

Analyzing Traffic-Related Air Pollution Exposure in the Philadelphia Area

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Introduction

- Exposure to traffic-related air pollution (TRAP), especially fine matter particulate (PM_{2.5}), has been linked to an increased risk for the development and persistence of asthma.¹
- Socioeconomic status (SES) has most consistently accounted for observed differences in asthma prevalence rates between racial groups; those in poverty appear more strongly affected by heavy traffic near their homes.^{2,3}

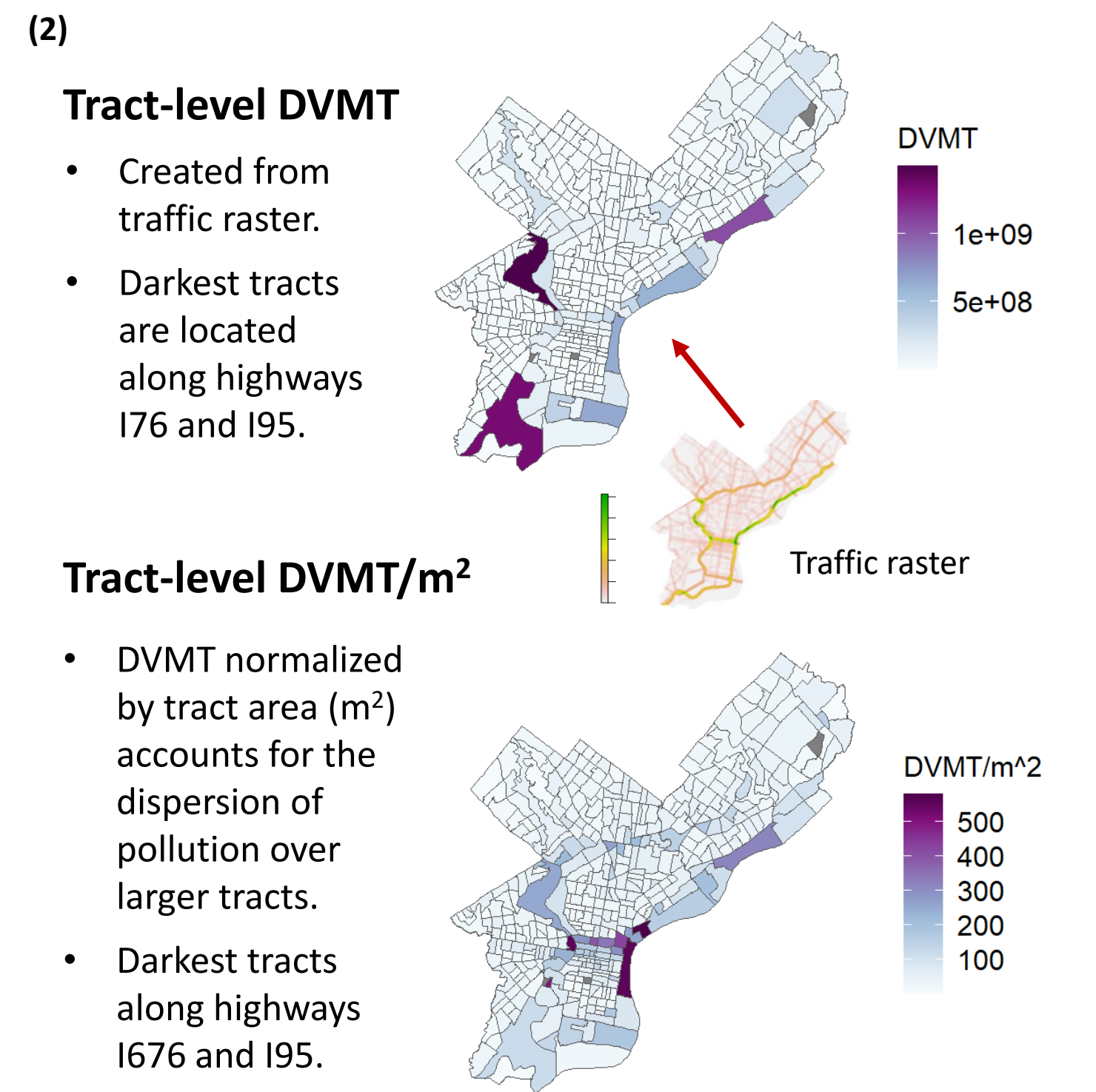
In this study, we aimed to... determine whether traffic volume is higher in Pennsylvania census tracts with greater proportion of racial/ethnic minority residents, lower median income, and/or other variables indicating lower SES.

