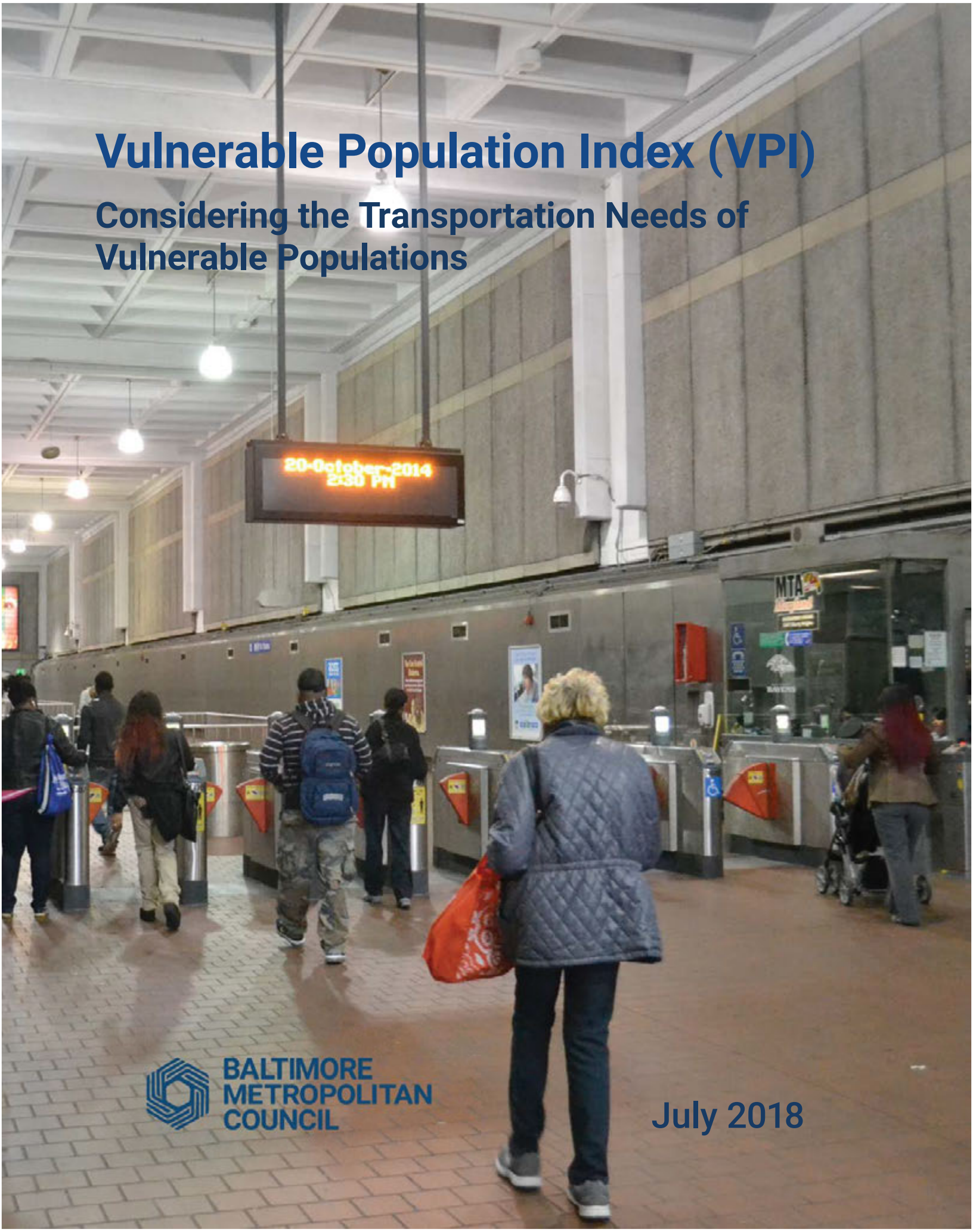
Vulnerable Population Index (VPI)

Considering the Transportation Needs of Vulnerable Populations



BALTIMORE METROPOLITAN COUNCIL

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"We have a responsibility as a state to protect our most vulnerable citizens: our children, seniors, people with disabilities. That is our moral obligation. But there is an economic justification too. We all pay when the basic needs of our citizens are unmet."

— John Lynch, Governor of New Hampshire, 2005-2013

The Baltimore Regional Transportation Board operates its programs and services without regard to race, color, or national origin in accordance with Title VI of the Civil Rights Act of 1964, and other applicable laws.

Qualified individuals with disabilities or those in need of language assistance can receive appropriate services by submitting a request at least seven days prior to a meeting. Call 410-732-0500.

The U.S. Department of Transportation, (the Federal Highway Administration, and the Federal Transit Administration) and the Maryland Department of Transportation contributed funding towards the preparation of the Addendum to the FY 2018-2019 Unified Planning Work Program.

Vulnerable Population Index

Vulnerable Populations and Transportation Decisions

As the council of governments for the Baltimore region, the Baltimore Metropolitan Council (BMC) has many functions and responsibilities. One of the most important of BMC's functions is to provide technical staff to support the Baltimore Regional Transportation Board (BRTB).

As the federally designated Metropolitan Planning Organization (MPO) for the region, the BRTB works with partners in the region to set transportation policies and make decisions about how and when to invest federal transportation funds to address regional needs.

Analyzing how these transportation policies and investment decisions could affect the region's traveling public is critical. On a broad, regional level, this involves analyzing data related to existing and proposed transportation systems and facilities. How effective are these systems and facilities in moving people and goods? Do these systems and facilities operate in an environmentally responsible way? Do they help to advance the overall prosperity of the region?

On a personal, community-based level, analyses consider how policies and investments could affect the region's most vulnerable people. This involves analyzing data on the conditions or circumstances that can limit the ability of some people to share the benefits of transportation investments or to access specific destinations and opportunities. Another important consideration is whether people have the opportunity and means to voice their opinions about proposed investments.

COMPLYING WITH TITLE VI AND ENVIRONMENTAL JUSTICE REQUIREMENTS

A fundamental part of these analyses is making sure the BRTB complies with the requirements of Title VI of the Civil Rights Act of 1964 and of Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low Income Populations."

Title VI states that no person in the U.S. shall, on the basis of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. Because the BRTB receives federal funding to carry out its transportation planning function, its programs and products must comply with Title VI.

Executive Order 12898 centers on the concept of Environmental Justice. Environmental Justice seeks to ensure that the benefits and burdens of transportation investments are shared as equitably as possible among all affected communities. Executive Order 12898 and its accompanying memorandum reinforce the requirements of Title VI that focus federal attention on environmental and public health conditions in minority and low-income communities.

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Vulnerable Population Index

CONSIDERING THE NEEDS OF UNDERSERVED POPULATIONS

Federal law and regulations require the BRTB to consult with the public when conducting transportation planning. Part of this process involves "seeking out and considering the needs of those traditionally underserved by existing transportation systems, such as low-income and minority households, who may face challenges accessing employment and other services" [23 Code of Federal Regulations, §450.316(a)(1)(vii)]. This is an important part of the BRTB's public outreach efforts. These efforts depend on data on underserved populations to let policy makers know where and how to engage people most effectively.

HELPING DISADVANTAGED PEOPLE GET WHERE THEY NEED TO GO

Another important part of these analyses is to determine how transportation facilities can better serve the travel needs of vulnerable groups, including people who either don't or can't drive. Do transportation facilities help people get where they need to go—jobs, school, medical care, shopping? Which investments could improve the ability of disadvantaged people to reach specific destinations and opportunities?

Identifying Vulnerable Populations – Data and Maps

This document describes the data and the analyses undertaken by BMC staff to identify the region's vulnerable people and groups. It also includes maps showing concentrations of vulnerable groups. The following seven populations were determined to be vulnerable – based on an understanding of both federal requirements and regional demographics:

Groups include:

1. Poverty
2. Non-Hispanic, Non-White
3. Hispanic
4. Limited English Proficiency (LEP)
5. Disabled
6. Elderly
7. Carless

This document presents data on these groups as a composite score. The regional mean remains the threshold for determining vulnerable populations. The composite score can aid in determining where the interaction of multiple factors might increase the vulnerability of populations.

This report also displays data for each vulnerable population individually, enabling a focus on particular vulnerable groups. For example, project sponsors who wish to find opportunities to improve outreach to underserved groups can look at the LEP group data and map. These could help them to identify potential locations for public meetings in the community. These meetings could be conducted with specific translators on hand to help with communication.

As another example, transit operators who wish to improve access to an employment center can look at the data and maps showing concentrations of disabled and carless people. These resources could help them to identify new bus routes and service hours to help people get to and from jobs.

This report also provides a histogram of the tract-level data for each vulnerable population. Histograms allow us to better visualize the distribution of data by dividing the range of values for a variable into intervals and counting how many values fall within these intervals.

This report will be accompanied by a web mapping application that will allow interested parties to view the data online. Researchers can take advantage of the ability to mix and match different data layers to look at communities that have concentrations of multiple vulnerable groups. This could help with extending outreach efforts and with making decisions on potential transportation investments.

