Area Deprivation Index Predicts Annual Chronic Kidney Disease Screening and Chronic Kidney Disease Development among Newly Diagnosed Hypertensive and Type 2 Diabetic Patients in a Large Midwestern Health System

Mary Ingle, PhD, MPH[1]; Rasha Khatib, PhD, MPH[1]; Yuxian Du, PhD[2], Vesta Valuckaite, MD, MSc[2], Rakesh Singh, PhD[2], Sheldon Kong, PhD[2], Todd Williamson, PhD[2], Sarang Baman, MD[3]

[1] Advocate Aurora Health Research Institute; [2] Data Generation and Observational Studies, Bayer U.S. Healthcare Pharmaceuticals [3] Enterprise Population Health, Advocate Aurora Health

Background

Clinical practice guidelines recommend annual chronic kidney disease (CKD) screening after initial diagnosis of hypertension (HTN) or type 2 diabetes (T2DM). Annual monitoring of kidney function increases early detection of CKD. However, disparities in neighborhood characteristics can impact access to routine care, including CKD screening. We hypothesize area deprivation index (ADI), a national ranking of neighborhood sociodemographic disadvantage would predict annual CKD screening and CKD development among newly diagnosed HTN or T2DM patients.

Table 1. Demographic characteristics of Advocate Aurora Health patients (n=235,208) with a new HTN and/or T2DM diagnosis between 2015-2018.

	All [a] (n=235,208)		HTN [b] only (n=154,056, 65%)		T2DM [c] only (n=20,514, 9%)		HTN & T2DM [d] (n=60,638, 26%)	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Age	60	(51, 69)	60	(50, 69)	54	(43, 64)	63	(55, 71)
BMI (kg/m^2)	31	(27, 36)	30	(27, 35)	31	(27, 36)	33	(28, 38)
	n	%	n	%	n	%	n	%
Female	123,944	53	82,657	54	10,483	51	30,804	51
Ever smoked	86,533	37	57,022	37	7,162	35	22,349	37
Race/Ethnicity								
White	126,502	57	89,899	65	9,539	50	27,064	47
Black	59,953	27	37,251	22	4,272	22	18,430	32
Hispanic/Latino	18,764	8	9,118	6	3,084	16	6,652	11
Asian	9,022	4	4,628	3	1,267	7	3,127	5
Other	9,498	4	6,050	4	952	5	2,496	4
Insurance								
Commercial	192,257	82	126,680	83	18,003	89	47,574	79
Medicare	38,687	17	24,545	16	2,061	10	12,081	20
Uninsured	2,110	1	1,462	1	206	1	442	1
Medicaid	114	<1	79	<1	10	<1	25	<1
National ADI								
Q1 (1-28)	45,465	20	30,307	21	3,687	19	9,956	17
Q2 (29-40)	47,011	20	30,357	21	4,006	20	10,899	19
Q3 (41-53)	48,123	20	30,378	21	3,981	20	11,899	21
Q4 (54-70)	45,568	20	27,998	19	3,801	20	11,813	20
Q5 (71-100)	47,041	20	27,555	18	4,017	21	13,254	23

[a] missing: race/ethnicity: n=11,469, insurance: n=2,040; ADI: n=233,208; [b] missing: race/ethnicity: n=7,110, insurance: n=1,290; ADI: n=146,595; [c] missing: race/ethnicity n=1,400, insurance: n=234; ADI: n=19,492; [d] missing: race/ethnicity n=2,959, insurance: n=516, employment: n=50; ADI national rank : n=57,821; Other race: American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander & two or more races; IQR: Interquartile range; Q:quintile

Methods

Electronic health records of patients (n=235,208) with an new HTN or T2DM diagnosis between 2015-2018 were abstracted using International Classification Codes. Patients were followed for three years to assess annual CKD screening (one estimated glomerular filtration rate and urinary albumin-to-creatine ratio). CKD development was classified as a CKD or end stage renal disease diagnosis. ADI ranks (1-100) were divided into quintiles (Q1=least deprived, Q5=most deprived). Multivariable logistic regression models evaluated associations between ADI quintiles with CKD screening and CKD development.

Conclusion

The most deprived patients were almost twice as likely to develop CKD compared to the least deprived ones and more likely to be screened annually. It's possible the most deprived patients have less access to primary care and diagnoses with CKD at the same time as HTN/T2DM. Or, an increase in deprivation is associated with poor lifestyle choices which can lead to an increase in CKD, it's possible early diagnosis is due to an increase in screening, thus leading to an increase in quality of life through monitoring kidney function.

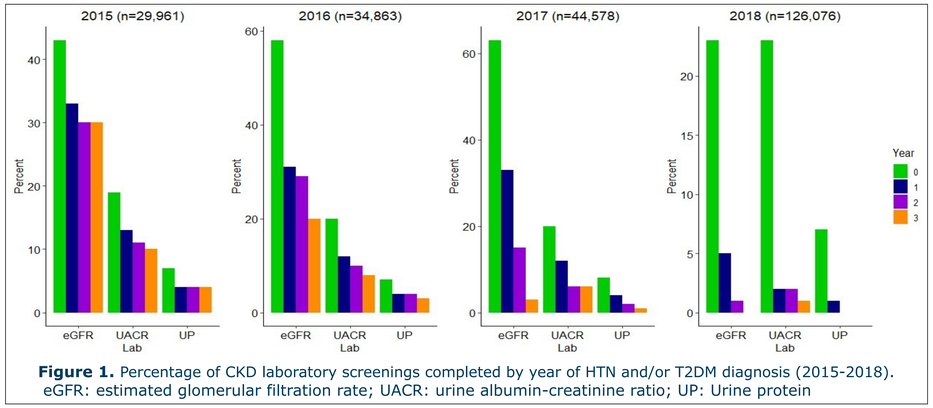

Figure 1. Percentage of CKD laboratory screenings completed by year of HTN and/or T2DM diagnosis (2015-2018). eGFR: estimated glomerular filtration rate; UACR: urine albumin-creatinine ratio; UP: Urine protein

