DATA REPORT

Health Behaviors & Outcomes
Transportation and Land Use Correlations

May 2022

Overview

More detailed health behavior and outcome data have recently become available at the Census tract level. These include: obesity, physical inactivity, asthma, poor reported health rates, and more. They allow us to measure correlations between transportation and land use factors that may impact health. These include: the presence of nearby walkable destinations, parks, freight routes, and polluting sites.

The new data also allow us to compare correlations between areas of concern identified by our Social Determinants of Health (SDOH) index and the new health data. WILMAPCO's SDOH index (see our April 2019 Data Report*) includes multiple categories of health stressors shown to impact health outcomes, including: income, education, employment, racial/ethnic minority segregation, homeownership, and food access. We have used the index to help prioritize transportation projects — awarding bonus points to projects in areas of high concern — while it has supported public health professionals with outreach and interventions, such as the COVID pandemic response.

The WILMAPCO SDOH index shows several moderate to significant correlations with health risks and observed conditions. Those correlations are much stronger than the widely used Social Vulnerability Index (SVI), developed by the Centers for Disease Control and Prevention.

We used the coefficient of determination, or R^2, to measure the association between areas of escalating SDOH/SVI concern and health behaviors and outcomes. Higher values have greater association, with 1 being a complete correlation and 0 none.

Asthma and poor mental health had the highest correlations, while high blood pressure and poor reported health had no correlation.

Social Vulnerability Index vs. Social Determinants of Health Index: Correlations with Health Risks and Conditions within WILMAPCO Regional Census Tracts
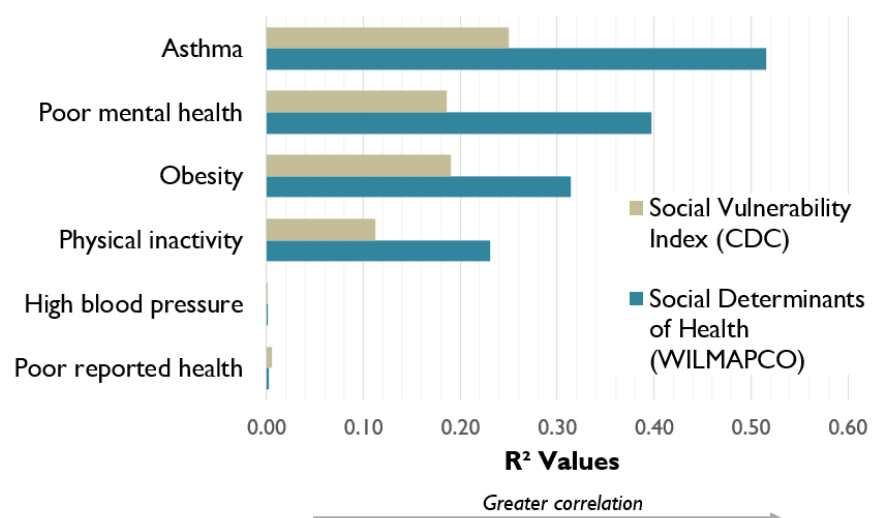
Data & Methodology

A variety of data and analyses are used in this report. All were collected and analyzed at the Census Tract level.

Health behaviors and outcomes data were pulled from PolicyMap by Healthy Communities Delaware. They originate from the Behavioral Risk Factor Surveillance System (BRFSS) and represent the latest data available on PolicyMap as of March 2021:

- **Poor Health** — estimated percent of adults reporting 14 or more days of poor health in the past 30 days
- **High Blood Pressure** — estimated percent of adults ever diagnosed with high blood pressure
- **Obesity** — estimated percent of adults reporting to be obese (a body mass index greater than 30)
- **Asthma** — estimated percent of adults reporting to have asthma in 2018
- **Poor Mental Health** — est. percent of adults reporting 14 or more days of poor mental health in the last 30 days
- **Physical Inactivity** — estimated percent of adults reporting to be physically inactive in the last 30 days