METHODS

NCHRP Report 532, *Effective Methods for Environmental Justice Assessment* (2004), lists threshold analysis as one of the possible methods of identifying protected populations. The U.S. EPA report *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis* (2016) suggests incorporating poverty thresholds and other demographic factors in analyzing the impacts of "industrial, governmental, and commercial operations." In recent years, threshold analysis has been applied to support Title VI and EJ planning activities at MPOs such as the Delaware Valley Regional Planning Commission (DVRPC) and the Des Moines Area Metropolitan Planning Organization.

The BRTB uses data from the U.S. Census Bureau to determine the concentrations of seven sensitive populations for the region and for each Census tract. A tract with a concentration of a sensitive population greater than the concentration of the Baltimore region as a whole is considered to be "vulnerable" for the sensitive population. The VPI indicates the number of vulnerable populations for each tract and thus provides a general indication of the extent to which each tract is vulnerable.

COMPARABILITY BETWEEN 2012 AND 2017 VULNERABLE POPULATION INDICES

There are several key differences between the 2012 and the 2017 Vulnerable Population Indices. For this VPI, data for Queen Anne's County is included. This creates a small difference in the regional average of most factors as well as an increase in regional population counts for each factor.

Since the publication of the first VPI, the American Community Survey (ACS) changed the way disability information was collected during the survey. This was done to correct a perceived overcount of disabled

populations. Because of this, the disabled population in the VPI appears to decrease significantly in the region and in some Census tracts. This is due to a change in how the data was collected and does not reflect actual population counts. Other potential sources of difference include changes in sample size, the removal of zero population and "no data" tracts, and minor changes in how the tracts percentages were calculated in certain variables.

The addition of a two-tiered scoring system doubles the potential score of any tract. This does not necessarily mean this tract is more vulnerable than before. The new scoring method allows for analysis at a finer level of detail. Because of this and the changes explained above, BMC does not recommend directly comparing the 2012 and 2017 VPI data, especially looking at change over time.

VULNERABLE POPULATION INDEX – METHODOLOGY

The following section details the methods used to map individual vulnerable populations and to calculate the composite index.

Mapping Individual Vulnerable Populations data

Individual variables are displayed with three categories above the mean. These categories are calculated by dividing the range of values above the regional mean into equally-sized intervals. The following method is used:

Step 1

Obtain the most recent data for each vulnerable population in raw form from the American Community Survey (ACS) to determine the regional concentration for each of the vulnerable populations. The regional mean is derived from aggregating county data. For example:

Regional Concentration% = Regional Vulnerable Population / Regional Population Total

Step 2

Determine the concentration of each vulnerable population for each Census tract. For example:

Tract Concentration% = Tract Vulnerable Population / Tract Population Total

Step 3

Determine the range above the regional concentration for each vulnerable population by identifying the tract with the maximum value. For example:

Range above Regional Concentration% = Maximum Tract Concentration% – Regional Concentration%

Step 4

Calculate three equally-sized intervals for the purposes of mapping each vulnerable population. For example:

Interval Size = Range above Regional Concentration% / 3

Step 5

Assign each tract to a map classification at the appropriate interval above the regional concentration. For example, if the regional concentration is 20% and the tract with the highest value has a concentration of 50%, equally-sized intervals would extend from 20%-30%, 30%-40%, and 40%-50%. All tracts with a value below the regional mean, in this case 20% would be in the lowest class

Each tract is then displayed according to the interval it falls within. This method is applied to the data for each of the seven vulnerable population groups.

COMPOSITE INDEX

As with individual variables, the regional mean remains the threshold for determining vulnerable populations. The previous vulnerable population index assigned Census tracts a value of 1 if the concentration of a vulnerable population in that tract was greater than the regional concentration. A tract was assigned a 0 otherwise. The index for each tract was created by summing the assigned values for each of the seven vulnerable populations. Thus, a tract would have a maximum VPI score of 7 if each of the seven vulnerable populations in that tract were present at concentrations greater than the regional concentration.

Under the previous VPI, all tracts with a concentration exceeding the regional concentration received the same value. The new VPI retains the methodology from the previous VPI while expanding the values assigned to a tract to include 1 and 2. Expanding the number of classes helps to differentiate between tracts that have extreme values and those that have values above but close to the regional concentration. A brief description of the methods used follows:

Step 1

Obtain the most recent data for each vulnerable population in raw form from the ACS to determine the regional concentration for each of the vulnerable populations. Data used for this analysis are from the 2011-2015 ACS. The regional mean is derived from aggregating county data. For example:

Regional Concentration% = Regional Vulnerable Population / Regional Population Total

Step 2

Determine the concentration of each sensitive population for each Census tract. For example:

Tract Concentration% = Tract Vulnerable Population / Tract Population Total

Step 3

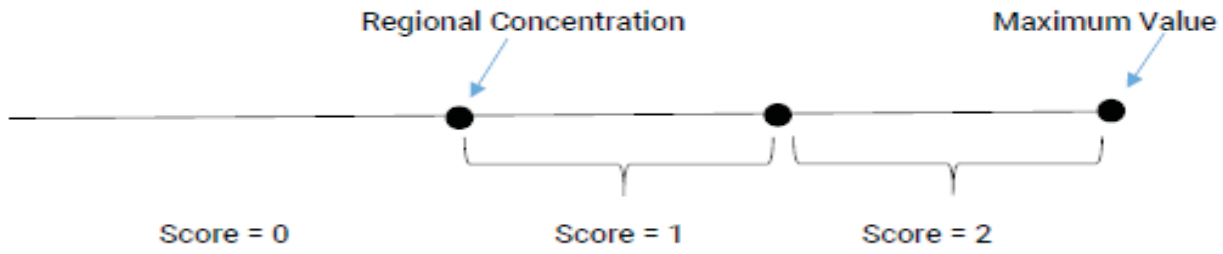
For each sensitive population, calculate the range for two equally-sized classes by identifying the tract with the maximum value. For example:

Range above Regional Concentration% = Maximum Tract Concentration% – Regional Concentration%

Step 4

Calculate two equally-sized intervals. For example:

- Interval Size = Range above Regional Concentration% / 2



Step 5

Assign each tract the appropriate score based on which interval it falls in. For example, if the regional concentration is 20% and the tract with the highest value has a concentration of 60%, equally-sized intervals would extend from 20% to 40% and from 40% to 60%. Tracts whose values fall below the regional mean of 20% are assigned an index value of 0. Tracts with a concentration between 20% and 40% are assigned a 1. Tracts with a concentration between 40% and 60% are assigned a 2.

Step 6

For each tract, sum the score for all seven sensitive populations to determine the Vulnerable Population Index (VPI) for that tract. Thus, the VPI extends from 0 to 14.

In general, a lower VPI indicates a less vulnerable population, while a higher VPI indicates a more vulnerable population. However, it is important that users understand that the VPI is a starting point for understanding where vulnerable populations live in the region. Scores in one tract should not be directly compared to scores in other tracts because there are multiple ways to arrive at each score. For example, a score of 6 could indicate the presence of six different vulnerable populations in the first interval above the regional concentration (i.e., six scores of one each) or more extreme concentrations of three vulnerable populations (i.e., three scores of two each).

Tracts with a population of 0 were excluded from the data set as “No data or no population.” This was done so as not to confuse them with populated tracts with very low percentages of variables. In most cases these tracts are located in water, parks, or industrialized areas. Additionally, some tracts with a low population or household count do not have American Community Survey data available. If included, these tracts would have incorrect index scores because all of the vulnerable population variables would not be available to create an index score on that tract. Tracts where the majority of the population is institutionalized, such as prisons, are included in this second category.

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Poverty

Population in poverty, Baltimore region: 297,097 [Note: The regional population for whom poverty status is determined is 2,701,223.]

