major Asian/PI groups. For the 43,100 (80.3%) with UACR measured each follow-up year, 2,342 (5.4%, 2016), 2,972 (6.9%, 2017), 3,689 (8.6%, 2018), and 5,320 (12.3%, 2019) had albuminuria. In multivariable analyses, adjusting for age, sex, smoking, neighborhood deprivation index quartile, hypertension, diabetes duration, BMI, HbA1c, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker use, follow-up eGFR, and UACR year, Asian/PI adults had a higher albuminuria risk (RR, 1.25 [1.19-1.31]) versus NHW adults, but Hispanic (RR, 0.94 [0.89-0.99]) and Black (RR, 0.90 [0.84-0.96]) adults did not (Fig 1). When compared with NHW adults, Chinese (RR, 1.19), Filipino (RR, 1.39), Japanese (RR, 1.34), Southeast Asian (RR, 1.36), and NHPI (RR, 1.28) had a higher risk, whereas South Asian (RR, 1.00) adults had a similar risk.

These findings demonstrate greater risk of albuminuria over 4 years for some but not all Asian/PI subgroups when compared with NHW adults with diabetes and preserved (baseline) kidney function. Chinese, Filipino, Japanese, Southeast Asian, and NHPI adults had a higher risk, South Asian adults had a similar risk, and Black and Hispanic adults with diabetes had a slightly lower risk among those with measured UACR and baseline eGFR ≥60 mL/min/1.73$m^2$.

Many but not all patients with DKD develop albuminuria before progression to reduced GFR.[1,2,5] Although albuminuria prevalence has declined nationally among US adults with diabetes,[6] disparity exists among Hispanic and Black adults when compared with NHW adults[6,7] and Asian/PI adults remain understudied. Asian Americans are reported to have a higher risk of albuminuria but lower risk of reduced eGFR, independent of obesity, diabetes, hypertension, and sociodemographic factors,[8] with cross-sectional observations indicating subgroup differences.[4,5] An early KPNC study (including those with DKD) identified greater incident albuminuria among Black, Asian, and especially Filipino adults but not Hispanic adults when compared to NHW White adults.[9]

A major strength is our cohort size with >14,000 Asian/PI adults receiving diabetes care in a single health care system with high rates of DKD monitoring. Our study does have limitations, such as the exclusion of patients without DKD assessment and the known variability in UACR.[1] Future studies should examine albuminuria persistence,[6] timing of DKD progression (and ethnicity-specific time trends), and factors that influence DKD monitoring, including early DKD progression. Our study excluded those with reduced baseline eGFR. We acknowledge that racial and ethnic differences can be multifactorial, influenced by genetic, dietary, environmental, and social factors;[10] these trends may vary among patients not receiving routine DKD monitoring and those with unknown duration of diabetes. Finally, baseline

**Table 1.** Baseline Characteristics Among 53,676 Adults Aged 45-74 years With Diabetes Mellitus and no Diabetic Kidney Disease (Including No Albuminuria), Stratified by Race, Ethnicity, and Asian and Pacific Islander (Asian/PI) Subgroup