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Socio-economic, transportation, and land use data, meanwhile, were gathered from a variety of sources. They were analyzed by WILMAPCO as follows:

- **Minority** — inverse of the percent of the non-Hispanic White population (ACS, 2015-9)
- **Renter Occupied** — percent of households occupied by renters (ACS, 2015-9)
- **Single Parent Households** — percent of single parent households (ACS, 2015-9)
- **Households in Poverty** — percent of households living in poverty (ACS, 2015-9)
- **Household Income** — median household income (ACS, 2015-9)
- **Housing Near Busy Road** — percent of households within 1/4 mile of a busy roadway, (+20k AADT) (DelDOT/SHA)
- **Housing Near Freight Network** — percent of households within 1/4 mile of the freight network (New Castle Co. only) (WILMAPCO)
- **Housing Near Industrial Zone** — percent of households within 1 mile of industrially zoned land (Delaware, Cecil County)
- **Air Violations** — number of air pollution violations within 1 mile of individual Census Tracts, October 2019 thru June 2020 (Clean Air Council, DNREC, and MDE)

Pixabay

Social Vulnerability Index vs. Social Determinants of Health

The Social Vulnerability Index (SVI), developed by the Centers for Disease Control and Prevention (CDC), aims to identify communities socially vulnerable to natural and man-made disasters. The SVI has been widely applied by both transportation and public health professionals. The Federal Highway Administration (FHWA) leans heavily on SVI in its scoring of Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant project proposals, for example, while Delaware's Division of Public Health and Healthy Communities Delaware have tapped SVI to identify vulnerable communities.

Tiger Lily

Social Determinants of Health (SDOH) are conditions in which people live that impact their health. WILMAPCO developed its SDOH index during our collaborative, community-based planning work along the Route 9 Corridor*. The SDOH index has influenced transportation project prioritization, while public health professionals have employed its use with prevention outreach and interventions. For example, Wilmington's COVID-19 Community Response Team targeted areas of high SDOH concern and low COVID-19 testing and vaccine uptake with additional intervention, while Delaware Guidance Services used the SDOH index to help locate a new mental health facility.

Both the SVI and the SDOH index rely on Census Tracts and their associated data. These data, shown below, are equally weighted in each index. And while both the SVI and SDOH utilize several similar measures – including poverty, education and minority segregation – each also features unique factors. SDOH examines homeownership, time-in-residence and food desert status, for example, while the SVI has ten exclusive measures. These include: concentrations of children and senior populations and the presence of multi-unit dwelling units.

Anna Shvets

| SVI-specific Measures		Shared (SVI & SDOH) Measures	SDOH-specific Measures
Income	Multi-units	Poverty	
Children	Mobile homes	Education	Homeownership
Limited English	Crowding	Minority segregation	Time-in-residence
Seniors	No vehicle	Employment	Food deserts
Disabled	Group quarters	Single parents	

Health Risks: SVI vs. SDOH

As shown on the graph on the front page and in the table to the right, the SVI has much weaker correlations to many health behaviors and outcomes, relative to the SDOH index. More incidences of obesity, asthma, poor mental health, and physical activity are common within areas of SDOH concern. SVI is a much broader index, designed to identify a wide swath of vulnerable populations. SDOH, meanwhile, targets fewer measures that specifically impact health outcomes. The inclusion of variables such as multi-unit dwellings and the presence of children likely account for SVI's weaker performance.

R-value (Correlation)

	SVI	SDOH
Asthma	0.25	0.52
Poor mental health	0.19	0.40
Obesity	0.19	0.31
Physical inactivity	0.11	0.23
Poor reported health	0.01	0.00
High blood pressure	0.00	0.00

Neither the SVI or SDOH indices showed correlations with poor reported health or high blood pressure. These conditions are better correlated with other factors, such as advancing age. Higher median age showed some correlation with high blood pressure (0.08) and even better correlation (0.18) with poor reported health.

