DETAILED METHODOLOGY AND LIMITATIONS

Choosing a Methodology

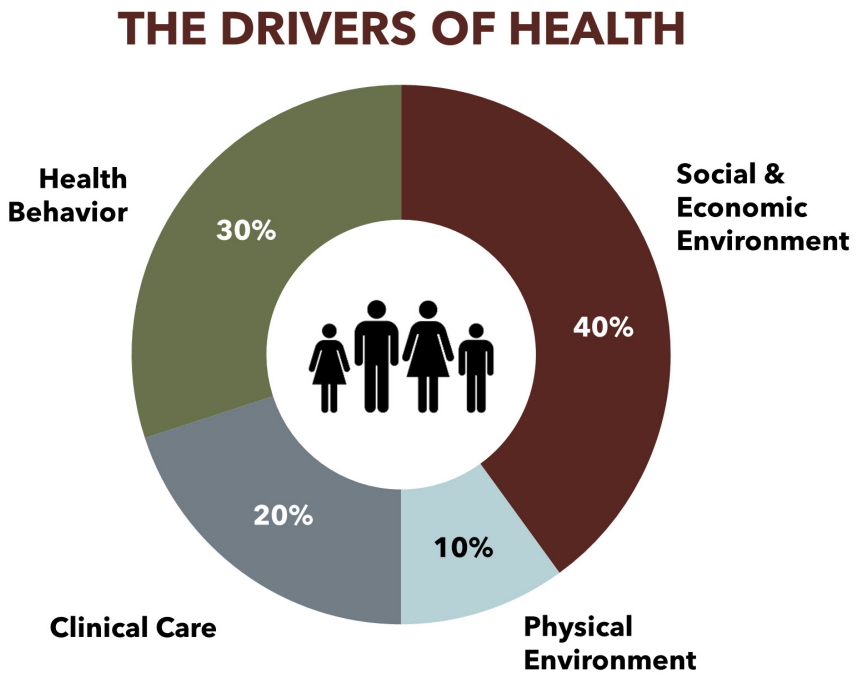
The Tennessee Health & Well-Being Index is adapted from the methodology developed by the Colorado Health Institute (CHI). CHI used this methodology for their **Colorado Access to Care Index**.[14] The CHI methods are based on the National Health Security Preparedness Index which was a shared effort between the Centers for Disease Control and Prevention (CDC), the Association of State and Territorial Health Officials, the Robert Wood Johnson Foundation, the University of Kentucky, and other organizations.[15]

We chose this methodology for our Index because:

- A scale of 0 to 10 is easy to interpret and understand.
- It allows us to track changes at both the state and regional level.
- We can calculate scores at the overall, domain, and individual metrics level.

Choosing the Domains

The 4 domains were chosen based on previous research around the drivers of health.[16,17] While many people think of health care as the main driver of health, where we live, work, and play has a much greater impact on our health and the quality of our lives. We chose to incorporate these factors into our Index to provide a comprehensive assessment of the drivers of population health in Tennessee. While genetics is a documented driver of health, population-level data on genetics are unavailable.



