How Environmental Risk Factors Drive Racial Disparities in Prostate Cancer Stage Diagnosis

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Introduction

- Prostate cancer is the leading cause of cancer among men in the U.S, primarily aged 65 and older.
- In research, prostate cancer shows significant, disproportional effects of 73% higher incidence rates and more than double higher rates of mortality in African American men when compared to Caucasian men.
- Additionally, AA men are diagnosed in younger ages with more aggressive tumors and advanced stages.
- Studies have linked these disparities to be associated with risk factors of socioeconomic, environmental, or biological influencers.
- In our study, we hypothesized environmental factors to be a contributor to the racial disparities in prostate cancer stage at diagnosis between African American and Caucasian men.

Objective

- Identify environmental variables associated with racial disparities in prostate cancer diagnosis outcomes among African American and Caucasian men and quantify their risk.

Methodology

- **Data Source**: Louisiana Tumor Registry (LTR) data from 2010 to 2018, 2010 Census Tract data, and Environmental Justice Index (EJI) data.

- **Participants**: N=24,647 men in Louisiana; African American (n=8,772 [36%]) and Caucasian (n=15,875 [64%])

- **Variables**: Outcome – stage at diagnosis, exposure – African American vs Caucasian, Exploratory Variables - (Marital Status, Insurance, Poverty, CDI, Ozone, Comorbidity, Acetaldehyde, Coal, Cancer Risk, etc.)

- **Methods**: Chi-Square test of association, T-Test, ANOVA, and Multiple Mediation Analysis were used to determine our variables' connection to racial disparity in stage
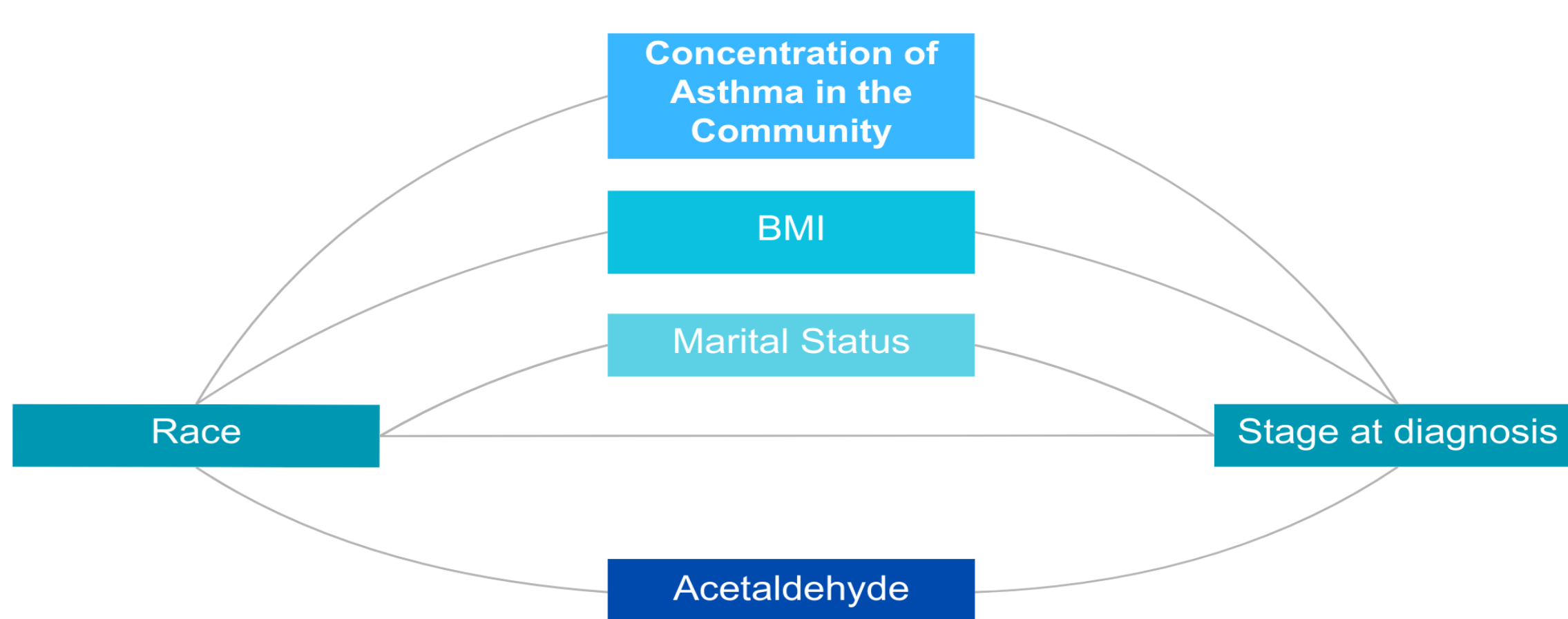
- **Analysis:** R Studio