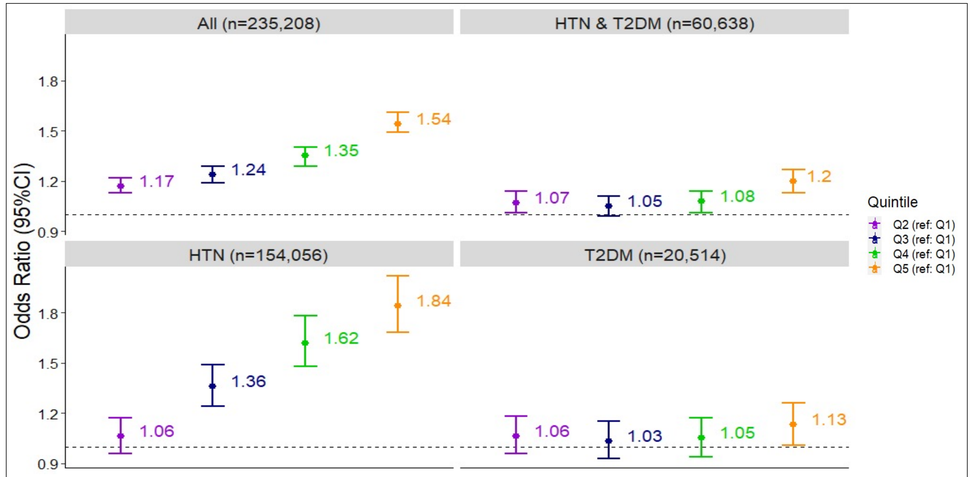

Figure 2. Association of ADI and receiving a CKD within 12 months of a new HTN and/or T2DM diagnosis between 2015-2018. Models adjusted for age, sex, smoking (never/ever), BMI (kg/m^2), year, weighted Charlson index & patient location (IL/WI). CI: Confidence interval.

Results

Most patients were White (57%) females (55%) with solely HTN (65%). Few with only T2DM (9%) and 26% had both. Screening was highest for patients who developed HTN and T2DM during the study (44%) compared to only T2DM (38%) or HTN (4%). Compared to the least deprived patients, the most deprived were more likely to be screened in the first year of HTN or T2DM diagnosis (Odds Ratio (OR)= 1.54; 95% confidence interval (CI): 1.48, 1.60). The most deprived patients were more likely to develop CKD compared to the least deprived patents (OR=2.46, 95%CI: 2.19, 2.76).

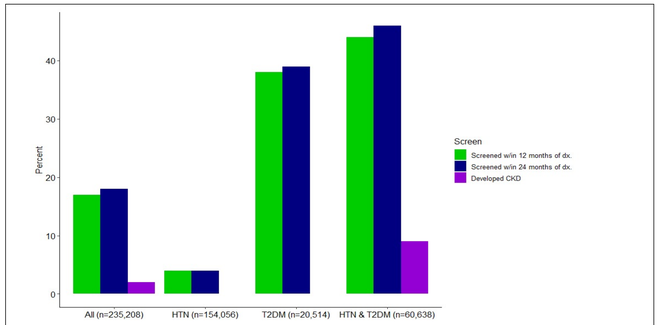

Figure 3. CKD screening frequency and CKD development among patients with a new HTN and/or T2DM diagnosis between 2015-2018. Screening is defined as one estimated glomerular filtration rate and one urine albumin-creatinine ratio

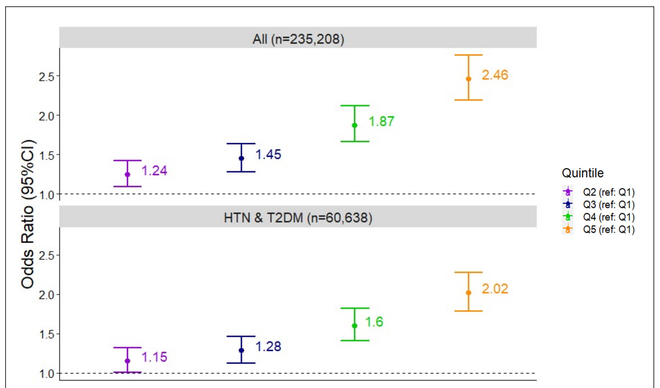

Figure 4. Association of ADI and receiving a CKD diagnosis after a new HTN and/or T2DM diagnosis between 2015-2018. Logistic regression models adjusted for age, sex, smoking (never/ever), BMI (kg/m^2), year, patient location (IL/WI), weighted Charlson index score & ≥1 CKD screening within 24 months of diagnosis (yes/no).

This study was funded by Bayer HealthCare Pharmaceuticals Inc., 100 Bayer Boulevard, Whippany, NJ 07981.

AdvocateAuroraHealth® Research Institute