| | Overall[a] | NHW | Black | Hispanic | Asian/PI[b] | Chinese | Japanese | Filipino | SE Asian | South Asian | NHPI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total number | 53,676 | 21,416 | 5,153 | 11,540 | 14,084 | 3,027 | 584 | 5,572 | 692 | 1,438 | 497 |
| Age (y) | 60.1 ± 7.3 | 61.4 ± 7.0 | 59.0 ± 7.1[c] | 58.5 ± 7.5[c] | 59.8 ± 7.2[c] | 61.4 ± 6.9 | 62.6 ± 6.7[c] | 59.8 ± 7.1[c] | 58.9 ± 7.2[c] | 58.8 ± 7.3[c] | 58.0 ± 7.3[c] |
| Male sex | 28,602 (53.3%) | 12,349 (57.7%) | 2,314 (44.9%)[c] | 5,930 (51.4%)[c] | 7,212 (51.2%)[c] | 1,557 (51.4%)[c] | 288 (49.3%)[c] | 2,525 (45.3%)[c] | 387 (55.9%) | 865 (60.2%) | 265 (53.3%) |
| Smoking | 3,625 (6.8%) | 1,574 (7.3%) | 498 (9.7%)[c] | 689 (6.0%)[c] | 740 (5.3%)[c] | 112 (3.7%)[c] | 33 (5.6%) | 329 (5.9%)[c] | 43 (6.2%) | 43 (3.0%)[c] | 30 (6.0%) |
| NDI[d] | | | | | | | | | | | |
| Q1 | 13,583 (25.3%) | 6,544 (30.6%) | 733 (14.2%) | 1,684 (14.6%) | 4,249 (30.2%) | 1,243 (41.1%) | 248 (42.5%) | 1,116 (20.0%) | 154 (22.3%) | 601 (41.8%) | 74 (14.9%) |
| Q2 | 13,691 (25.5%) | 6,154 (28.7%) | 1,109 (21.6%) | 2,291 (19.9%) | 3,749 (26.6%) | 845 (27.9%) | 170 (29.1%) | 1,552 (27.9%) | 169 (24.4%) | 356 (24.8%) | 100 (20.1%) |
| Q3 | 13,520 (25.2%) | 5,217 (24.4%) | 1,271 (24.7%) | 3,152 (27.3%) | 3,516 (25.0%) | 569 (18.8%) | 105 (18.0%) | 1,710 (30.7%) | 181 (26.2%) | 308 (21.4%) | 141 (28.4%) |
| Q4 | 12,840 (23.9%) | 3,497 (16.3%) | 2,033 (39.5%)[c] | 4,400 (38.2%)[c] | 2,553 (18.1%)[c] | 367 (12.1%)[c] | 61 (10.5%)[c] | 1,184 (21.3%)[c] | 187 (27.0%)[c] | 171 (11.9%)[c] | 182 (36.6%)[c] |
| DM duration, median, IQR | 6.1 y 2.7-10.7 | 6.0 y 2.8-10.5 | 6.3 y 2.8-11.2 | 6.4 y 2.8-10.8 | 5.8 y[c] 2.5-10.5 | 5.7 y 2.5-10.6 | 7.4 y[c] 3.3-12.0 | 5.8 y 2.7-10.5 | 5.5 y[c] 2.2-9.7 | 6.8 y 2.8-11.4 | 5.8 y 2.6-10.4 |
| HbA1c (%) | 7.6 ± 1.4 | 7.4 ± 1.4 | 7.8 ± 1.7[c] | 7.8 ± 1.6[c] | 7.5 ± 1.2[c] | 7.3 ± 1.1[c] | 7.4 ± 1.1 | 7.5 ± 1.3[c] | 7.4 ± 1.2 | 7.5 ± 1.2 | 7.8 ± 1.5[c] |
| BMI (kg/m$^2$) | 31.5 ± 6.7 | 33.2 ± 6.7 | 33.5 ± 7.1 | 32.6 ± 6.2[c] | 27.2 ± 4.5[c] | 25.9 ± 4.1[c] | 28.8 ± 5.3[c] | 27.6 ± 4.4[c] | 25.7 ± 3.7[c] | 27.8 ± 4.5[c] | 30.2 ± 5.7[c] |
| Hypertension | 40,038 (74.6%) | 16,601 (77.5%) | 4,246 (82.4%)[c] | 8,071 (69.9%)[c] | 10,045 (71.3%)[c] | 1,957 (64.7%)[c] | 456 (78.1%) | 4,434 (79.6%)[c] | 429 (62.0%)[c] | 984 (68.4%)[c] | 366 (73.6%) |
| ACEI/ARB | 34,920 (65.1%) | 14,759 (68.9%) | 3,279 (63.6%)[c] | 7,002 (60.7%)[c] | 8,932 (63.4%)[c] | 1,793 (59.2%)[c] | 433 (74.1%) | 3,895 (69.9%) | 390 (56.4%)[c] | 844 (58.7%)[c] | 313 (63.0%) |