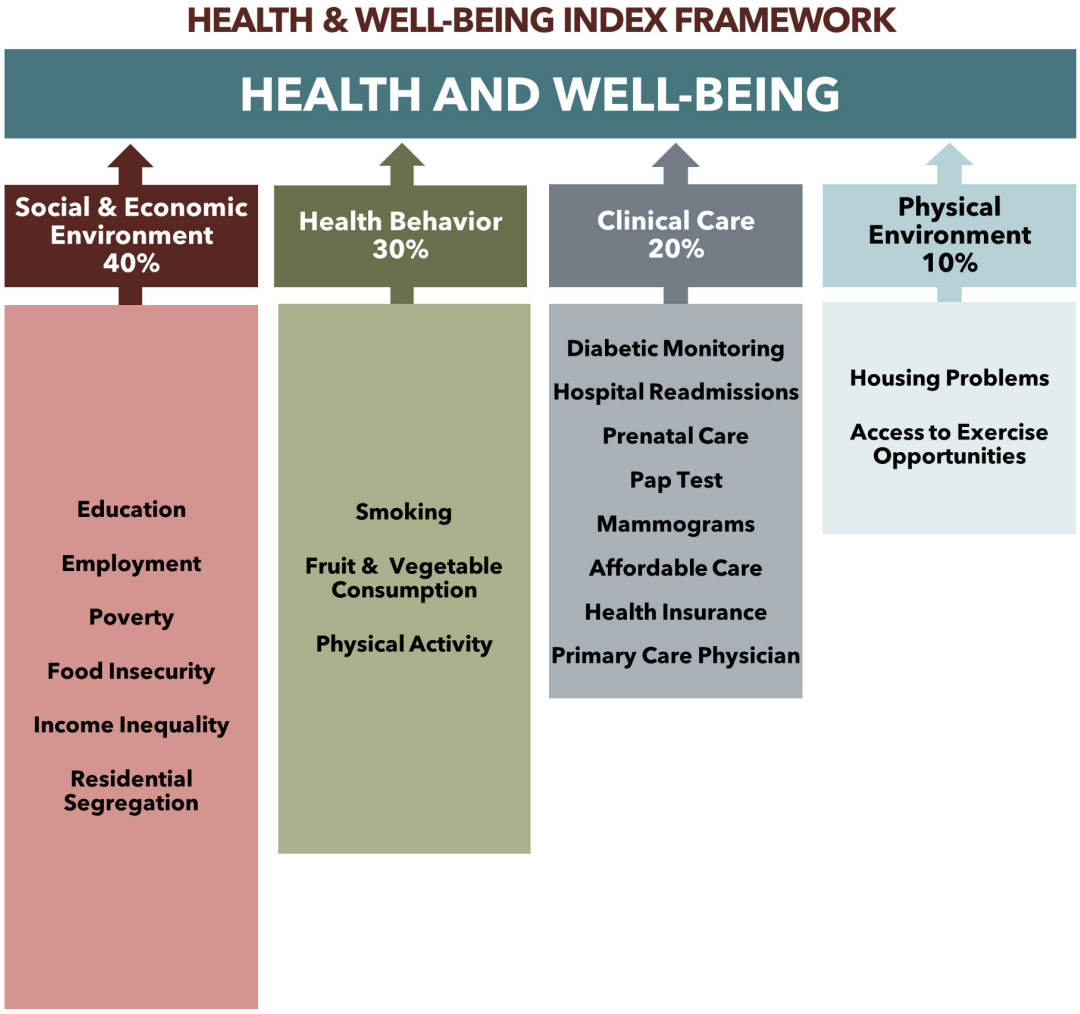
Selecting the Metrics

The following criteria were used to choose the metrics for our Index:

- *Metrics must be available at both the state and regional and/or county level*: It is important to show the variation within our state.
- *Metrics must be available for multiple years*: This allows us to update the Index and track changes over time. Most of the data sources are collected annually.
- *Metrics must be validated*: The metrics are supported by the literature and have been used in similar studies to assess the health care system, access to care, social and economic environments, public health and prevention, and health outcomes.

Defining the Domains and Metrics

The Tennessee Health & Well-Being Index is comprised of 4 domains and 24 metrics. The 4 domains are: Social & Economic Environment, Health Behavior, Clinical Care, and Physical Environment.



Calculating Index Scores
The data were compiled from each of the data sources listed below. For the 2017 Index metrics, the most recent data available were used to calculate the Index score. These data were mostly for 2015, 2014, and 2013. For the 2016 baseline measurements, data from the most recent previous years (e.g. 2014, 2013, and 2012) were used. Scores were calculated at the state and regional levels for all domains and metrics.

Differences in State and Regional Scores
State scores were not derived from averaging the regional scores. State-level aggregate data were used for the statewide scores, and regional-level aggregate data were used for the regional scores. Because of this, averaging the regional scores will not produce numbers that are equal to the state scores. In fact, it is possible that a statewide score could be higher than or lower than all of the regional scores for a domain. For example, each region may have a score lower than the statewide score, but each of those lower scores may be driven by different factors (i.e. lower performance on different metrics). In the aggregate, each region's lower performance on different, specific metrics may be more than offset by the other regions' relatively higher performance. This is similar to the sensitivity issue discussed in the last bullet of the limitations sections below.

Establishing Benchmarks
Before calculating the score, an aspirational benchmark of 0% or 100% was established. For example, we set an aspirational benchmark of 100% for the proportion of Tennesseans that eat 5 or more fruits and vegetables per day. On the other hand, we set an aspirational benchmark that 0% of Tennesseans be uninsured or food insecure.

Again, these benchmarks are aspirational and may not always be possible, but ambitious benchmarks can push us towards improvements in the health and well-being of all people in our state.