The maps below show that there is significant overlap between the places with the highest and lowest scores on the SVI and SDOH index. A key difference is that the areas of the most SDOH concern are mainly within the City of Wilmington and along the Route 9 corridor south of that city. Areas of strong SVI concern are more dispersed. They appear in Wilmington's western suburbs and along the US 40 corridor between New Castle and Elkton.
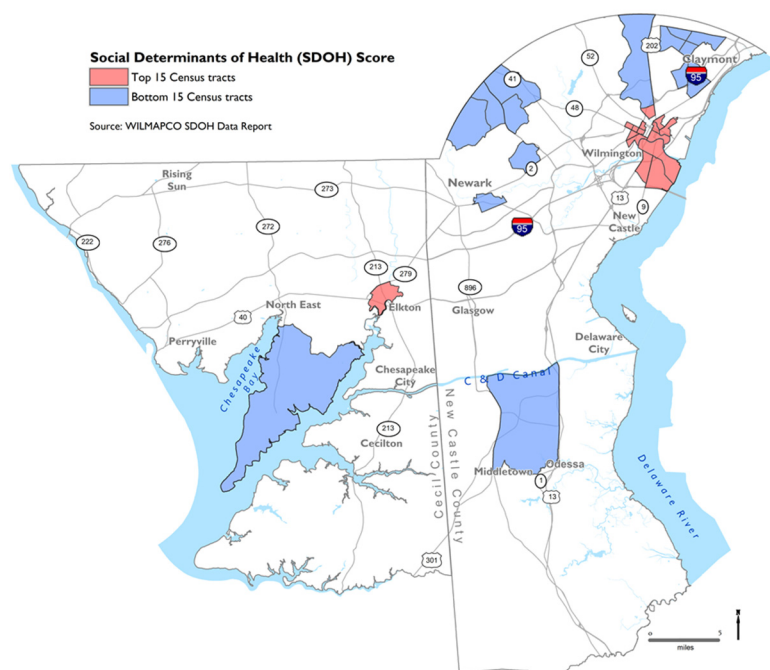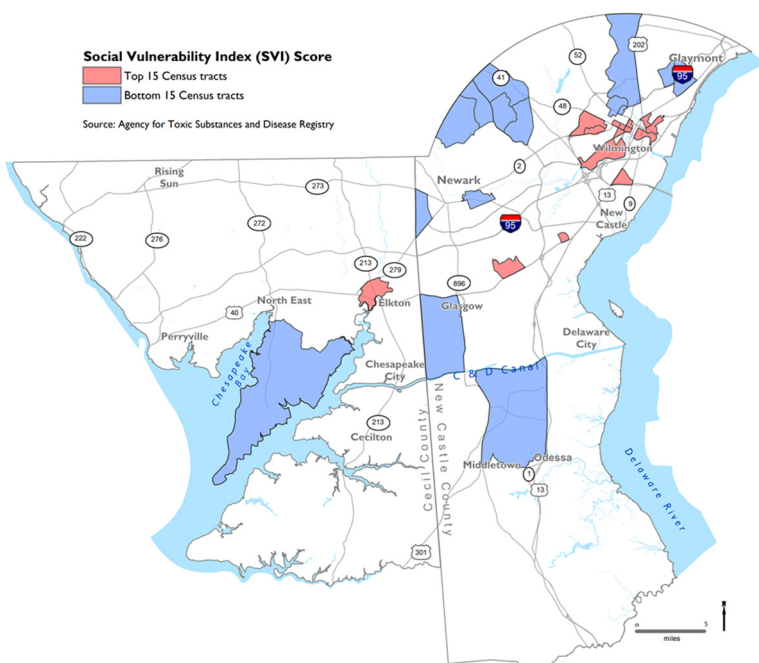
Asthma

Higher adult asthma rates in the WILMAPCO region show mixed correlations with both SDOH-related and transportation and land use factors.

Specific to the latter, places with higher asthma rates show no correlation with either the presence of a nearby busy road (0) or park (0.02). Some places with high asthma are nearby these features and others are not.