Concentration of population in poverty, Baltimore region: 11%

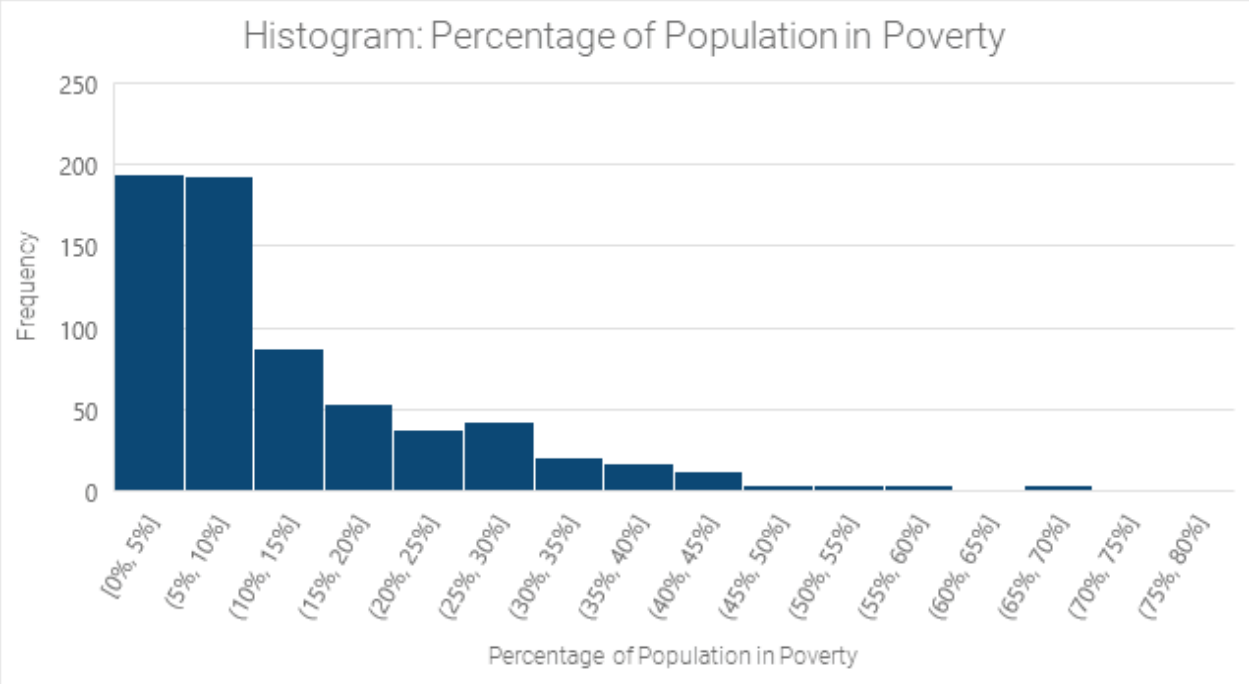
Definition

The U.S. Census Bureau presents single and multi-year estimates of median household income for small areas in the ACS. The Census Bureau uses a set of income thresholds that vary by household size and composition to determine poverty. If a household's total income is less than the threshold, then that household and every individual in it is considered in poverty. For example, the threshold for 2010 for a four-person household with two dependents is $22,113. While the thresholds do not vary by place, they are updated for inflation using the Consumer Price Index (CPI-U).

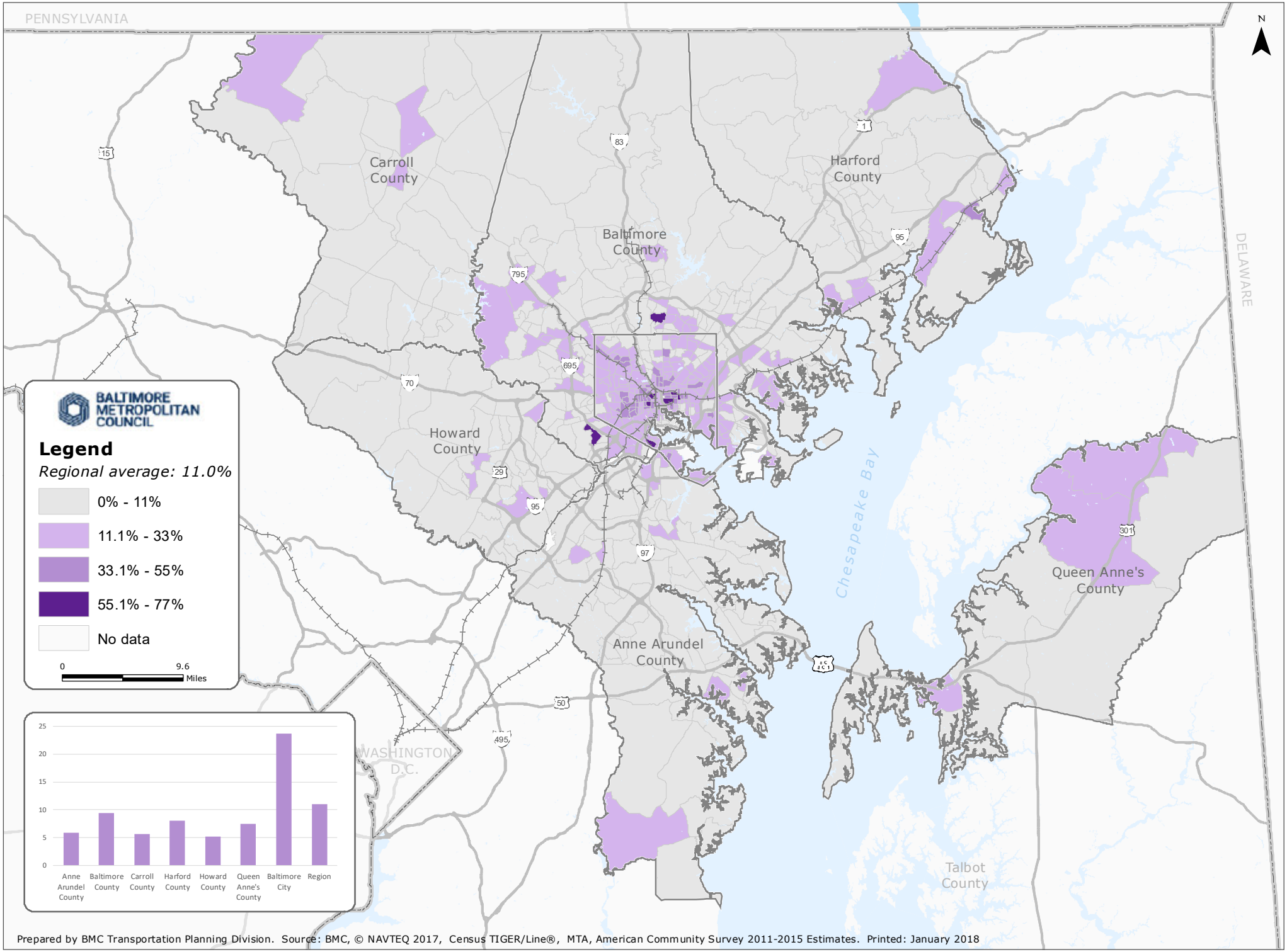
The concentration (or percentage) of the population in poverty in the Baltimore region is 11%; so Census tracts with a concentration of population in poverty greater than 11% are considered vulnerable. The table below shows the 10 most vulnerable tracts for poverty in the region. The map below is a sample of the map of poverty for all tracts in the region, found on page A–1.

Source

American Community Survey 2011–2015, Table B17025



Percent of Population with Income Below the Federal Poverty Level



Hispanic or Latino

Population of Hispanic minorities, Baltimore region: 141,742

Concentration of Hispanic minorities, Baltimore region: 5.1%

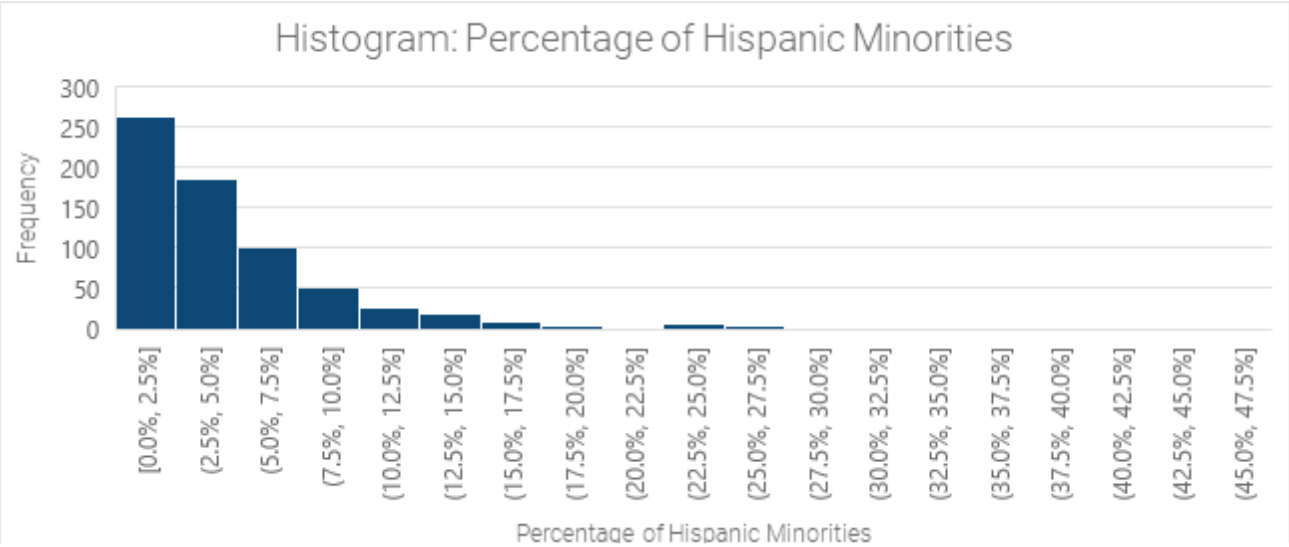
Definition

The U.S. Census Bureau defines Hispanic as person(s) of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