Calculating Domain Scores
Each metric was converted to a score of 0 to 1 where 1 is the best score and 0 is the worst score. For example, 75.3% would be converted to .753.

For some metrics, the scores had to be flipped so that 0 would represent a poor score and 1 would represent a good score. The percent of uninsured Tennesseans is an example of this. For the 2017 calculation, 17.4% of adult Tennesseans were uninsured (from 2014). We converted the percentage to .174 and then subtracted it from 1 (1 -.174 = 0.826). In this scoring methodology, having an uninsured rate of 0% would result in an index score of 1 (1 - 0 = 1). The inequality metrics were also treated similarly because they are expressed on a scale of either to 0 to 100 or 0 to 1, where 100 and 1, respectively, represent high segregation or inequality.

After all of the metrics were converted to a scale of 0 to 1, the scores of each metric within a domain were averaged and multiplied by 10. This resulted in an overall score of 0 to 10 for each of 4 the domains.

Calculating the Health & Well-Being Score
Individual domain scores were used to generate the state and regional Health & Well-Being Index scores. Each domain score was weighted based on its relative contribution to health and well-being. The relative contribution is based on the research cited above on the drivers of health. The following formula was used when calculating scores:

Health & Well-Being = (Social & Economic Environment*0.4) + (Health Behavior*0.3) + (Clinical Care*0.2) + (Physical Environment*0.1)

Determining National Averages

Each metric was compared to the United States national average to provide context for the state and each region. If possible, the national average was obtained from the same data source as the state/regional metric. If the same data source did not have a national average for the metric, a validated, outside source was used. Tables of each of the metrics compared to national averages for the state and each region can be found in the appendix.

Limitations

- While the most recent available data were used for each metric, the year of the most recent data varied by each source.
- There may have been more robust or timely metrics that were excluded from the Index based on our selection criteria.
- Many of the data sources rely on self-reported data. When using self-reported data, we assume that people are being honest, providing accurate answers, and that they understand the questions they are being asked.
- The Index relies on cross-sectional data that only captures a single point in time. The data do not include the impact of cumulative exposures over the life course.
- Data are presented at the regional and county level and cannot/should not be interpreted at the individual level.
- Many of the metrics were reported as crude rates. Crude rates do not take into account any confounding factors (e.g. age) that may affect the rate of the disease or circumstance reported.
- Because we used multiple sources of data, there may be inconsistencies among the data due to different sampling methods, definitions, modeling techniques, and approaches to data collection and analysis.
- The Index is not sensitive to different directional changes in domain metrics. For example, if childless household food insecurity decreases but child food insecurity increases, they may offset one another, and the domain score may remain unchanged. Because of this, we provide data for the individual metrics in the appendix in addition to the domain scores.

Data Sources for Metrics

- **The Tennessee Behavioral Risk Factor Surveillance System**
- **County Health Rankings & Roadmaps**
- **Tennessee Mortality Data**
- **Health Indicators Warehouse**
- **Kids Count Data Center**
- **Small Area and Income Poverty Estimates**
- **Feeding America: Map the Meal Gap**
- **American Community Survey**
- **Small Area Health Insurance Estimates (SAHIE)**

DATA SOURCES

The Tennessee Health & Well-Being Index uses the 9 data sources listed below. All of the data sources are publicly available and more information can be found by clicking the title of each source.

1. The Tennessee Behavioral Risk Factor Surveillance System

Description: The Tennessee Behavioral Risk Factor Surveillance System (BRFSS) is an annual survey managed by the Tennessee Department of Health in cooperation with the Centers for Disease Control and Prevention (CDC). The survey uses telephone interviews to ask questions about individual behaviors that affect the risk of developing chronic conditions. State-level data for the health disparities metric were obtained directly from CDC.

Time Period: Regional level data are publically available for 2011-2013. The 2013 data were used for 2017 Index metrics, and 2012 data were used for the 2016 baseline metrics. The statewide data for the health disparities metric are from 2014 and 2015.