Moderate correlations can be shown to the freight network, or principal truck routes (0.08) and industrial zoned land (0.13). A better still correlation can be shown to higher asthma Census Tracts and sites cited with air violations (0.33).

Higher asthma is also correlated with good walking connectivity (0.37) and bus access (0.33). Places with high asthma rates, such as in Wilmington, have better walking connections and bus access.

R-value (Correlation)

	Asthma vs.
Poor mental health	0.59
Obesity	0.47
Physical inactivity	0.36
Income	0.34
Poor physical health	0.04
Transportation and Land Use	
Good walk connectivity	0.37
Air violations	0.33
Good bus access	0.28
Industrial zones	0.13
Nearby parks	0.02
Busy road	0.00

The map below shows the places with the most and least asthma in the region. High asthma areas are almost exclusively found in and around the City of Wilmington, while the lowest asthma areas are mostly found along the SR 2 Corridor and in hilly suburbs to its north.
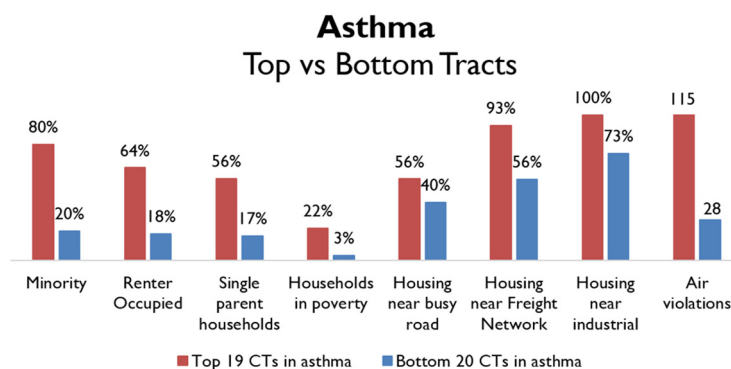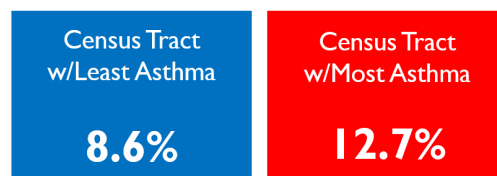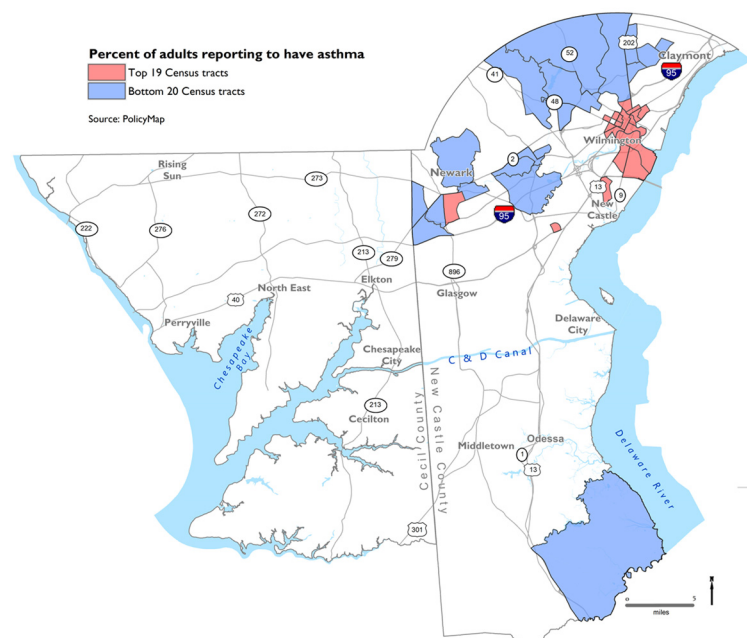
While there is a limited range between the tracts with the least and most percentage of adults struggling with asthma, stark demographic and transportation and land use differences between top and bottom asthma census tracts are present. For example, 115 air violations were recorded between October 2019 and June 2020 near places with the most asthma, while only 28 were nearby tracts with the least.

