Using Big Data to Assess Social and Individual Factors Associated with Pediatric Essential Hypertension: A Cosmos Database Study

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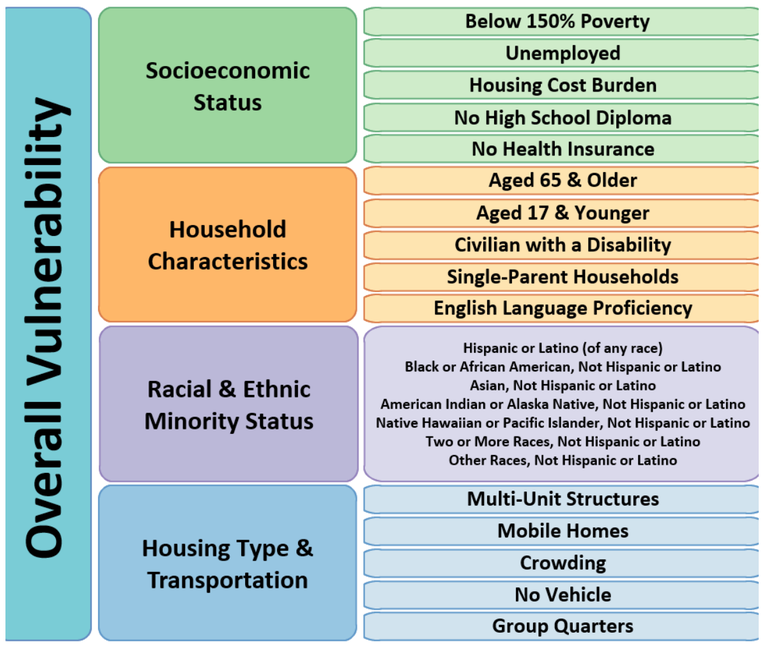
Background

- Pediatric essential hypertension (HTN) is rising, but data on the impact of social and economic factors on pediatric HTN is limited.
- Aim: Describe the relationship between individual, social, and economic factors in pediatric HTN in the largest database study.
- We hypothesize that obesity, non-white race, and increased social vulnerability are associated with increased risk for pediatric HTN.



Methods

- A multicenter case-control study using Epic Cosmos, a US database with over 240 million patient records. Given the large sample size, we randomly sampled 200,000 control patients for the analysis
- Included patients aged 10-18 years with (cases) and without (controls) an ICD coded diagnosis of essential HTN from 2014 to 2023
- We performed univariate and multivariate analyses using Wilcoxon Rank Sum test for continuous and Chi Square for categorical variables.

Characteristic	Overall N = 348,581[1]	Non-Hypertensive N = 200,000[1]	Hypertensive N = 148,581[1]	p-value[2]
Social Vulnerability Index (SVI)	0.66 (0.37, 0.87)	0.61 (0.33, 0.84)	0.72 (0.45, 0.90)	<0.001
SVIHHComp	0.63 (0.39, 0.82)	0.59 (0.36, 0.80)	0.68 (0.44, 0.85)	<0.001
SVI - Household Composition & Disability	0.59 (0.29, 0.84)	0.54 (0.24, 0.80)	0.66 (0.38, 0.87)	<0.001
SVI - Housing Type & Transportation	0.65 (0.39, 0.84)	0.62 (0.36, 0.82)	0.69 (0.44, 0.86)	<0.001
SVI - Minority Status & Language	0.70 (0.51, 0.86)	0.68 (0.50, 0.85)	0.72 (0.52, 0.88)	<0.001
Obese				<0.001
No	222,656 (64%)	160,151 (80%)	62,505 (42%)	
Yes	125,925 (36%)	39,849 (20%)	86,076 (58%)	
Race				<0.001
White	199,091 (57%)	121,562 (61%)	77,529 (52%)	
Asian	8,103 (2%)	5,356 (3%)	2,747 (2%)	
Black or African American	65,916 (19%)	30,866 (15%)	35,050 (24%)	
Native Hawaiin or Other Pacific Islander	1,302 (0%)	750 (0%)	552 (0%)	
Other	22,561 (6%)	12,721 (6%)	9,840 (7%)	
Multirace	33,488 (10%)	16,920 (8%)	16,568 (11%)	
Unknown	18,120 (5%)	11,825 (6%)	6,295 (4%)	
Rural Status				<0.001
Rural	47,984 (14%)	22,996 (11%)	24,988 (17%)	
Urban	300,595 (86%)	177,004 (89%)	123,591 (83%)	

[1] Median (Q1, Q3); n (%)
[2] Wilcoxon rank sum test; Pearson's Chi-squared test