Figure 1. Mediator chart of association between predictor, indicator, and outcome variables.

Results

	Chi-Square	P-Value
Race	10.406	0.001

*Test of association between stage and race

	Black/African American (N=8772)	White/ Caucasian (N=15875)	P-value
Stage			0.00126
Early stage	6905 (78.7%)	12771 (80.4%)	
Late stage	1867 (21.3%)	3104 (19.6%)	
Marital Status			<0.001
Married	4593 (52.4%)	10822 (68.2%)	
Not Married	3348 (38.2%)	3291 (20.7%)	
Insurance			<0.001
Private Insurance	2989 (34.1%)	6609 (41.6%)	
Public Insurance	5416 (61.7%)	8472 (53.4%)	
BMI			0.00523
Mean (SD)	29.2 (6.25)	29.4 (5.44)	
Comorbidity			<0.001
0	6765 (77.1%)	13457 (84.8%)	
1 or 2	1736 (19.8%)	2204 (13.9%)	
3 or above	271 (3.1%)	214 (1.3%)	
Poverty Indicator			<0.001
Mean (SD)	3.49 (0.749)	2.83 (0.917)	
Acetaldehyde			<0.001
Mean (SD)	2920 (14900)	2050 (12500)	
Cancer Risk due to Air Toxics			<0.001
Mean (SD)	0.864 (0.120)	0.858 (0.138)	
% of housing built before 1980 (Lead Exposure)			<0.001
Mean (SD)	59.9 (21.8)	46.7 (22.9)	
Neighborhood Walkability			<0.001
Mean (SD)	7.74 (3.21)	6.75 (2.81)	
Proximity to Railroad (1 mile radius)			<0.001
Mean (SD)	56.6 (37.1)	33.6 (33.4)	
Concentration of Asthma in the Community			<0.001
Mean (SD)	10.7 (1.47)	9.26 (1.13)	