Percent of adults reporting to have asthma
- Top 19 Census tracts
- Bottom 20 Census tracts

Source: PolicyMap

Census Tract w/Least Asthma	Census Tract w/Most Asthma
8.6%	12.7%

Asthma
Top vs Bottom Tracts

	Minority	Renter Occupied	Single parent households	Households in poverty	Housing near busy road	Housing near Freight Network	Housing near industrial	Air violations
Top 19 CTs in asthma	80%	64%	56%	22%	56%	93%	100%	115
Bottom 20 CTs in asthma	20%	18%	17%	3%	40%	56%	73%	28

Asthma: Scatterplots

The scatter plots below show correlations, or lack thereof, between asthma rates and selected transportation and land-use conditions. Individual census tracts are represented by a blue dot. Dots further to the right have higher asthma rates, while those further to the top have more exposure to the transportation or land use condition.
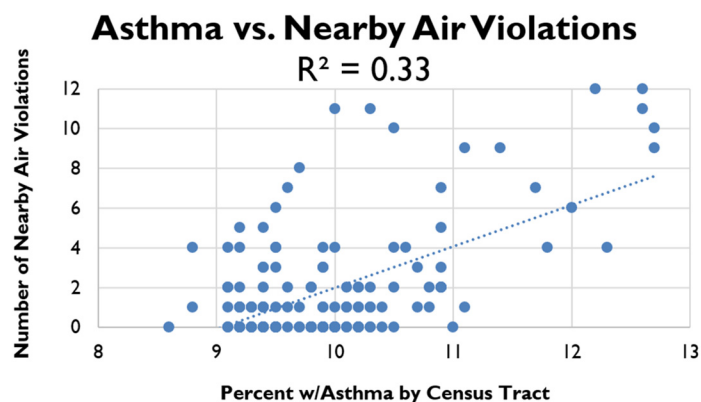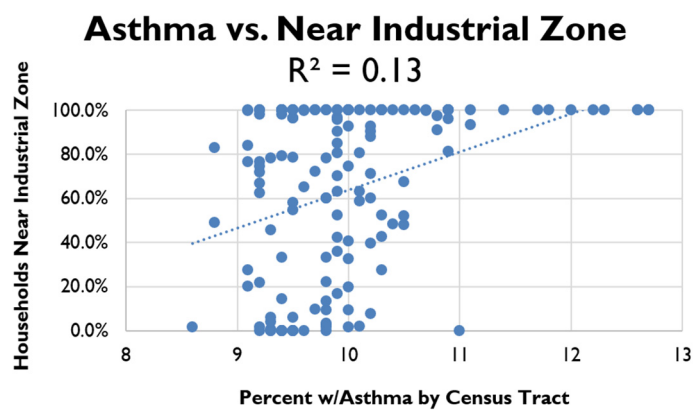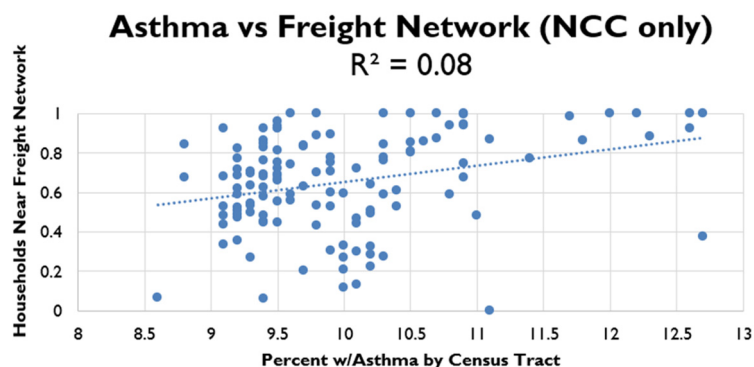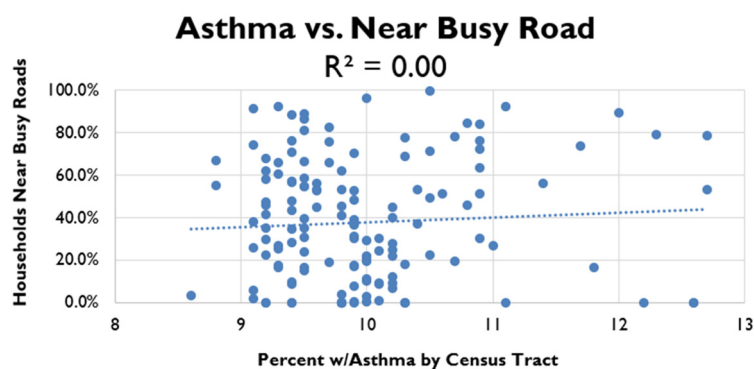
DelDOT