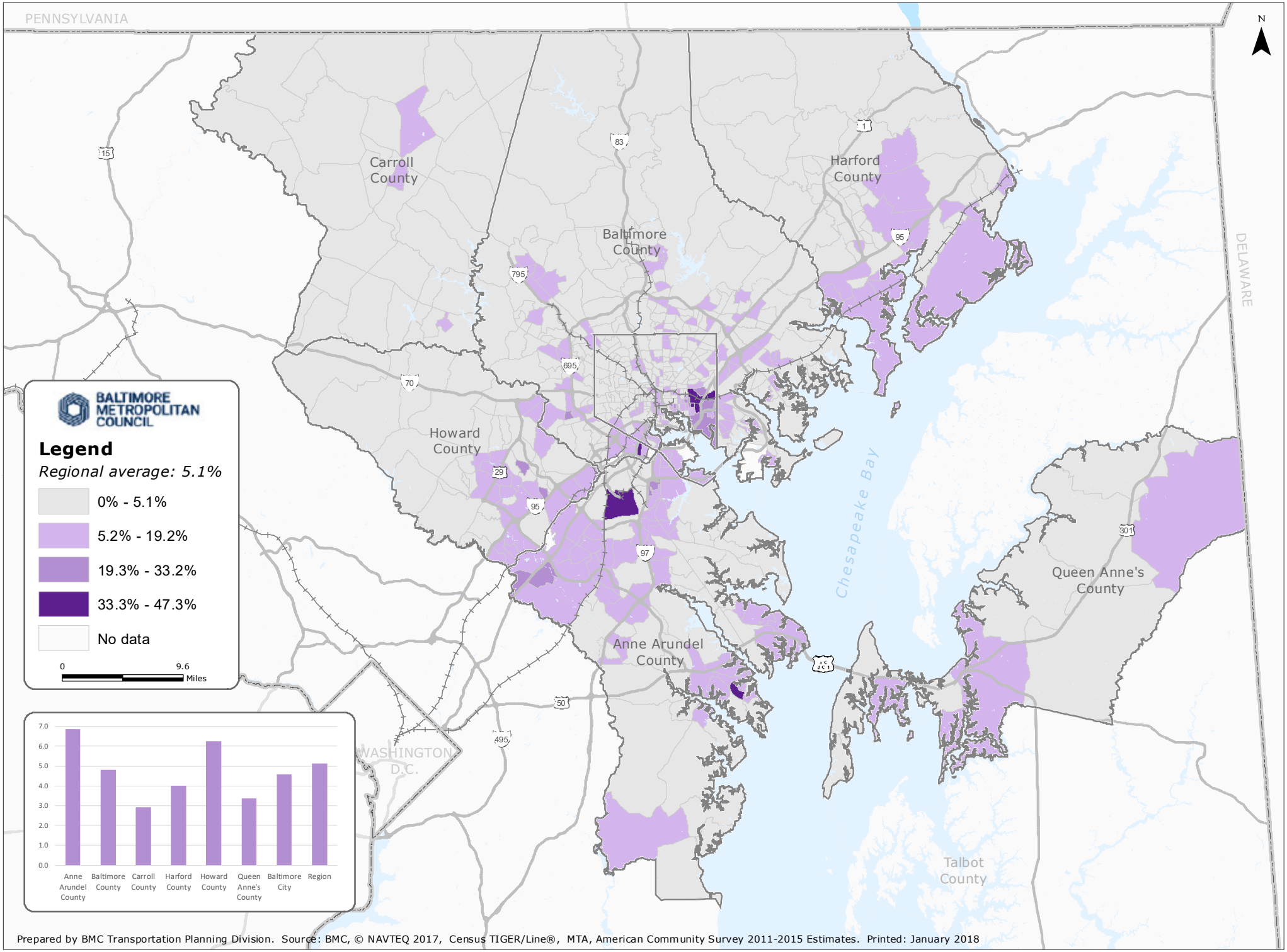
The concentration (or percentage) of Hispanic minorities in the Baltimore region is 5.1%; so Census tracts with a concentration of Hispanic minorities greater then 5.1% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the Hispanic population. The map below is a sample of the map of tracts considered vulnerable for the Hispanic minorities population, found on page A–2.

Source

American Community Survey 2011–2015, Table B03002



Percentage of Population That is Hispanic or Latino



Non-Hispanic Minorities

Population of non-Hispanic minorities, Baltimore region: 1,149,241

Concentration of non-Hispanic minorities, Baltimore region: 41.5%

Definition

The U.S. Department of Transportation (DOT) Order (5610.2) on EJ defines "Minority" as:

1. Black: a person having origins in any of the black racial groups of Africa
2. Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent
3. Native Hawaiian or Pacific Islander
4. American Indian and Alaskan Native: a person having origins in any of the original people of North America who maintain cultural identification through tribal affiliation or community recognition

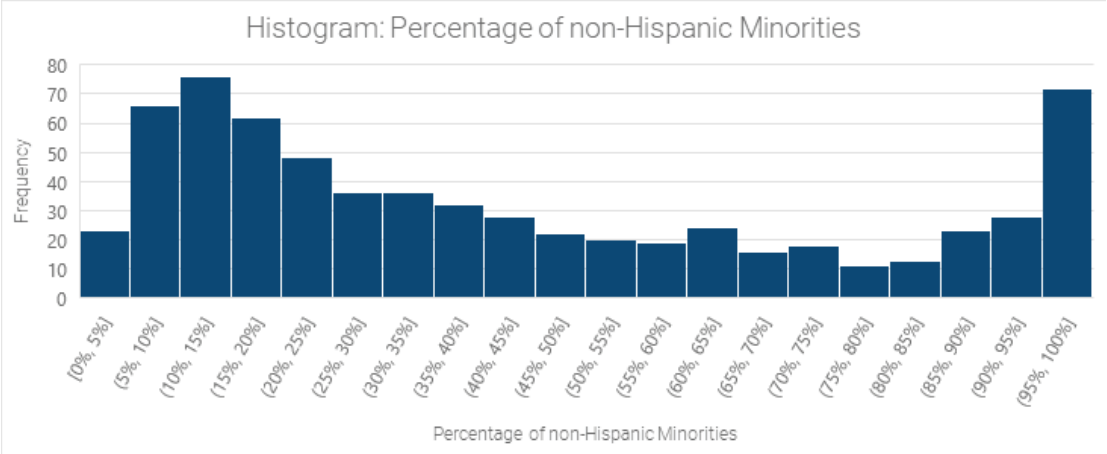
In addition to the groups mentioned above, the U.S. Census recognizes two additional racial categories:

1. Some other race alone and
2. Two or more races

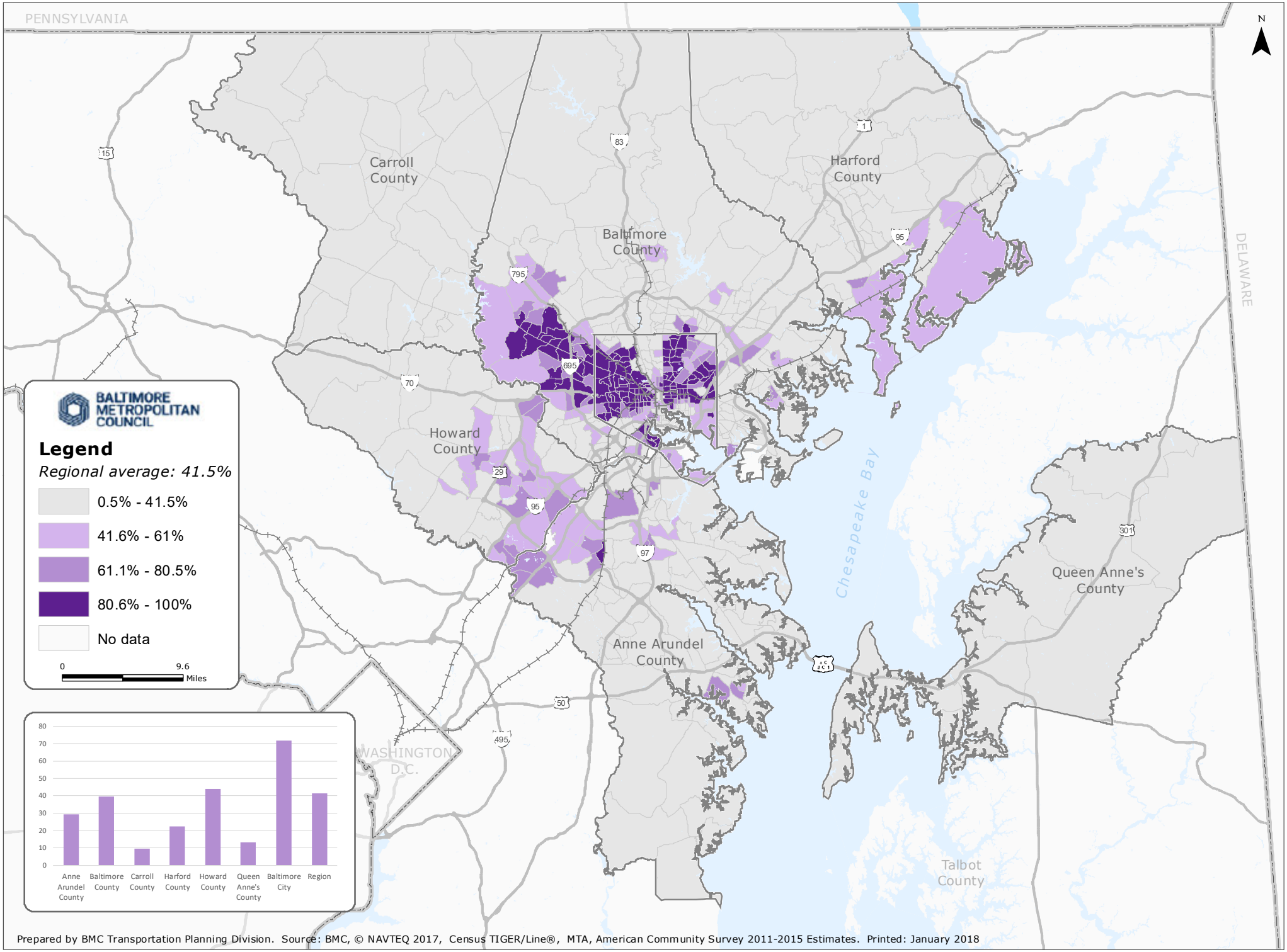
The concentration (or percentage) of non-Hispanic minorities in the Baltimore region is 41.5%; so Census tracts with a concentration of non-Hispanic minorities greater than 41.5% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the Non-Hispanic Minorities population. The map below is a sample of the map of tracts considered vulnerable for the non-Hispanic minorities population, found on page A–3.

