Arizona Healthy Community Map Technical Report

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12/20/2018

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Executive Summary

The Arizona Healthy Community Map is a joint effort of Arizona State University's (ASU) School of Geographical Sciences and Urban Planning and Vitalyst Health Foundation to develop a statewide, publicly accessible interactive map and database of social and environmental conditions related to neighborhood health in Arizona. The purpose of the map is to promote awareness and provide information about health opportunities and disparities among diverse communities within the state.

The map conveys how communities across the state fare based on a set of 36 evidence-based indicators. The map also displays overall health scores, which show how communities fare across the indicators. The indicators are grouped based on 12 dimensions that reflect the Elements of a Healthy Community model, which Vitalyst developed as part of its Live Well Arizona initiative (see livewellaz.org).

The indicators were selected based on a rigorous, three step process that involved a review of existing 1) scholarly literature and 2) healthy community maps and the 3) solicitation of feedback from an advisory board. The advisory board, which also gave input on the interactive map and technical report, represented leading Arizona health-related organizations, regional council of governments, local officials, and faculty at health-related research centers at state universities.

The interactive map allows users to understand the social and environmental determinants of health in the communities where they live and work and how these determinants compare to those found in other communities in the state. The map also allows users to download data of interest. The interactive map has wide ranging applications to diverse audiences, including residents, health care providers, community groups and institutions, and local and state officials. For instance, health care providers may use the map to understand conditions potentially affecting health in the neighborhoods where their patients live and work, which may enable them to offer higher quality and more targeted care. Community groups and institutions may use the map to understand conditions in the places that they serve and advocate for policy and planning changes when necessary.

Users should keep in mind that the interactive map is the product of an imperfect process. The map is based on the best publicly accessible data that was available when the map was developed. However, one limitation is that the map only reports data for one point in time, which makes it difficult for users to understand the trajectories of communities of interest. Users should keep this and other limitations in mind in engaging with the map. Future updates of the map should attempt to overcome these limitations.

Purpose

The Arizona Healthy Community Map is a joint effort of Arizona State University's (ASU) School of Geographical Sciences and Urban Planning and Vitalyst Health Foundation. The project developed a statewide, publicly accessible interactive map and database of social and environmental conditions related to neighborhood health in Arizona. The purpose of project is to promote awareness and provide information about health opportunities and disparities among diverse communities within the state. The project was completed in December 2018.

The project evolved from the Arizona Partnership for Healthy Communities' Arizona Healthy Communities Opportunities Index (see arizonahealthycommunities.org), which was developed in 2016 by Paul Minnick, who was a Master of Urban and Environmental Planning student in the School of Geographical Sciences and Urban Planning at Arizona State University. The project built on this index by developing evidence-based health scores to indicate how a community reflects the Elements of a Healthy Community model that Vitalyst developed as part of its Live Well Arizona initiative (see livewellaz.org). The model has 12 dimensions: access to care, affordable quality housing, community safety, economic opportunity, educational opportunity, environmental quality, food access, healthy community design, parks and recreation, social/cultural cohesion, social justice, and transportation options.

The health scores were conveyed on an interactive map (see http://18.191.11.50/Maps/#), which provides information on how a community fares across the elements (the health score) and for each separate element and indicator (e.g., access to care; insured population). Health scores are available for neighborhoods (census tracts or block groups). Users can also view the health scores of neighborhoods located in particular zip codes, localities, and counties. The map allows users to understand the social and environmental determinants of health in the communities where they live and work, and how these determinants compare to those found in other communities in the state. The map also allows users to download data of interest.

This technical report is a guide detailing how the process of selecting the indicators, collecting the data, and developing the interactive map unfolded, allowing for future updates of the map.

Participants

The ASU team was led by Deirdre Pfeiffer and Daoqin Tong, associate professors in the School of Geographical Sciences and Urban Planning. Wangshu Mu, postdoctoral scholar in the School of Geographical Sciences and Urban Planning, provided research support and developed the interactive website. Research support also was provided by Elizabeth Van Horn, a Master of Urban and Environmental Planning student. Vitalyst's involvement was led by Jon Ford, Director of Strategic Initiatives.

An advisory board provided guidance on indicator selection, data collection, and the final draft products. Members represented leading Arizona health-related organizations, such as the Arizona Department of Health Services, county health departments, regional council of governments, local officials, and faculty at health-related research centers at state universities. A list of the advisory board members is included in Appendix 2.