Table 1. Univariate Analysis for Hypertension

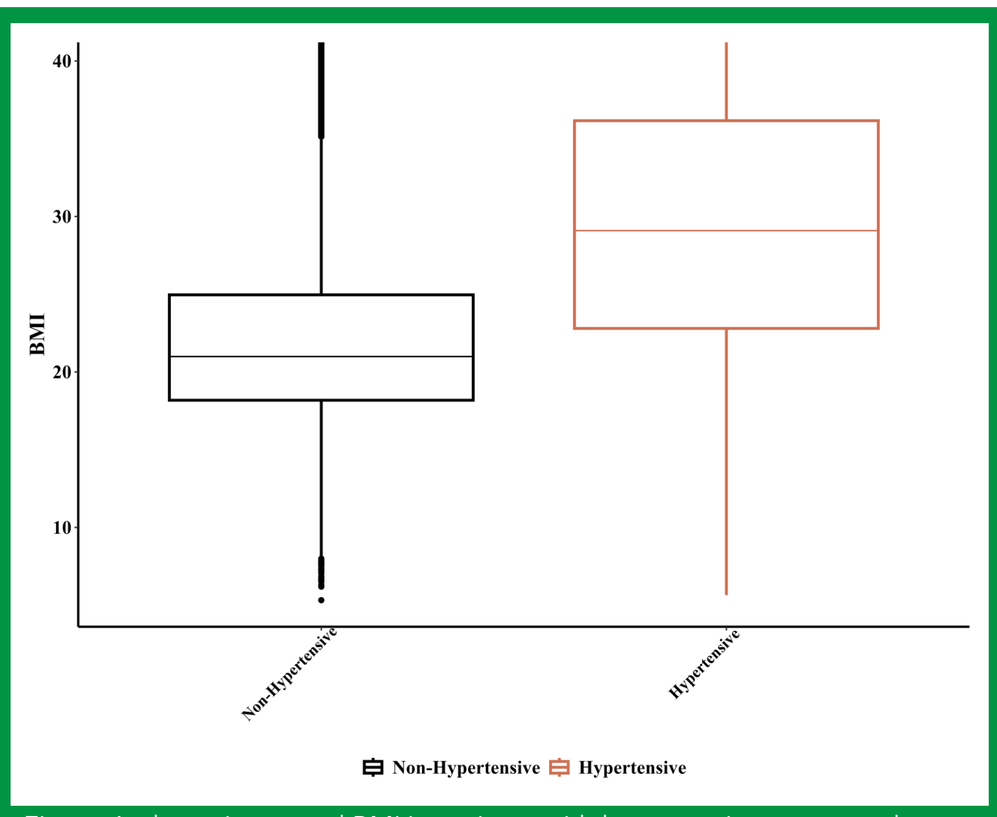


Figure 1. shows increased BMI in patients with hypertension compared to non-hypertensive patients.

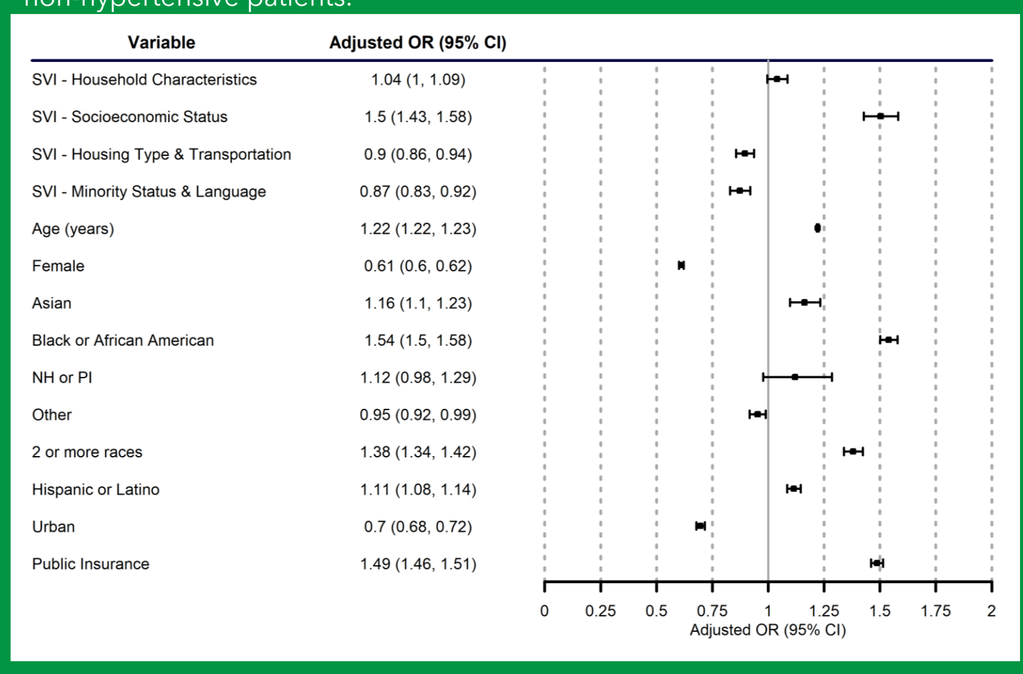


Figure 2. Multivariate regression model showing adjusted odds ratios for hypertension. Not included is Obesity with an adjusted odds ratio of 5.2 (95% confidence interval (CI) 5.1, 5.29)

Pediatric hypertension was linked to obesity, black or multiracial race, rural living, public insurance, and high social vulnerability, especially in socioeconomic status

Results

- We identified 148,581 patients with HTN and 16,973,958 controls
- Household composition showed increased risk of HTN (odds ratio (OR) = 1.56, 95% confidence interval (CI) [1.37, 1.78].
- Black or African American patients have a higher odds of hypertension (OR= 1.56 [1.52-1.58].
- Additionally, patients with HTN were more likely to reside in rural areas (17% vs. 11%, $p < 0.001$).

Conclusions

- Our findings highlight a need to focus risk factor mitigation efforts for pediatric patients with vulnerability in household composition.
- The data supports continued public and clinical health efforts to address obesity.
- While big data can reveal statistically significant patterns even with small differences, deeper analysis can highlight areas with considerable potential for impactful improvements.