Source

American Community Survey 2011–2015, Table B03002



Percent of Population That is a Non-Hispanic Minority



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Limited English Proficiency (LEP)

Population of LEP individuals, Baltimore Region: 48,555

Concentration of LEP individuals, Baltimore region: 1.9%

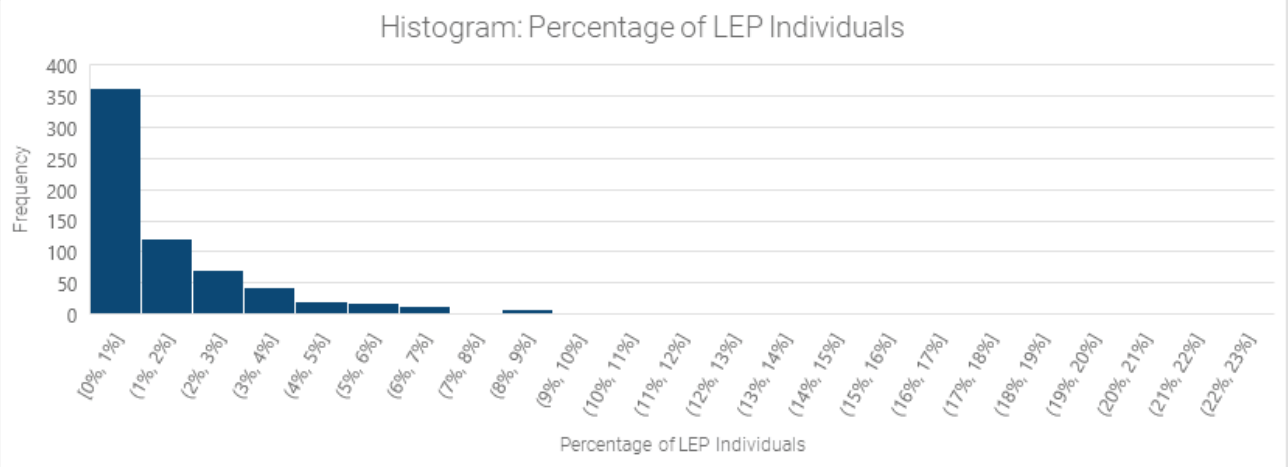
Definition

The LEP population is defined as people aged 5 and over who speak a foreign language at home and either speak no English or speak English "not well."

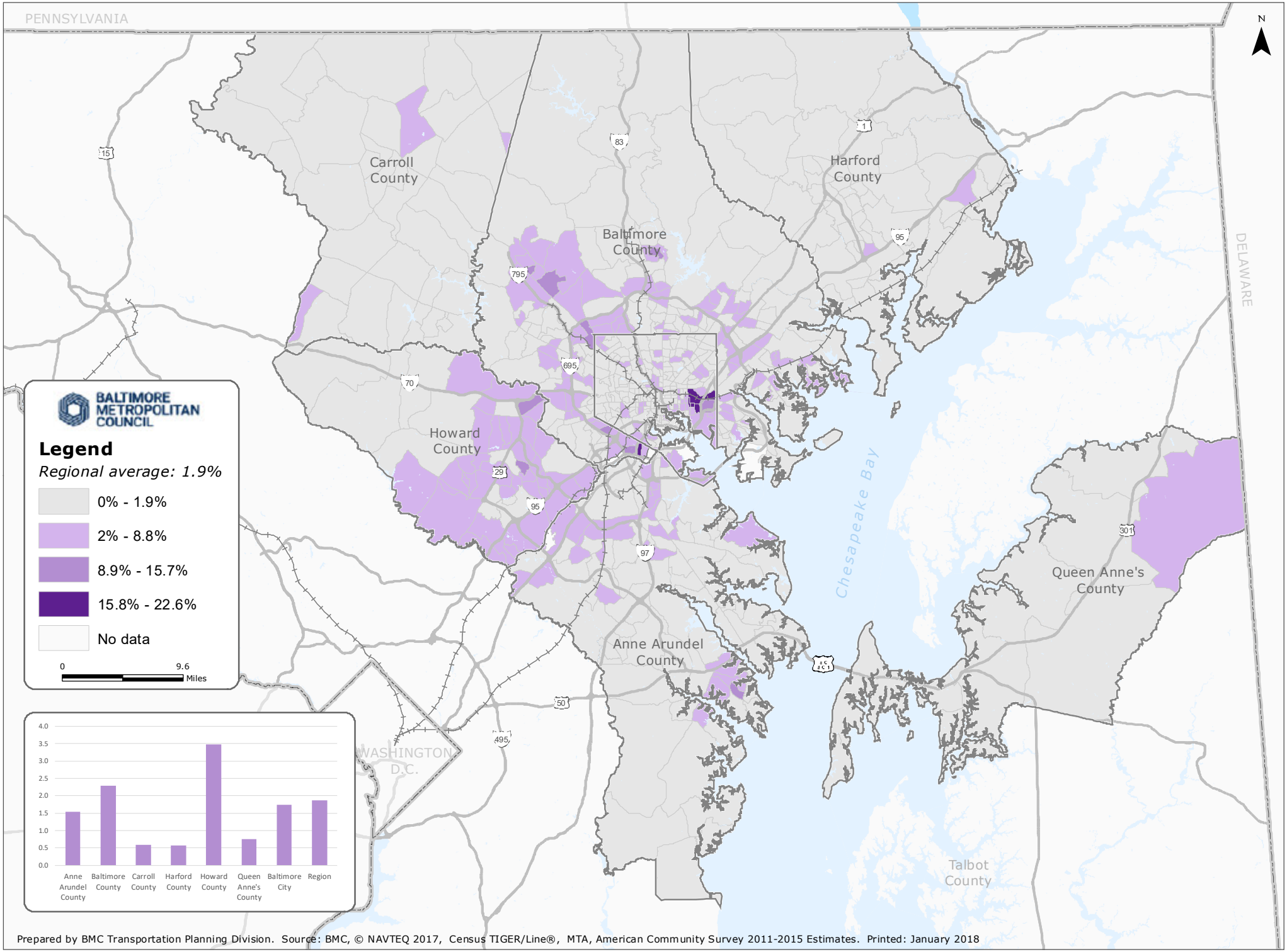
The concentration (or percentage) of LEP individuals in the Baltimore region is 1.9%; so Census tracts with a concentration of LEP individuals greater than 1.9% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the LEP population. The map below is a sample of the map of tracts considered vulnerable for the LEP population, found on page A–4.

Source

American Community Survey 2011–2015, Table B16005



Percent of Population That Speaks English "Not Well" or "Not at All"