Metrics Used:

Domain: Clinical Care

- Diabetic Monitoring – percent of adults ages 18+ diagnosed with diabetes who have received 2 or more HbA1c measurements in the last year
- Affordable Care - percent of adults ages 18+ who avoided seeing a doctor because of the cost
- Primary Care Physician – percent of adults ages 18+ that have a personal doctor or health care provider
- Mammogram – percent of women ages 40+ who received a mammogram in the past 2 years
- Pap Test – percent of women ages 18+ who had a Pap test within the past 3 years

Domain: Health Behavior

- Smoking – percent of adults ages 18+ who currently smoke cigarettes
- Fruit and Vegetable Consumption – percent of adults ages 18+ who consume 5 or more servings of fruits or vegetables per day

Health Disparities

- Self-Rated Health Status – individuals were asked "Would you say that in general your health is – Excellent, Very good, Good, Fair, or Poor?"

2. County Health Rankings & Roadmaps

Description: The County Health Rankings & Roadmaps is an annual program that measures factors that influence health. The program is a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute. Rankings are generated for all states and counties in the United States.

Time Period: Data are available for 2010-2016. The 2016 data were used for 2017 Index metrics, and 2015 data were used for the 2016 baseline metrics.

Metrics Used:

Domain: Health Behavior

- Physical Inactivity – percent of adults ages 20+ who reported no leisure-time physical activity (e.g. running, calisthenics, golf, gardening, or walking for exercise)

Domain: Social & Economic Environment

- Unemployment – percent of people ages 16+ who were unemployed and looking for work
- Child Poverty – percent of children under the age of 18 living in a household with an income below the federal poverty threshold, which varies by family/household size (e.g. $24,300 per year for a family of 4 in 2016)
- Residential Segregation – differences in the residential distribution of 2 or more groups across census tracts in an area. We use two separate metrics to measure residential distribution differences between blacks and whites and whites and non-whites. These distribution differences represent residential segregation. This is measured by a dissimilarity index that quantifies the gap on a scale of 0 to 100, where 100 is considered the highest level of residential segregation (i.e. 2 groups living in different areas). Values of 40 or 50 are considered moderate levels of segregation, and values of 30 or below are considered low levels of segregation. 5-year estimates of 2012-2016 data were used because they are more accurate than 1-year estimates when analyzing small populations and geographies.
- Some College – percent of adults ages 25-44 with some post-secondary education (i.e. vocational/technical school, junior college, 4 year college)

Domain: Physical Environment

- Severe Housing Problems – percent of households with at least 1 of 4 housing problems: overcrowding, lack of kitchen, lack of plumbing facilities, or high housing costs (defined as monthly housing costs including utilities that exceed 50% of monthly income)
- Access to Exercise Opportunities – percent of individuals who live reasonably close to a location for physical activity (local, state, and national parks; gyms, community centers, YMCAs, dance studios, and pools). Reasonably close is defined as living within a census block that is within 0.5 miles of a park, an urban census tract that is within 1 mile of a recreational facility, or a rural census tract that is within 3 miles of a recreational facility.

Domain: Clinical Care

- Uninsured Children – percent of the population under age 19 that has no health insurance coverage

3. Tennessee Mortality Data

Description: Mortality data are collected through standardized Certificate of Death forms that are forwarded to the Tennessee Department of Health's Office of Vital Records. Data include information on in-state and out-of-state deaths of all Tennessee residents. They also include demographic characteristics and the cause of death

Time Period: Data are available for 1990-2014. The 2014 data were used for 2017 Index metrics, and 2013 data were used for the 2016 baseline metrics.

Metrics Used:

Health Disparities

- Infant Mortality Rate – the number of deaths of infants under age 1 occurring among all live births in a given year

4. Health Indicators Warehouse

Description: The Health Indicators Warehouse is a collaboration of many agencies and offices within the U.S. Department of Health and Human Services and is maintained by the Centers for Disease Control and Prevention (CDC). Hospital readmission data are provided by the Centers for Medicare and Medicaid Services (CMS) databases (i.e. Medicare Administrative Data and Chronic Condition Data Warehouse).

Time Period: Data are available for 2007-2013. The 2013 data were used for 2017 Index metrics, and 2012 data were used for the 2016 baseline metrics.

Metrics Used:

Domain: Clinical Care

- Medicare Readmissions – percent of Medicare beneficiaries covered by traditional fee-for-service Medicare that experienced an inpatient readmissions within 30 days of an acute hospital stay

5. Kids Count Data Center

Description: The Kids Count Data Center is a collaboration between the Annie E. Casey Foundation and state-level organizations in all 50 states, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia. The Center provides annual data on the health and well-being of children and families in the United States and the underlying factors that influence their health and well-being.