Overview

The project was completed over one year (2018) in three phases.

The first phase, indicator selection, ensued from January to May. This phase involved the review of 1) scholarly literature on the social and environmental determinants of health and 2) existing healthy community maps to arrive at a final draft list of proposed indicators. The list of indicators was finalized following feedback given by the advisory board in May.

The second phase, data collection, ensued from June to August. Data was collected from primary and secondary sources. The most common secondary data collection sources were the American Community Survey and the U.S. Environmental Protection Agency's EJSCREEN. Some data were converted using geographic information systems (GIS). This phase also involved the construction of element and overall health scores.

The third phase, product generation, was completed from September to December. The focus of this phase was on the development of the interactive map and technical report. These products were finalized following feedback given by the advisory board in November.

Selection of Indicators

The indicators included in the Arizona Healthy Community Map were selected using a three-pronged approach: a review of existing 1) scholarly literature and 2) healthy community maps and the 3) solicitation of feedback from the advisory board.

Review of Scholarly Literature

A set of evidence-based indicators was derived from a review of existing scholarly literature on the social and environmental determinants of health. A list of keywords pertaining to the healthy community elements was first developed collaboratively by the ASU project team (see Appendix 3). Then, the keywords were entered sequentially into Google Scholar. Results were sorted by relevance to the keywords. The first 50 most relevant research studies were captured. About 1,700 studies were collected.

ASU team members followed a strict protocol in reviewing the literature for possible inclusion in the sample (see Appendix 4). Studies were included if they met seven criteria:

1. *Empirical*: The study must use empirical data; theoretical or conceptual studies were excluded. Systematic reviews of empirical studies were captured.
2. *Peer-reviewed*: The study must be a peer-reviewed prior to publication. Studies published through non-peer reviewed journals or presses were excluded. Reports or opinion pieces also were excluded.
3. *Citations*: The study must have 50 or more citations on Google Scholar. Studies with fewer than 50 citations were excluded. This rule was primarily imposed to ensure that evidence from only the most vetted, respected, and replicated research was included. Staff also lacked the capacity to review studies with fewer than 50 citations.
4. *Geography*: The study must be based on data from the U.S. or Canada. This rule was imposed to capture effects that might be applicable to Arizona's political, economic, and cultural context. The relationship of interest must occur at the neighborhood level (block, block group, census tract, zip code or comparable geography) or derive from point-to-point distances between individuals and local infrastructure, resources, or amenities.
5. *Explanatory variable*: The independent or explanatory variable must relate to one of the healthy community elements.
6. *Outcome variable*: The dependent or outcome variable must be a direct or indirect health outcome. Direct health outcomes must be physiological. Examples of direct health outcomes captured include mortality/suicide, birth outcomes, health conditions that you would see a doctor to treatment (e.g., heart or lung issues (asthma), diabetes, hypertension, cancer, injuries, depression,

etc.), allostatic load, life satisfaction/wellbeing/happiness, emotional/behavioral functioning, and tooth retention. Indirect health outcomes are behaviors that are indirectly associated with a direct health outcome. Examples of indirect health outcomes captured include stress, high blood pressure, overweight/obesity/body mass index (BMI), physical activity/exercise, fruit and vegetable consumption, showing up to doctor's visits, smoking, alcohol and drug consumption, and gun ownership.

7. *Research method*: Studies may use any research method, including quantitative or qualitative data collection and analytical approaches and exploratory, descriptive, or experimental research design.

About 600 studies met these criteria. The following table shows the number of studies that met the criteria by element.

Table 1: Studies Meeting Review Criteria	
Access to Care	11
Affordable Quality Housing	77
Community Design	98
Community Safety	38
Economic Opportunity	31
Educational Opportunity	13
Environmental Quality	46
Food Access	65
Parks	35
Social & Cultural	99
Social Justice	50
Transportation	40
Total	603

Next, ASU team members reviewed the studies in the sample. Effects on direct or indirect health outcomes were captured first from the abstract of each study. If effects were not clear from the abstract, then effects were captured from the description of the results, tables, discussion and conclusion. Information on how the variables were defined was captured from the data and methods section. ASU team members reported effects for each applicable indicator (see Appendix 1). Effects were reported from about 300 studies.