Disabled

Population of disabled individuals, Baltimore region: 308,445

Concentration of disabled individuals, Baltimore region: 11.3%

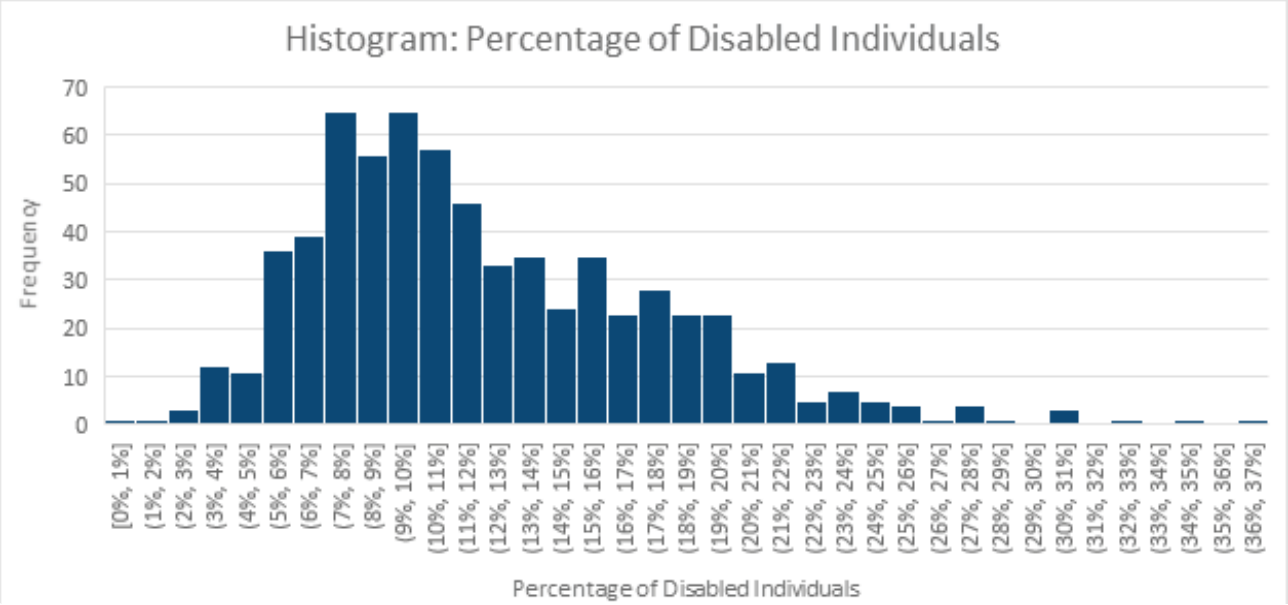
Definition

The U.S. Census Bureau classifies a disabled person as someone (of any age) whose hearing, vision, cognition, or ambulation difficulties result in limitations of activities and restrictions to full participation at school, work, home, or in the community.

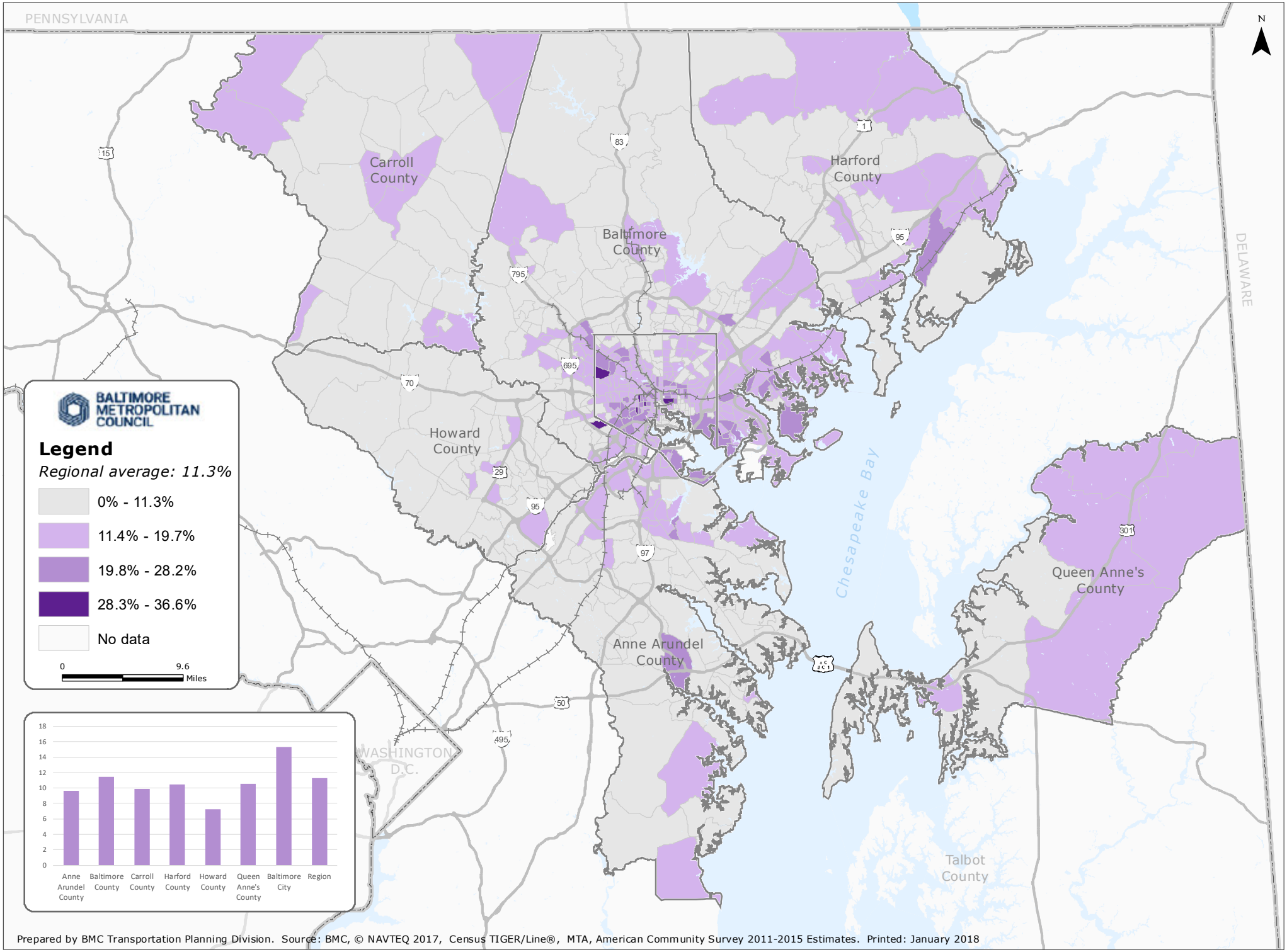
The concentration (or percentage) of disabled individuals in the Baltimore region is 11.3%; so Census tracts with a concentration of disabled individuals greater than 11.3% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the disabled population. The map below is a sample of the map of tracts considered vulnerable for the disabled population, found on page A–5.

Source

American Community Survey 2011–2015, Table B18101



Percent of Population That Has a Disability



Elderly

Population of elderly individuals, Baltimore region: 163,836

Concentration of elderly individuals, Baltimore region: 5.9%

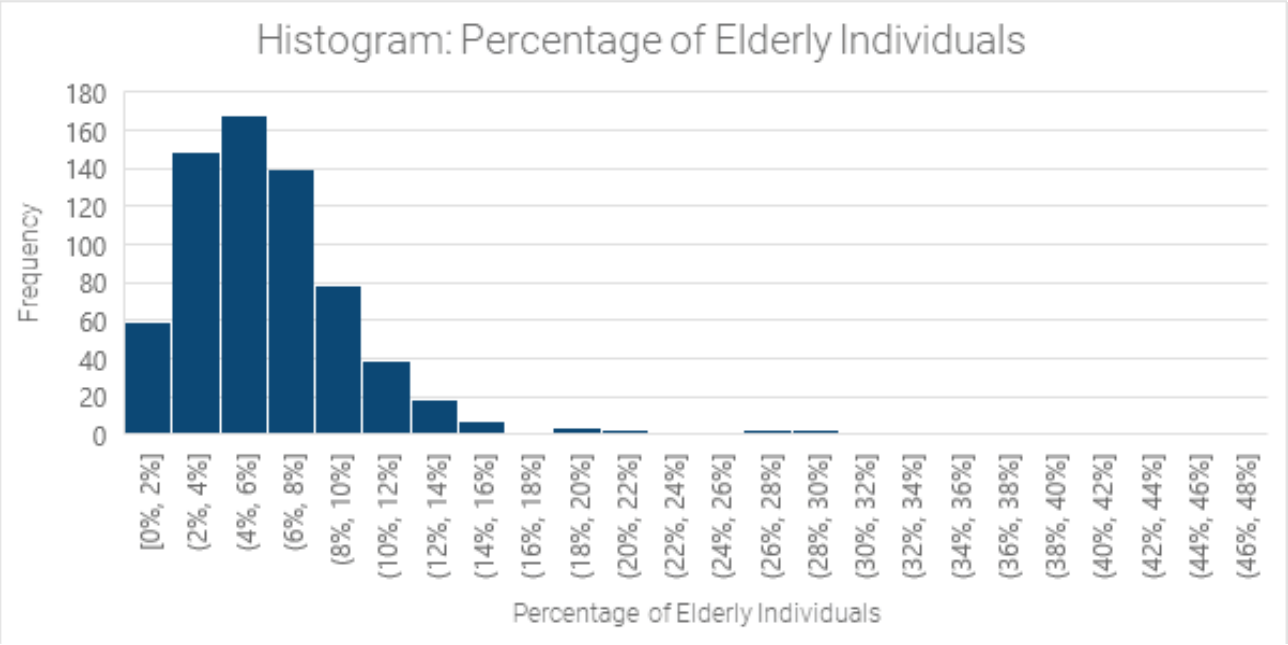
Definition

Elderly is defined as age 75 and above.