Methods

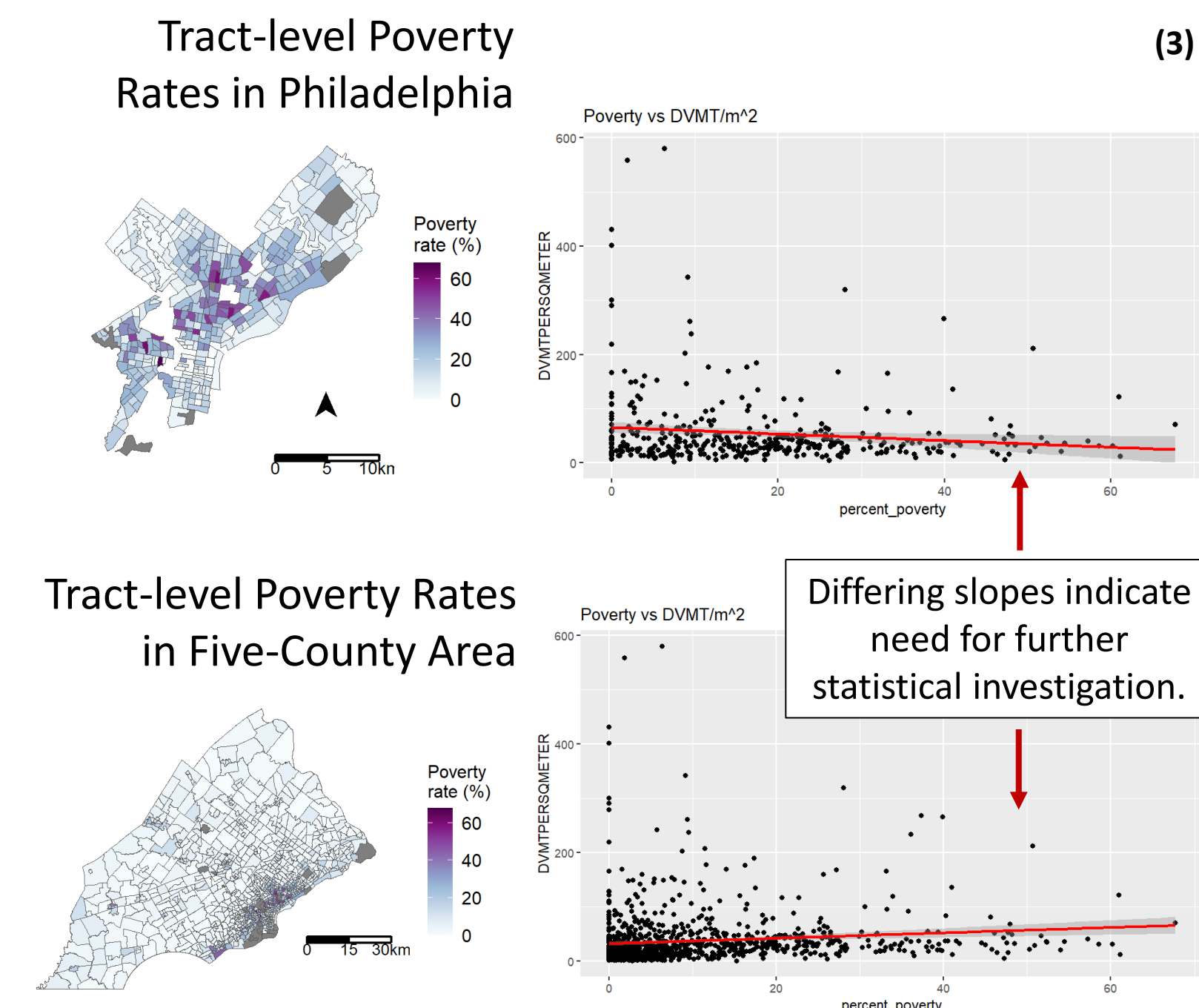
- Demographic variables and census tracts defined and collected by US Census and American Community Survey (ACS); traffic data collected by Pennsylvania Department of Transportation.
- (1) Extracted annual average daily traffic (AADT) from traffic data and converted AADT to daily vehicle miles traveled (DVMT) for traffic raster; constructed shapefiles for Philadelphia, Bucks, Chester, Delaware, and Montgomery counties.
- (2) Estimated DVMT per census tract to map tract-level DVMT and DVMT/m²; mapped additional tract-level ACS characteristics.
- (3) Plotted ACS characteristics against traffic volume of tracts, then calculated regression of DVMT/m² vs ACS characteristics w/ linear models.