*Note:* Column percentages presented; age, HbA1c, and BMI reported as mean ± SD; DM duration (years) reported as median (IQR).
Abbreviations: ACEI/ARB, treatment with angiotensin converting enzyme inhibitor or angiotensin receptor blocker drug in the year before baseline UACR measurement (defined by ≥2 prescriptions); BMI, body mass index; DM, diabetes mellitus; HbA1c, hemoglobin A1c; IQR, interquartile range; NDI, neighborhood deprivation index; NHPI, Native Hawaiian or Pacific Islander; NHW, non-Hispanic White; Q, quartile; SE, Southeast.
[a]The overall cohort included 1,483 (2.8%) of other or unknown race.
[b]The Asian/PI group included 2,274 (16.1%) with unspecified or other Asian/PI ethnicity.
[c]$P < 0.05$ versus NHW adults. Pairwise comparisons were performed using Fisher exact tests (proportions), *t* tests (age, HbA1c, and BMI), or 2-sample Wilcoxon tests (DM duration) and corresponding *P* values were adjusted to control for multiple comparisons. The corresponding *P* values are provided in Table S1.
[d]Within the overall cohort, NDI could not be calculated in 42 individuals.

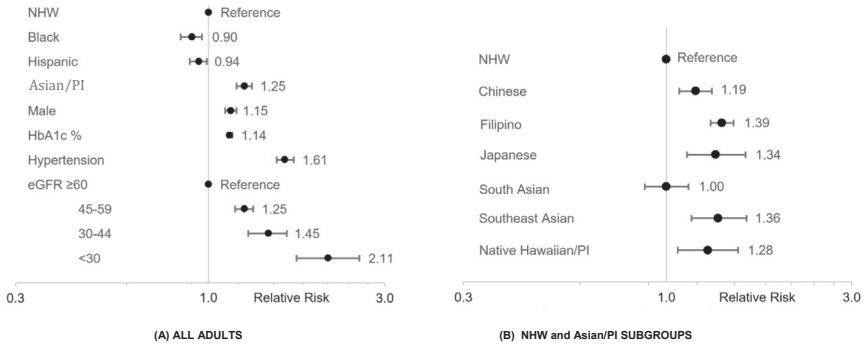


**Fig 1.** Relative risk of repeated measures of albuminuria progression among adults with diabetes, preserved kidney function, and no albuminuria at baseline, comparing (A) race and ethnicity and (B) Asian/Pacific Islander (PI) groups to non-Hispanic White (NHW) adults. Modified Poisson regression with robust variance estimation was used to fit generalized estimating equation models for repeated measures of UACR, based on the lowest available measure each year. Relative risk of albuminuria is reported, adjusting for baseline age, smoking, neighborhood deprivation index, body mass index, diabetes duration, HbA1c, hypertension; angiotensin-converting enzyme inhibitor or receptor blocker therapy in the year before UACR measurement, year of UACR measurement, and eGFR category (calculated using the refitted Chronic Kidney Disease Epidemiology Collaboration equation), with 1.8%-4.0% categorized as missing eGFR. Missing HbA1c (< 0.1%) and BMI (12.5%) were imputed with mean values by race, ethnicity, or Asian/PI subgroup. Abbreviations: NHW, non-Hispanic White; PI, Pacific Islander; HbA1c, hemoglobin A1c.

HbA1c and diagnosed hypertension were assessed, but not blood pressure, follow-up glycemic control, or diabetes pharmacotherapy.

Overall, the observed ethnic differences in early progression to albuminuria among patients with diabetes and preserved (baseline) kidney function support the need to examine disaggregated Asian/PI populations with more granular data on biological, social, and socioeconomic factors.

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## SUPPLEMENTARY MATERIALS

### Supplementary File (PDF)

**Figure S1:** Flowchart describing the identification of the study cohort.

**Table S1:** Corresponding *P* values for Table 1 comparing each racial and ethnic group with non-Hispanic White.

## ARTICLE INFORMATION

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