Table 1. Comparison of socioeconomic and environmental variables between Black and White patients with p-value.
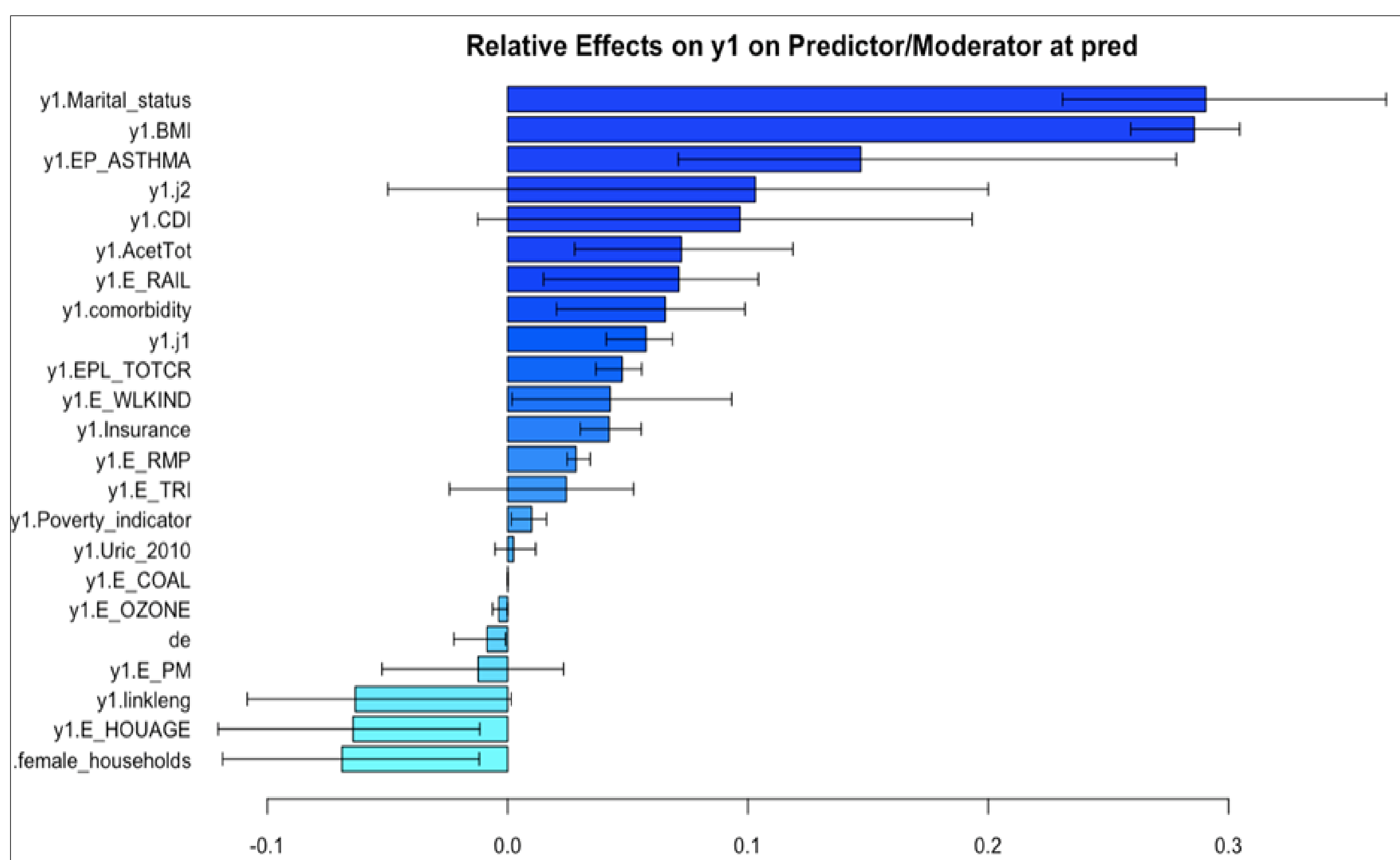