Results



Example of tract-level ACS characteristic maps and corresponding regressions w/ linear models



Regression Table: Philadelphia vs Five-County Area

Philadelphia County

ACS Characteristics	P-value	Change in DVMT/m ² for every increase in 10% of population
Below poverty line	0.009977	-1.310056
White	< 2.2e-16	2.254249
Black	< 2.2e-16	-2.446769
American Indian and Alaskan Native	0.06017	-4.262571 *
Asian	1.162e-12	1.60273
Native Hawaiian and Pacific Islander	0.003263	0.6667236
Some Other Race	0.9855	0.004123906 *
Two or More Races	0.2288	0.3052692 *
Hispanic and/or Latino	0.5488	0.1521122 *
Noncitizen	1.57e-06	0.992078
Less than college-educated	< 2.2e-16	-1.993505
College-educated	< 2.2e-16	2.205828

Five-County Area

ACS Characteristics	P-value	Change in DVMT/m ² for every increase in 10% of population
Below poverty line	0.0001839	1.16909
White	6.689e-10	-1.358615
Black	0.005732	0.6102826
American Indian and Alaskan Native	0.7194	0.07943117 *
Asian	2.205e-14	1.676857
Native Hawaiian and Pacific Islander	0.006166	0.6050153
Some Other Race	8.925e-06	0.979723
Two or More Races	0.002244	0.6749059
Hispanic and/or Latino	5.632e-06	1.001242
Noncitizen	4.645e-15	1.719702
Less than college-educated	< 2.2e-16	-1.993505
College-educated	< 2.2e-16	2.205828

- Pink highlights ACS characteristics w/ rate of change for DVMT/m² observed in Philadelphia in opposite direction to rate observed in FCA.
- Yellow highlights ACS characteristics w/ rate of change for DVMT/m² observed in Philadelphia in same direction but also noticeably stronger in FCA.
- ACS characteristics marked by asterisk (*) did not have p-value meet < 0.05 threshold and should be considered w/ caution.

Conclusions

The demography of census tracts with highest traffic volumes in Philadelphia County appears to differ from the demography observed in the Five-County Area, deviating from hypothesized patterns.

- An increased percentage of White population is associated w/ positive change in DVMT/m² in Philadelphia while associated w/ negative change in the FCA; the opposite is true for an increased percentage of Black population, American Indian and Alaskan Native population, and population below the poverty line.
- Additionally, increased percentages of other minorities– such as those identifying as “Some Other Race”, multi-racial, Hispanic and/or Latino, and noncitizens– appear to have stronger associations w/ positive change in DVMT/m² in FCA tracts compared to just Philadelphia tracts.
- Philadelphia’s difference from the rest of the FCA may be explained by its large Black population and placement of highways near major tourist areas as opposed to residential neighborhoods like in the other counties.

Next steps can further explore... the different relationships between tract-level ACS variables and traffic volume in Philadelphia and the FCA utilizing methods such as correlation matrixes.

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References