Physical Inactivity

Higher physical inactivity rates in the WILMAPCO region show mixed correlations with both SDOH-related and transportation and land use factors.
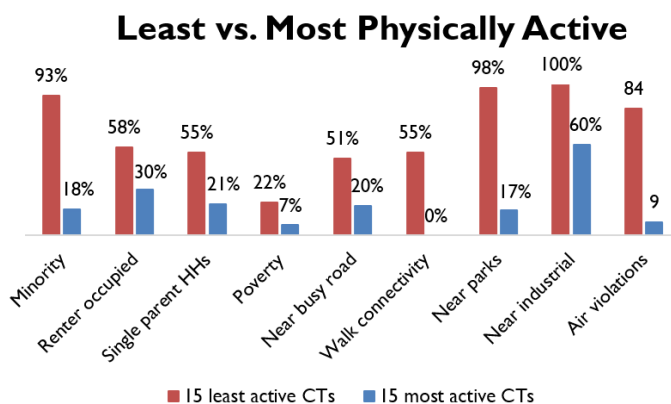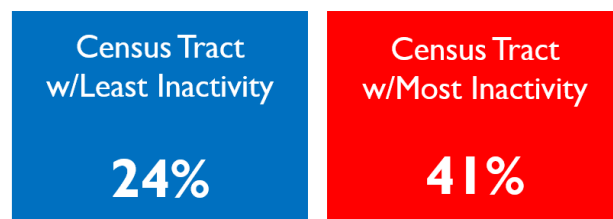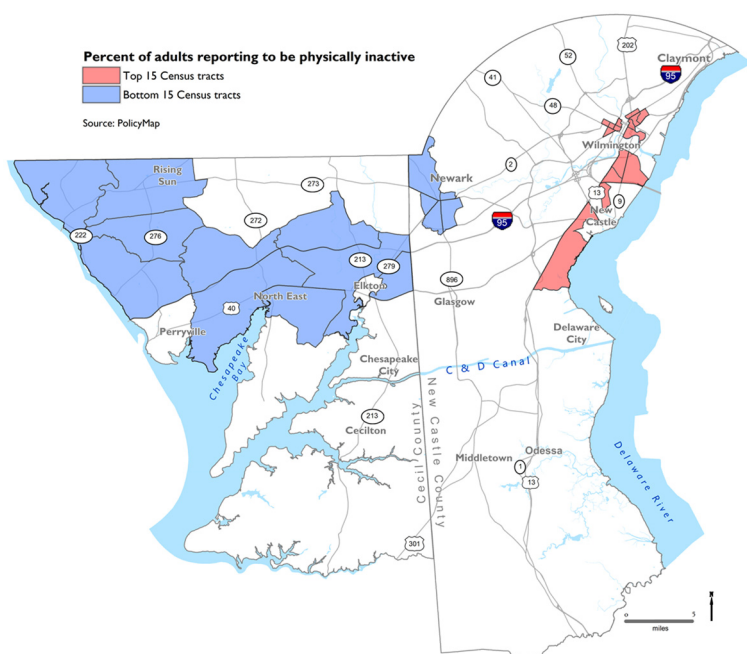
Specific to the latter, places with more physical inactivity show no correlation with the presence of a nearby busy road (0.01) and positive correlations with walking, park, and bus access (0.21—0.25). These inverse correlations suggest other factors are the key drivers of physical inactivity. Obesity (0.81), poor physical health (0.50), lower incomes (0.08) meanwhile, show positive correlations.