Figure 2: Relative Effects of mediators explaining the observed racial disparity in Prostate cancer patients.
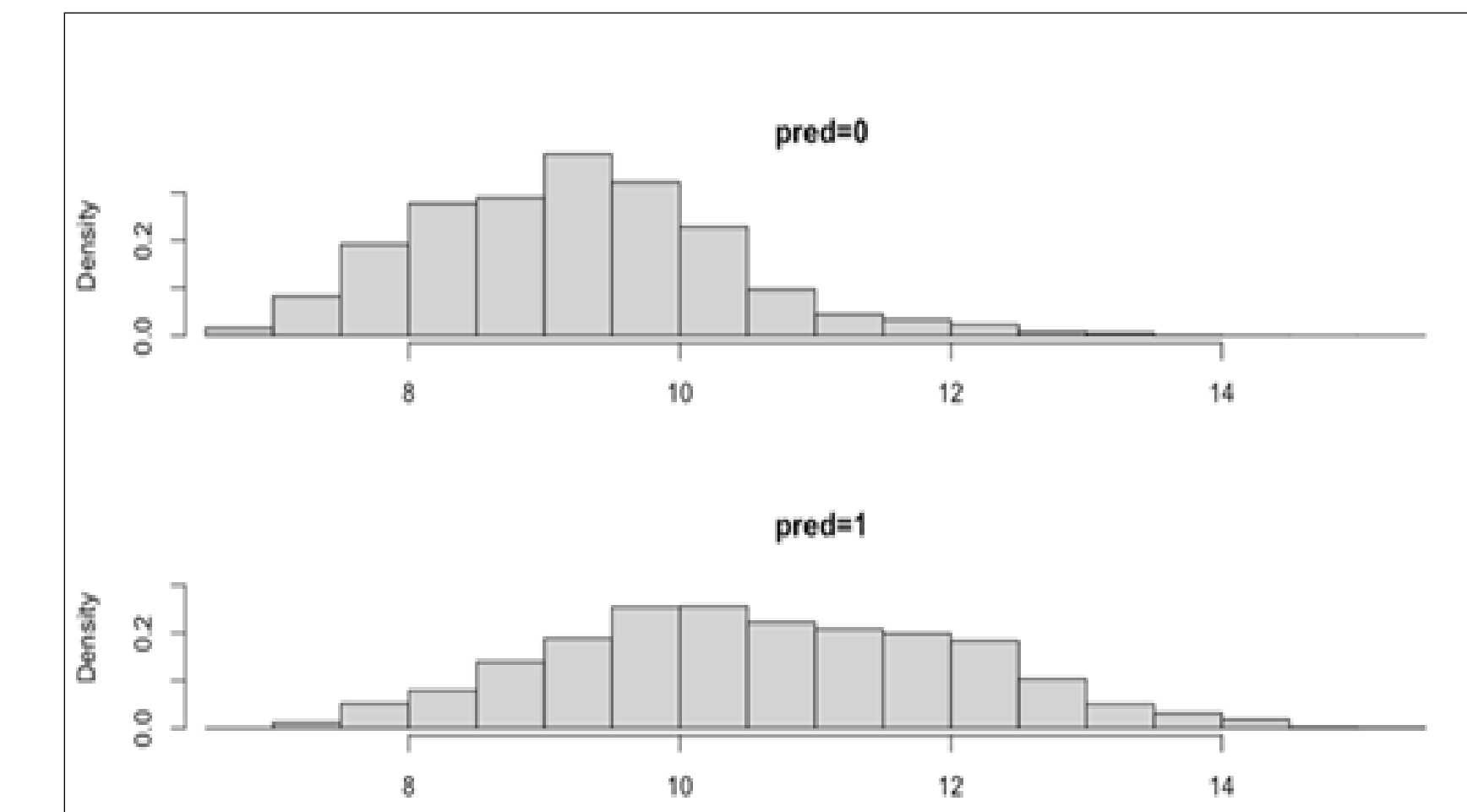
Results (Cont.)