A score was applied to each indicator to arrive at an estimate of the strength of the empirical evidence on the effect of the indicator on health. Scores were given to effects reported by the studies reviewed as follows:

- Direct health promoting effect: 1
- Direct health detracting effect: -1
- Indirect health promoting effect: 0.5
- Indirect health promoting effect: -0.5
- Mixed effect (health promoting & detracting): 0

Effect scores were averaged to arrive at a composite score for each indicator (see Appendix 1). Scores ranged from -1 to 1. Scores that fell between -0.5 and 0.5 were classified as “weak” effects; those that ranged from -0.51 to -1 and 0.51 to 1 were classified as “strong” effects.

Review of Healthy Community Maps

Indicators also were identified through a systematic review of healthy community maps that were online in January 2018. Maps with similar project goals to this project were selected through a systematic Google keyword search (see Appendix 5). Staff who were involved in these maps were contacted; information on the map making process and indicator selection was gathered.

A total of eleven similar health maps were reviewed in depth, including the website and associated maps and interactive elements, the technical reports, annual reports, and indicator lists. The mapping projects included: America’s Health Rankings, California Healthy Places Index, Health Matters, Community Health Rankings, Opportunity Index, Healthy Communities Assessment Tool, Oklahoma City-County Wellness Scores, America’s Healthiest Communities, Kent County Community Health Survey, Lane County Health Map, and King County Community Health Needs Assessment.

Indicators were listed and organized based on whether they were 1) identified in the literature review and frequently used by existing maps, 2) identified in the literature review and infrequently used by existing maps, 3) identified in the literature review and not used by existing maps, and 4) not identified in the literature but used by existing maps (see Appendix 5).

Proposal of Indicators

The ASU team then determined the feasibility of collecting data for each indicator identified through the review of scholarly literature and healthy community maps given the project timeline and staff capacity. Indicators that lacked scholarly evidence, were rarely used by existing maps, and/or were deemed infeasible to collect were removed from the list of proposed indicators.

Advisory Board Feedback

Additional guidance on indicator selection was provided by the advisory board. The following indicators were recommended for inclusion:

- *Incarceration rates*. This indicator was not previously proposed.
- *SNAP enrollment*. This indicator was previously considered but not proposed based on lack of evidence on neighborhood-level effects on health.
- *Underemployment*. This indicator was previously considered but not proposed based on lack of evidence on neighborhood-level effects on health.
- *Employment access/diversity*. This indicator was previously considered but not proposed based on lack of evidence on neighborhood-level effects on health.
- *Garbage services*. This indicator was previously considered but not proposed based on lack of evidence on neighborhood-level effects on health.

The following indicators were recommended for removal:

- *Housing value*. Advisory board members felt that there was not an intuitive effect of this indicator on health.
- *Household income*. There was concern that including this indicator would denigrate poor communities.

There also was support for moving the indicator long commute from the transportation to the economic opportunity element. The advisory board also expressed some concerns about the project. One concern was that the review of the scholarly literature introduced older white male bias into the indicator selection, given that academics tend to be older, white, and male. There was interest in identifying potential indicators using a more bottom up, community-based approach; there was consensus that this could be a future extension of updates to the project. Some advisory board members also expressed concern about the inclusion of the income inequality indicator in the social justice element. There was interest in accounting for community activism and dissent, but there was not a consensus about how to collect this data in a systematic way.

Final Indicator Selection

A few changes were made to the list of indicators following the advisory board meeting. The following indicators were removed due to difficulty collecting data: primary care providers access, garbage services, and incarceration rate. The indicator employment diversity was removed due to outdated data. The indicators property and violent crime rate were included in the calculation of the health scores but suppressed for individual neighborhoods in the indicator-level final maps and tables due to licensing issues.

The final list included the following 36 indicators (see Table 2). The geographic availability of the indicators is also noted. Detailed descriptions of these indicators are available in Appendix 1.