R-value (Correlation)

	Physical Inactivity vs.
Obesity	0.81
Poor physical health	0.50
Income	0.08
Poor mental health	0.03
Transportation and Land Use	
Good bus access	0.25
Nearby parks	0.22
Good walk connectivity	0.21
Busy road	0.01

The map below illustrates the places with the most and least physical inactivity. Census Tracts with the least physical inactivity (or the places that are most active) stretch across northern Cecil County to the City of Newark. Places with the most physical inactivity (the least active) are within the City of Wilmington and in its southern suburbs along the US 13/SR 9 corridors.

Significant differences between the areas with the most and least physical inactivity are evident. Nearly all residents of the most physically inactive places are racial/ethnic minorities (93%) and more than half are renters (58%). These communities are also about twice as likely to be nearby busy roads and industrially zoned lands as places with the least physical inactivity.

Percent of adults reporting to be physically inactive
- Top 15 Census tracts
- Bottom 15 Census tracts

Source: PolicyMap

Census Tract w/Least Inactivity

24%

Census Tract w/Most Inactivity

41%

Least vs. Most Physically Active

|	Minority	Renter occupied	Single parent HHs	Poverty	Near busy road	Walk connectivity	Near parks	Near industrial	Air violations
15 least active CTs	93%	58%	55%	22%	51%	55%	98%	100%	84
15 most active CTs	18%	30%	21%	7%	20%	0%	17%	60%	9

Physical Inactivity: Scatterplots

The scatter plots below show correlations, or lack thereof, between physical inactivity rates and selected transportation and land use conditions and other health conditions. Individual Census Tracts are represented by a blue dot. Dots further to the right have higher physical inactivity rates, while those further to the top have more exposure to the transportation, land use, or other health conditions.
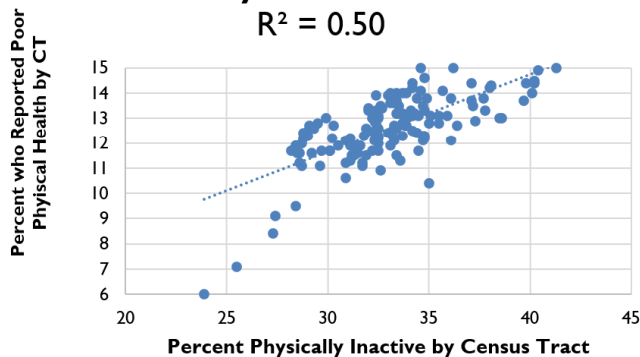
Physical Inactivity vs. Proximity to Busy Road
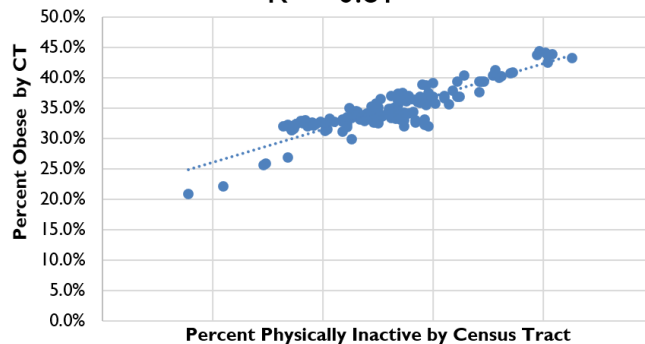$R^2 = 0.01$
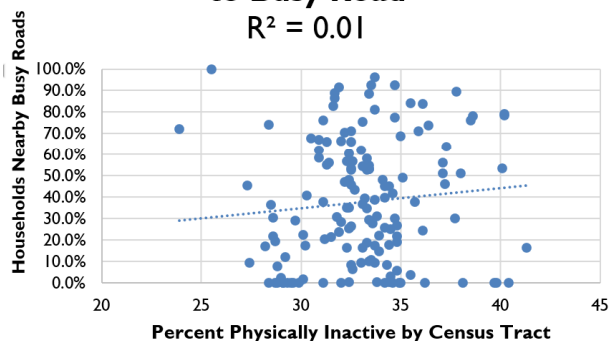
Physical Inactivity vs. Walk Connectivity
$R^2 = 0.21$
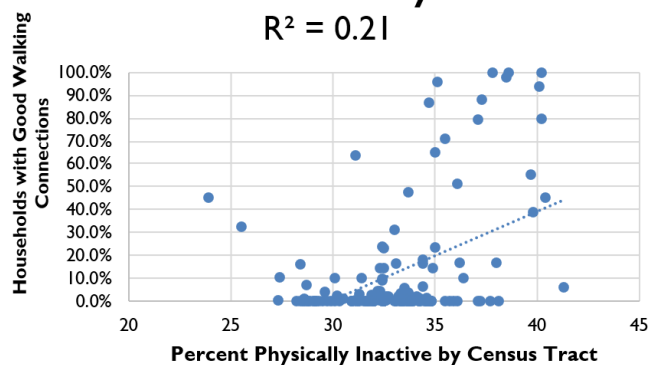
Physical Inactivity vs. Poor Physical Health
$R^2 = 0.50$