Figure 3: Pred=0 is White and Pred=1 is Black. Higher proportion of White patients lived in areas where proportion of population with Asthma is low compared to Black patients.
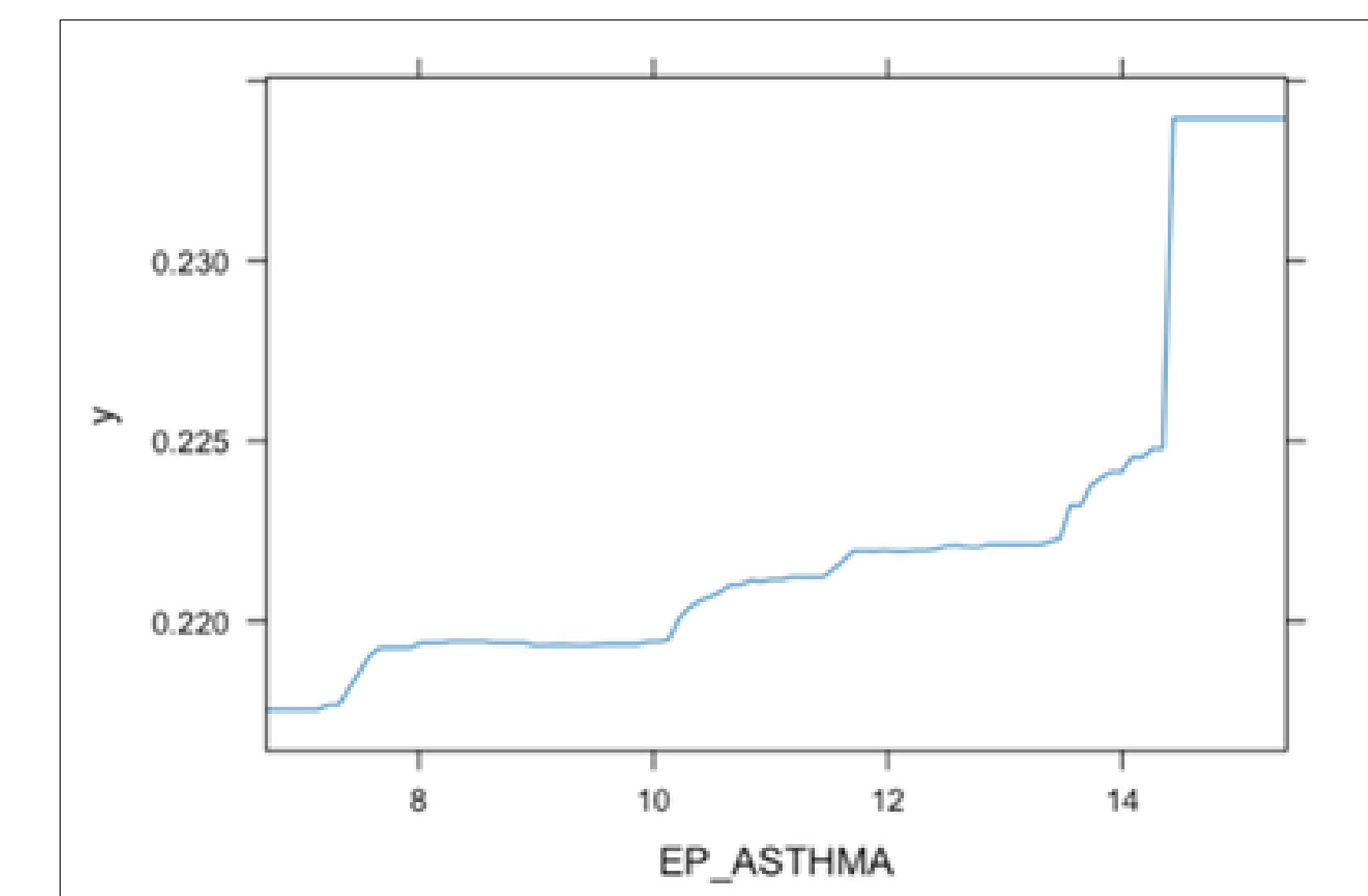

Figure 4: Living in areas with increased proportion of Asthma patients increases the probability of getting diagnosed at a later stage.

Discussion

- Our investigation found environmental variables to have a partial contribution in explaining the observed racial disparities in prostate cancer stage diagnosis through potential associations in Acetaldehyde (7.1%) and Cancer Risk due to Air Toxics (7.3%).

- Findings in this study were however consistent with previous literature showing that SES factors such as BMI (35.9%), marital status (31.9%), and insurance (7.3%) provide more significant impact in the disparity of prostate cancer diagnosis when compared to environmental exposure.

- Limitations: No genetic data were collected for the analysis, variables were limited to cancer registry standard data, and a study of African American and Caucasian cancer patients were only able to be considered due the sample size that was too small for other races.

Conclusion

- Environmental risk factors including Acetaldehyde, Concentration of Asthma in the Community, and Cancer Risk due to Air Toxins were identified in contributing an association among racial disparities in prostate cancer stage diagnosis between African American and Caucasian men.
- Further studies should investigate what chemical substances lead to air toxicity and cancer development in neighborhoods to help indicate other associate factors of disparities within cancer diagnosis

Acknowledgments