Table 2: Final Indicator List

Element	Indicator	Block Group	Tract
Access to Care	Health Facilities Access	X	X
	Insured Population	X	X
Affordable Quality Housing	Percent Loans Denied	X	X
	Percent Loans at Risk	X	X
	Housing Cost Burden	X	X
	Housing Instability	X	X
	Severe Overcrowding	X	X
	Subsidized Housing Density	X	X
Community Safety	Property Crime Rate	X	X
	Street Lighting	X	X
	Violent Crime Rate	X	X
Economic Opportunity	Long Commute	X	X
	Underemployment	X	X
	Unemployment	X	X
Educational Opportunity	College Degree	X	X
	High School Dropouts	X	X
	Opportunity Youth	X	X
	Preschool Enrollment	X	X
	School Facilities Access	X	X
Environmental Quality	Air Quality	X	Averaged
	Extreme Heat	X	X
	Hazardous Land Use	X	Averaged
	Major Roads and Highways	X	Averaged
	Toxins	X	Averaged

	Water Discharge Proximity	X	Averaged
Food Access	Low Income Low Access	Interpolated	X
	SNAP Enrollment	X	Averaged
Healthy Community Design	Bikeability	X	X
	Pedestrian Deaths	X	X
	Walkability	X	Averaged
Parks & Recreation	Greenness	X	X
	Open Space Access	X	X
Social & Cultural Cohesion	Community Stability	X	X
	Homeowners	X	X
	Linguistic Homogeneity	X	X
Social Justice	Income Inequality	X	X
Transportation	Lack of Car	X	X
	Public Transit Commuters	X	X
	Transit Accessibility	X	X

X: The data are available and collected at the given spatial scale.

Averaged: The data are not available at the tract level but only the block group level. The average value of block groups in each tract is calculated for the tract level data.

Interpolated: The data are not available at the block group level but only the tract level. The interpolated value with the weight of the population of each block group is applied to calculated the value of each block group.

Data Collection

Data for the indicators were collected from various sources using a strict protocol (see Appendix 1 and 6). Some raw data (e.g., School Facilities Access) were geocoded using Geographic Information Systems (GIS). The data were joined using the GEOID_Data field provided by the U.S. Census Bureau's American Community Survey ACS.

Creation of Health Scores

The data were normalized to a common scale using the Z-score method. This method identifies how much the value of the data for a particular neighborhood diverges from the average value of the data for all neighborhoods by reporting how many standard deviations away from the average value the value for a particular neighborhood is. The formula for calculating the Z score is:

$$Z - score = (\chi - \mu)/\sigma$$

where χ is the value of the indicator for a particular neighborhood, μ is the average value of the indicator across all neighborhoods, and σ is the standard deviation from the average value across all neighborhoods. The Z-scores for health detracting indicators were multiplied by -1. Neighborhoods with no population, households, or housing were treated as missing values for variables that were rates or percentages.

The Z-scores were averaged by element and across all elements to arrive at the element and overall health scores. Neighborhood percentiles were calculated using the formula below. First, the rank (r) of each neighborhood was determined by ordering the data in a decreasing order (for health promoting variables) or an increasing order (for health detracting variables). Then, the percentile was calculated by dividing the rank by the total number of neighborhoods.

$$Percentile = \frac{r}{total\ number\ of\ neighborhoods} * 100\%$$

Interactive Map Development

The health scores and indicator-specific values were displayed on an interactive map. The specifications for the interactive map are as follows:

Table 3: Technical Specifications for Interactive Map

Operation System	Ubuntu Server 18.04 LTS
Server End	Python 3.6.6 with Django 2.0.2
Browser	JavaScript with Leaflet
System Requirements	
CPU	Dual-core 3.0GHz or better
Memory	4GB or better
Disk Space	40GB or more
Internet Connection	10MB upload with static IP

Strengths and Limitations

There are strengths and limitations to our approach to developing the interactive map. One strength of our process is that we determined what indicators to include on the map using a rigorous, three-step process that drew expertise from 1) scholars, 2) existing health maps, and 3) community leaders in Arizona. This process helped to ensure that the indicators displayed on the map were evidence-based, applied widely, which enables comparison across places, and made sense for Arizona's unique context. Another strength of our process was our use of highly reliable and publicly available data sources, such as the U.S. Census and the U.S. Environmental Protection Agency, and detailed documentation of the data acquisition and management process in Appendix 1, which helps build trust in the reported data and aid future updates of the data.

Our approach to the interactive map also has several limitations. One limitation is that we only report data for one point in time; the map does not convey information about trends over time, which makes it difficult for users to understand the trajectories of communities of interest.