Time Period: Data are available for 2010- 2015. The 2015 data were used for the 2017 Index metrics for the Social & Economic Environment domain. The 2014 date were used for the 2016 baseline metrics for the Social & Economic Environment domain. The 2014 data were used for the 2017 Index metrics for the Clinical Care domain because they were the most recent data available for the particular metric. The 2013 data were used for the 2016 baseline metrics for the Clinical Care domain.

Metrics Used:

Domain: Social & Economic Environment

- High School Graduation Rate – percent of students graduating within 4 years of entering high school and graduation in more than 4 years for students with an Individual Education Plan

Domain: Clinical Care

- Adequate Prenatal Care – percent of live births in a given calendar year where the mother received adequate prenatal care. The adequacy of care is based on the Kessner index, which was developed by the Institute of Medicine in 1973 to assess prenatal care.

6. Small Area and Income Poverty Estimates, 2014, US Census Bureau

Description: The U.S. Census Bureau Small Area Income and Poverty Estimates (SAIPE) provide annual income and poverty estimates for states, counties, and school districts. The SAIPE are model-based estimates that use summary data from federal income tax returns, Supplemental Nutrition Assistance Program (SNAP) benefits data, decennial census data, postcensal population estimates, Supplemental Security Income data, economic data from the Bureau of Economic Analysis, and the American Community Survey.

Time Period: Data are available for 1989, 1993, and 1995-2014. The 2014 data were used for 2017 Index metrics, and 2013 data were used for the 2016 baseline metrics.

Metrics Used:
Domain: Social & Economic Environment

- Overall Poverty – percent of individuals of any age living in a household with an income below the federal poverty threshold, which varies by family size (e.g. $24,300 per year for a family of 4 in 2016)

7. Small Area Health Insurance Estimates (SAHIE)

Description: The U.S. Census Bureau Small Area Health Insurance Estimates (SAHIE) provides single-year estimates of health insurance coverage for counties in the US. The estimates are based on an area-level model and are supplemented with administrative data.

Time Period: Data are available for 2006-2014. The 2014 data were used for 2017 Index metrics, and 2013 data were used for the 2016 baseline metrics.

Metrics Used:
Domain: Clinical Care

- Uninsured Adults – percent of adults ages 18-64 that do not have any kind of health care coverage

8. Feeding America: Map the Meal Gap

Description: The Map the Meal Gap project provides annual state and county level estimates of food insecurity, food budget shortfall, cost-of-food index, and the national average cost of a meal. Data from the Current Population Survey and the Bureau of Labor Statistics are used to assess the relationship between food insecurity and associated factors (e.g. unemployment rate, poverty rate, homeownership rate, and other demographic variables) at the state level. County level estimates are then made based on the state level relationship between food insecurity and the associated variables by using the American Community Survey.

Time Period: Data are available for 2012-2014. The 2014 data were used for 2017 Index metrics, and 2013 data were used for the 2016 baseline metrics.

Metrics Used:
Domain: Social & Economic Environment

- Childless Adult Food Insecurity - percent of households without children that have limited or uncertain access to adequate food
- Child Food Insecurity – percent of households with children under the age of 18 that have limited or uncertain access to food

9. American Community Survey

Description: The American Community Survey (ACS) is an annual survey conducted by the U.S. Census Bureau. The ACS collects information related to demographics, housing, and economic, and social factors for multiple geographic areas.

Time Period: ACS data were first collected in 2005 with 1-year, 3-year, and 5-year estimates available as well. The 5-year estimates associated with 2011-2015 data were used for 2017 Index metrics, and the 5-year estimates associated with 2010-2014 data were used for the 2016 baseline Index metrics.

Metrics Used:

Domain: Social & Economic Environment

- Income Inequality – a measurement of the distribution of income in Tennessee. It is measured by the Gini index, which quantifies the distribution on a scale of 0 to 1. At 0, all Tennesseans would have the same income. At 1, the difference between the highest incomes and the lowest would be greatest. 5-year estimates were used because they are more accurate than 1-year estimates when analyzing small populations and geographies.

Data Sources Used for National Averages

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ABOUT THE SYCAMORE INSTITUTE

Launched in 2015, The Sycamore Institute is an independent, nonpartisan public policy research center for Tennessee. The Institute's mission is to provide accessible, reliable data and research in pursuit of sound, sustainable policies that improve the lives of all Tennesseans.

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SUGGESTED CITATION:

The Sycamore Institute, "Tennessee Health and Well-Being Index," 2017.