Physical Inactivity vs. Obesity
$R^2 = 0.81$

Anastasia Shuraeva

Takeaways and Next Steps

This Data Report marked the first time WILMAPCO analyzed Census Tract level health data vis-à-vis transportation and land use factors. Many of the results were as expected, while some were surprising.

The strong correlations uncovered between our Social Determinants of Health (SDOH) index and health behaviors and outcomes — such as asthma and obesity – gives us confidence in the continued use of SDOH as a planning and project prioritization tool. The SDOH index's stronger correlations relative to the Social Vulnerability Index (SVI), moreover, gives us further confidence in SDOH and pause with applying SVI specific to identifying areas of health concern. The absence of correlations between both indices and poor reported health is a reminder their limitations.

Specific to asthma, we uncovered overall stronger correlations with health and SDOH factors, such as obesity and income, rather than transportation and land use conditions, like proximity to busy roads. Proximity to air polluting sites, however, was a notable exception. We also noted a limited range between Census Tracts with the lowest asthma rates (about 8%) and those with the most (about 12%). Nevertheless, stark differences are present between communities at either end of the scale, both in their demographic makeup and their built environmental conditions.

With regards to physical inactivity, we found very strong correlations with poor reported health and obesity, but no or inverse correlations to transportation and land use conditions. Areas with more physical inactivity had better walking connections, bus access, and were more likely to be nearby parks. While sidewalks, pathways and parks promote more physical activity, and while our analysis did not consider important other factors such as personal safety or lighting conditions, these results still suggest their limited impact on influencing physical activity relative to deeper SDOH factors. We also noted a wide range between Census Tracts with the lowest physical inactivity rates (about 24%) and those with the most (about 41%). Significant demographic differences are present between these communities and the transportation and land use conditions they experience.

It is important to stress that the correlations found in this report do not equate to causation, but may well stem from other influencing factors. They do, however, advance a conversation about the role transportation and land use plays in community health.

WILMAPCO will examine further strengthening its SDOH index to provide even better connections to health risks and conditions.

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The Wilmington Area Planning Council (WILMAPCO) is the Metropolitan Planning Organization serving New Castle County, Delaware and Cecil County, Maryland.

This data report is part of a series that summarizes key data to allow both residents and decision-makers to better understand our region.

Other data reports are available at:
www.wilmapco.org/data-reports.