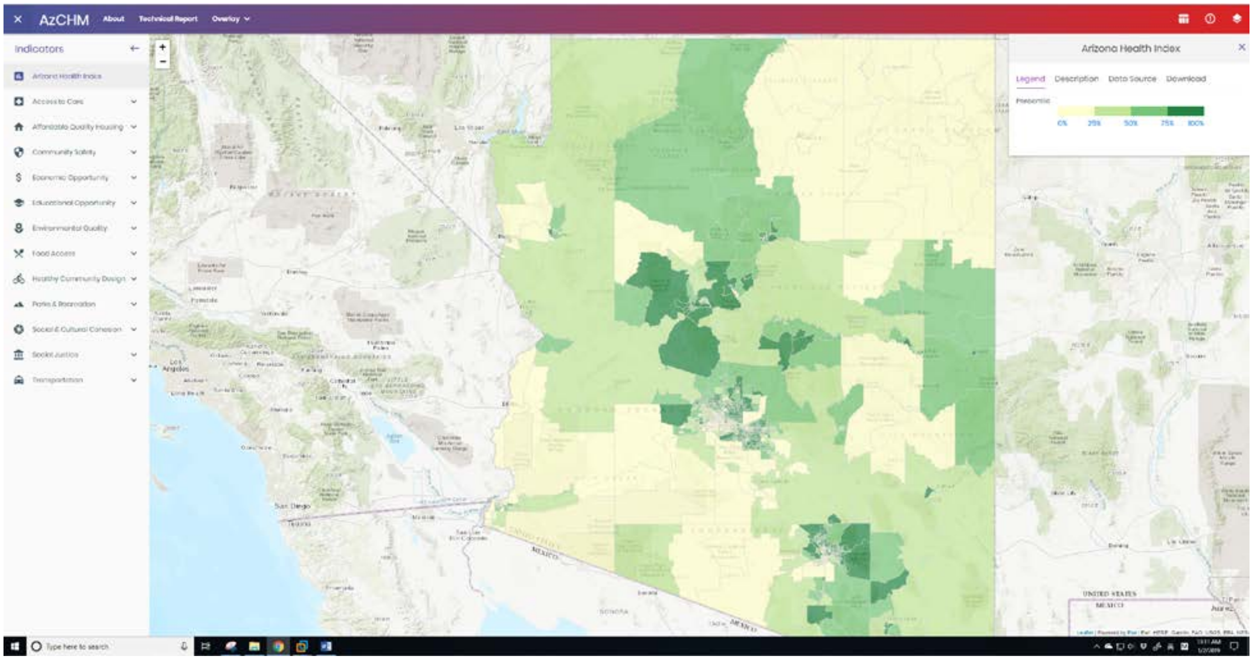
Other limitations stem from our review of the scholarly literature. First, the ASU team only had the capacity to have one ASU team member review and report effects for each study. It is possible that effects may be interpreted differently by different people. Having multiple people review and report effects would increase the reliability of the effect scores and should be a priority of future extensions of this project. Second, the measurement of some of the indicators varied across the studies, which may shape effects identified. For example, walkability often was conveyed as a composite score or index capturing one or more of the following conditions within a certain geography (e.g., within a 500 meter buffer zone of a neighborhood): residential density, land use mix, and road connectivity. These conditions also were often captured as composite or index scores. Finally, the choice to only review studies that had 50 or more citations meant that some recently published studies were excluded from the review. Further, it is possible that some highly cited, controversial studies were included in the sample. The ASU team examined how including literature with fewer than 50 citations would change the proposed indicators for the following elements: food, community safety, economic opportunity, parks, access to care, and transportation. No new indicators were identified from the inclusion of these studies; in turn, the inclusion of these studies did not dramatically affect how the indicators relate to health.

Additional indicator-specific limitations are reported under the description of each indicator in Appendix 1.

In short, the interactive map is the product of an imperfect process. The map is based on the best publicly accessible data that was available when the map was developed in 2018. Users should keep these limitations in mind in engaging with the map. Future updates of the map should attempt to overcome these limitations.