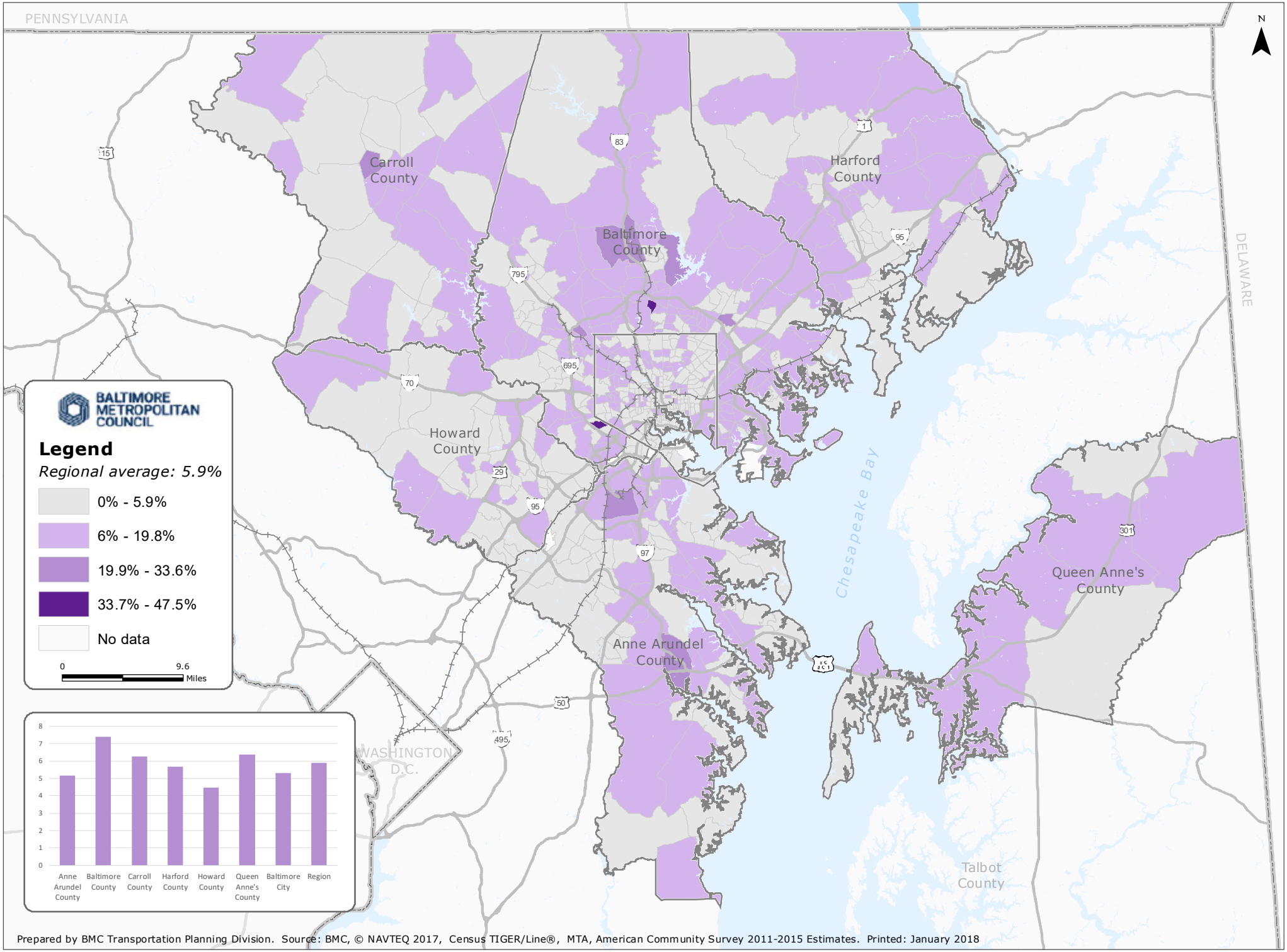
The concentration (or percentage) of elderly individuals in the Baltimore region is 5.9%; so Census tracts with a concentration of elderly individuals greater than 5.9% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the elderly population. The map below is a sample of a map of all tracts considered vulnerable for the elderly population, found on page A–6.

Source

American Community Survey 2011–2015, Table B01001



Percent of Population That is Age 75 or Older



Carless

Carless households, Baltimore region: 116,711

Concentration of Carless households, Baltimore region: 11.3%

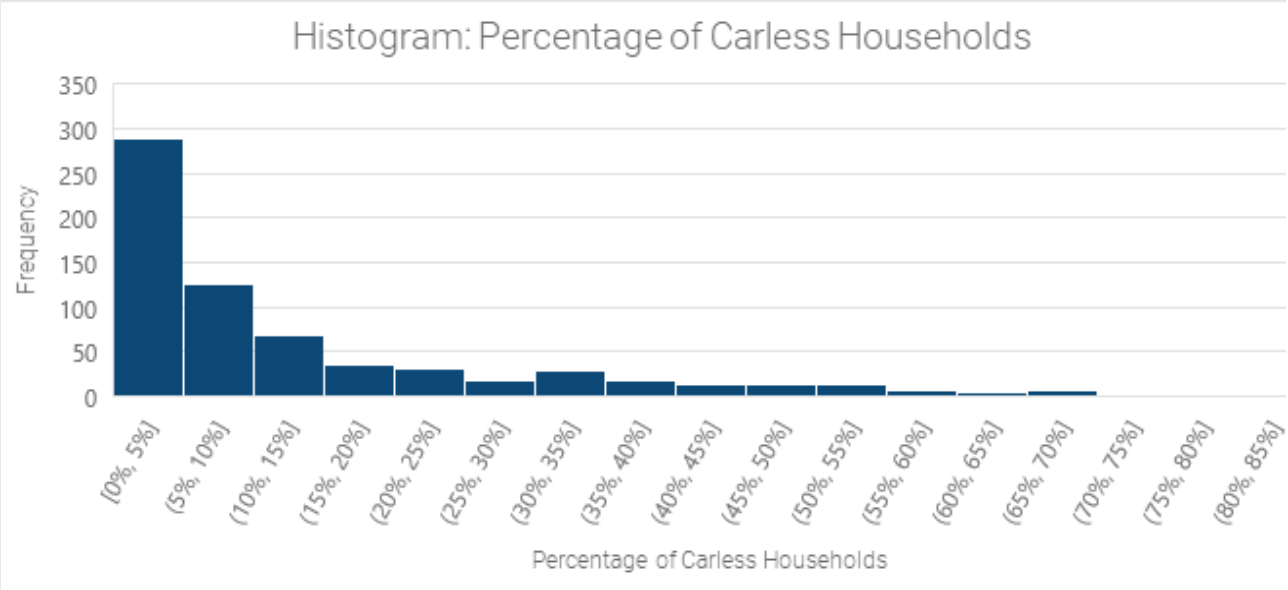
Definition

The U.S. Census Bureau defines carless as a household with no vehicles available.

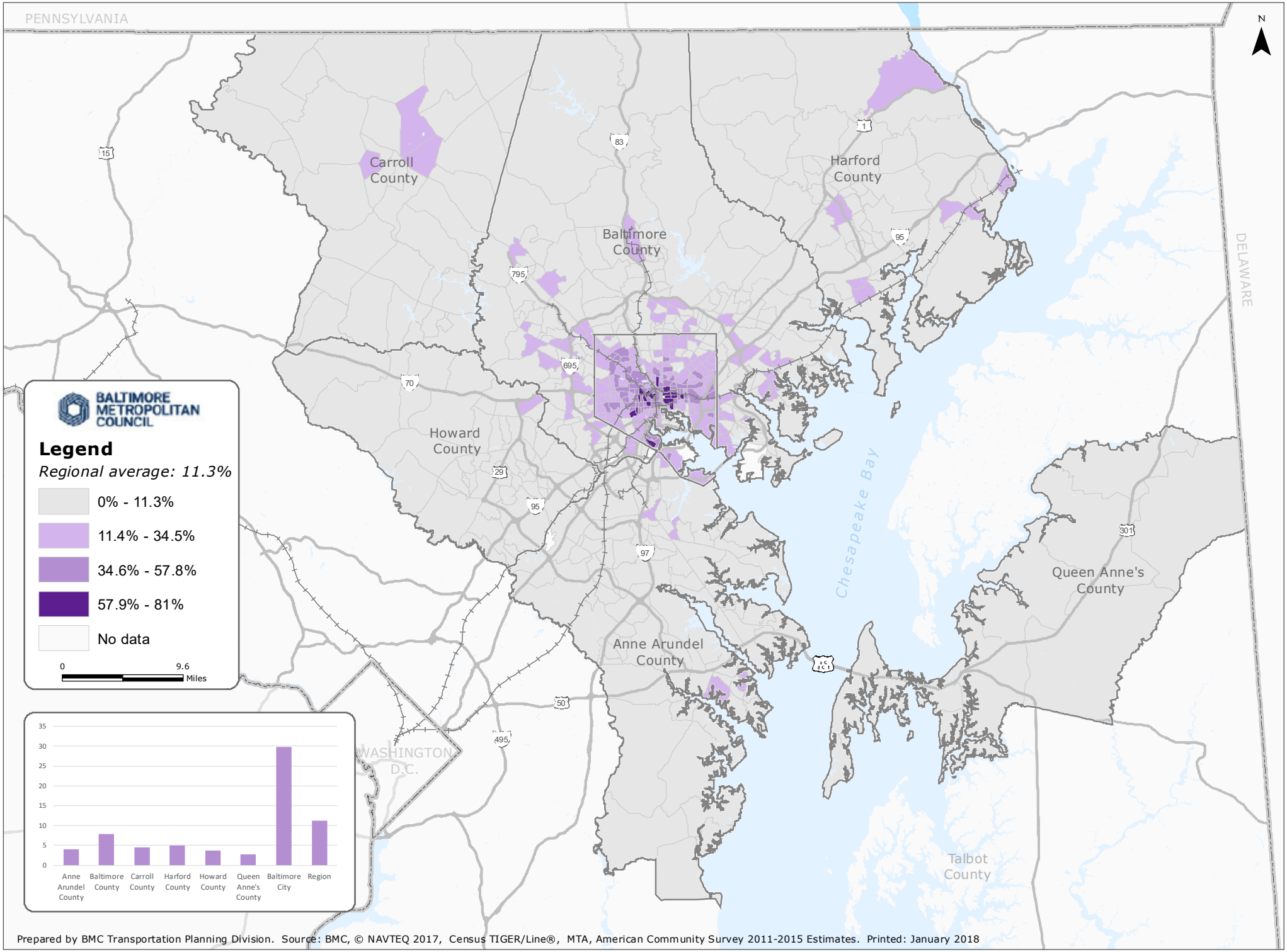
The concentration (or percentage) of carless households in the Baltimore region is 11.3%; so Census tracts with a concentration of carless households greater than 11.3% are considered vulnerable. The table below shows the 10 most vulnerable tracts for the carless population. The map below is a sample of the map of tracts considered vulnerable for the carless population, found on page A–7.