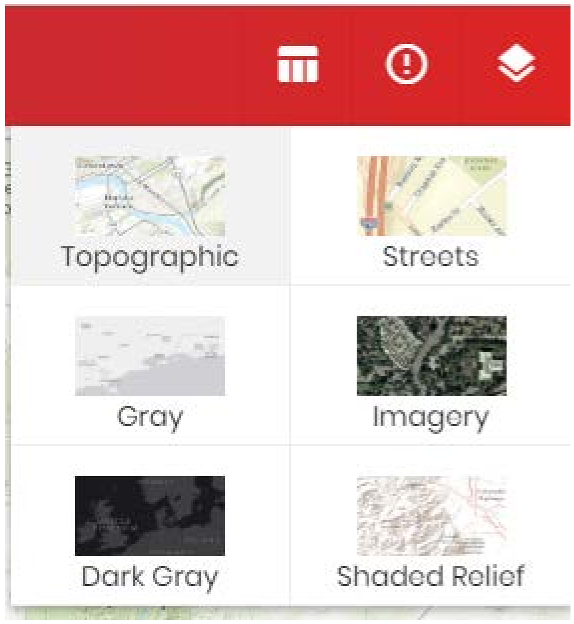
Using the Interactive Map

The interactive map is displayed as follows:



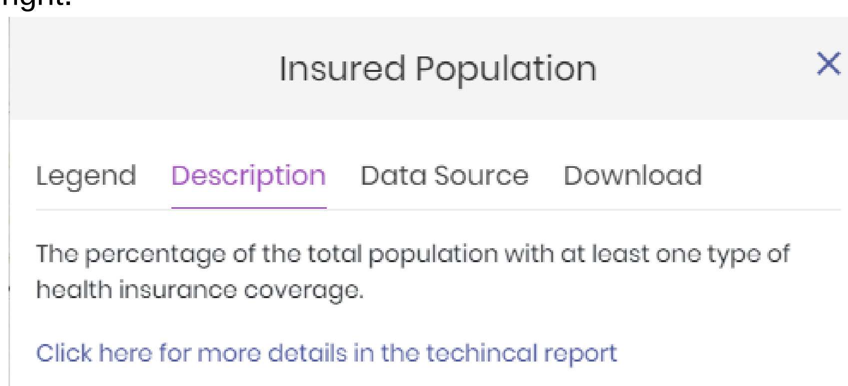
The interactive map includes the following features:

- Pan, Zoom In/Out
  - o Pan: Click and hold the left button of the mouse, and drag.
  - o Zoom In/Out: Click the +/- sign on the left upper corner of the map, or use the scroll on the mouse to zoom in/out the map. The map will show tract level data when resolution is low (zoomed out) and show block group level data when resolution is high (zoomed in)
- Change base map
  - o Click the upper right corner button to show the base map menu, select one out of six predefined base maps.
- View technical report.
  - o Click the “Technical Report” button on the menu will direct the user to the technical report file.

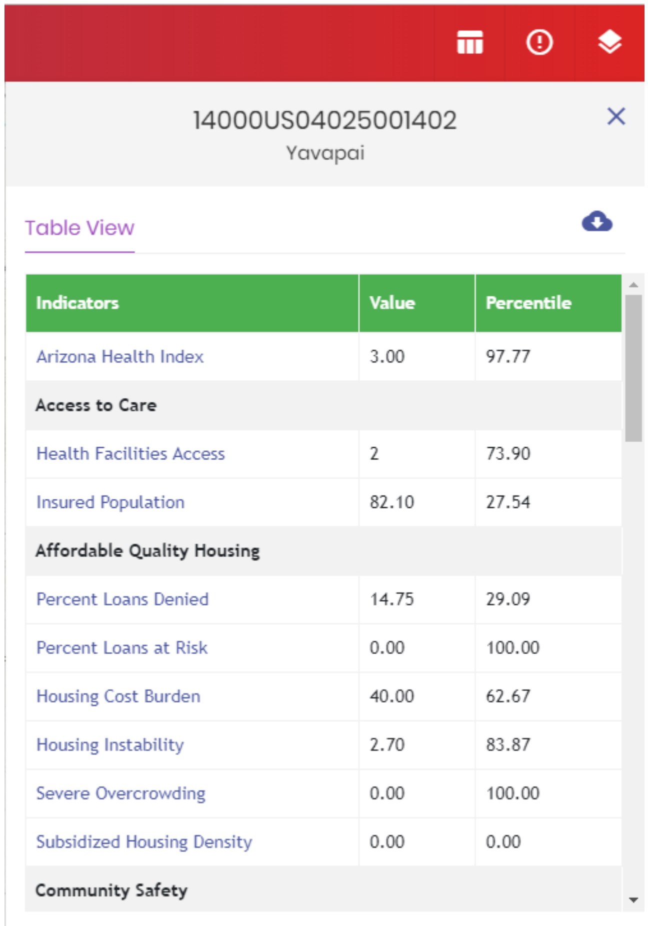


- Select indicators
  - Click the dropdown menu on the left and select the indicator you want to display.
  - Click the cross on the upper left of the webpage to close the dropdown menu. Click the same button to reopen it.
  - A popup menu on the right upper corner shows the variable name currently displayed and other metadata including:
    - Legend
    - Description with a link to the corresponding page of the technical report
    - Data source with a link to the corresponding page of the technical report
    - Download link for both block group and tract level data

The popup menu can be toggled on/off by clicking  icon on the upper right.