Source

American Community Survey 2011–2015, Table B08201



Percent of Households That Do Not Have a Car



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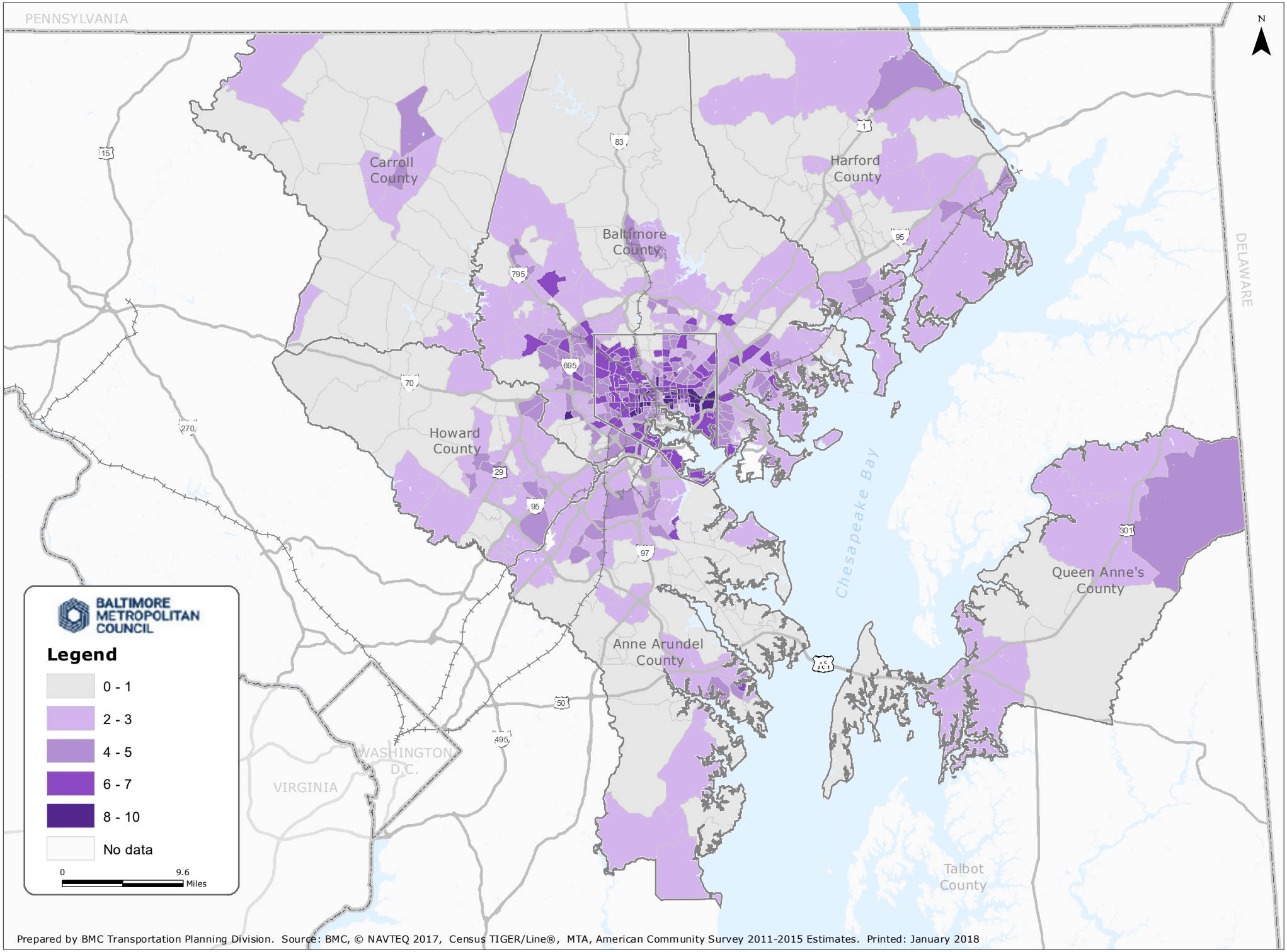
Vulnerable Population Index

Definition

Each Census tract can contain a concentration greater than the regional threshold for each individual population group considered sensitive. Tracts above the regional concentration are divided into two categories with a score of “1” at 0% to 50% above the mean and “2” for 51% to 100% above the mean. As a result, each Census tract is considered vulnerable for between zero and seven sensitive populations with a total score between zero and fourteen. The number of vulnerable populations in each Census tract is referred to the Vulnerable Population Index—or VPI. A lower VPI indicates a less vulnerable area, while a higher VPI indicates a more vulnerable area.

Vulnerable Population Index



Vulnerable Population Index –
Appendix: Margins of Error

Margins of Error

The Vulnerable Population Index (VPI) uses estimates from the American Community Survey (ACS), which is a data set that surveys 3 million people each year. Collecting the data continuously allows demographic data to be available more frequently than the Decennial Census. Using data over a 5-year period enables a larger sample size so that the data can be made available for small areas.

Because the estimates are based on a sample, a certain amount of variability is associated with each data point. This variability is expressed as a "margin of error." This number gives an idea of how precise an estimate is. ACS provides margins of error (MOE) for a 90% confidence interval. For example, consider an estimate for a Census tract where 20 people walk to work with a margin of error of 5. This can also be expressed as 20 +/- 5. So while the estimate for that tract is 20, the full interpretation is that the American Community Survey is 90% sure that between 15 and 25 people walk to work in that Census tract. Larger margins of error indicate data may not be reliable. In general, the smaller a population that is being estimated is, the larger the margin of error.

The maps and data in this report show the primary estimate and do not depict the margin of error. While BMC's analysis serves as a planning tool and a way to get a general portrait of the region, it is important to remember that the true population count in any one Census tract may vary, and the data should not be used when an exact count for a particular population is required. Alternative data sets, administrative records, field surveys, public outreach, and local knowledge are all possible methods for getting a more in-depth view when precise demographics on a neighborhood are needed.

In order to address the complications caused by margins of error, BMC takes several steps. Census tracts are used in the VPI analysis instead of block groups or traffic analysis zones. These latter two geographies are smaller. While they would give a more detailed picture of the region, the margins of error are notably higher than those in Census tracts. BMC makes the raw data for the VPI available to the public through our Open Data website. This data includes the original margins of error so that advanced data and geospatial analysts can incorporate the information into their work. Lastly, the Vulnerable Population Index is used by BMC as the starting point for public outreach wherein we reach out to disadvantaged communities during the transportation planning and programming process. These conversations allow us to get a better picture of the needs of different communities in the region.

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DATA RELIABILITY: TRACTS PER REGION

The coefficient of variation (CV) is a measure derived from the margin of error which allows sampling error to be visualized in a standard format independent of population size. The reliability evaluation below was created after consultation with several sources, including the American Community Survey, ESRI, and the Housing Assistance Council. Coefficients of variation were not calculated for Non-Hispanic Minority because of statistical issues that arise from using a derived estimate.

Coefficient of Variation (%)	Reliability
0% - 15%	High
15% - 40%	Medium
40% +	Low

Vulnerable Population Index –
Appendix: Margins of Error

Hispanic or Latino

High Reliability Medium Reliability Low Reliability

Age 75 or Older

High Reliability Medium Reliability Low Reliability

Disabled Population

High Reliability Medium Reliability Low Reliability

Limited English Proficiency

High Reliability Medium Reliability Low Reliability

People in Poverty

High Reliability Medium Reliability Low Reliability

Households with No Car

High Reliability Medium Reliability Low Reliability