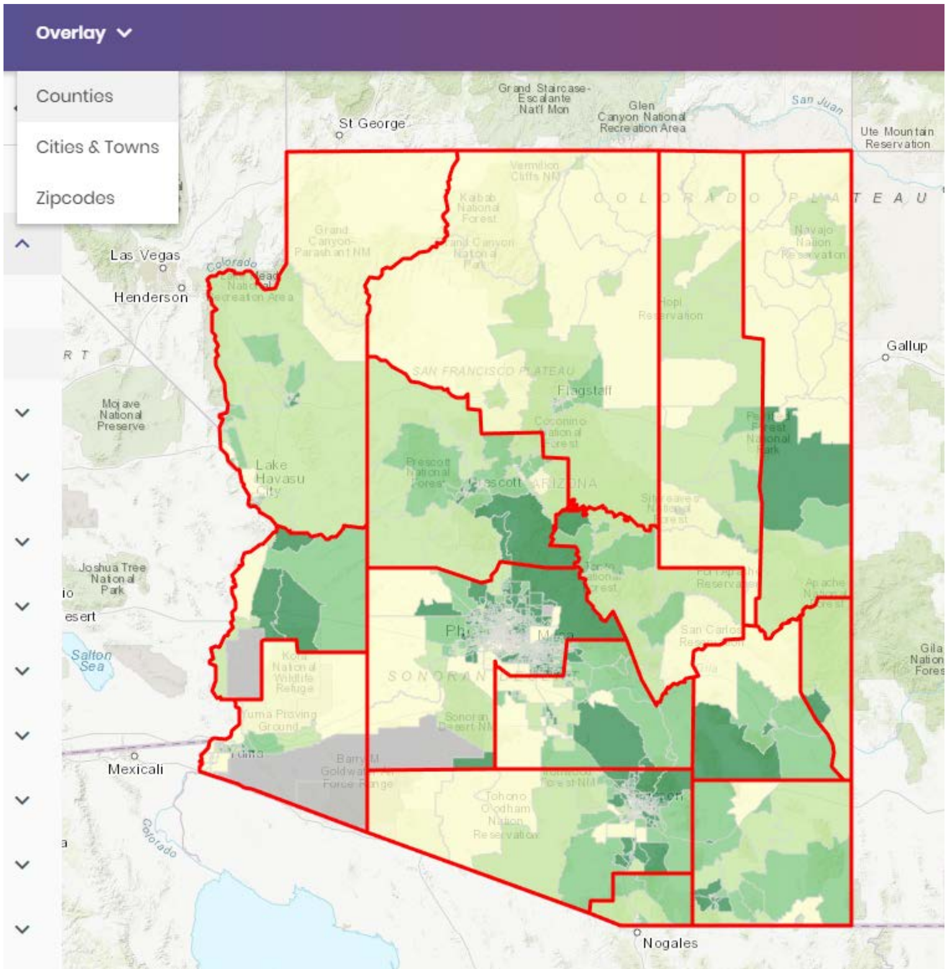


- Identify health score and indicator values
    - Click a neighborhood on the map. A pop out table will show the value of the health score and each indicator. The table will also show the percentile that the neighborhood falls into for each indicator.
    - Hover over each indicator will show a brief description of the indicator.
    - Click the icon to download the data shown in the table



Indicators	Value	Percentile
Arizona Health Index	3.00	97.77
Access to Care		
Health Facilities Access	2	73.90
Insured Population	82.10	27.54
Affordable Quality Housing		
Percent Loans Denied	14.75	29.09
Percent Loans at Risk	0.00	100.00
Housing Cost Burden	40.00	62.67
Housing Instability	2.70	83.87
Severe Overcrowding	0.00	100.00
Subsidized Housing Density	0.00	0.00
Community Safety		

- Overlay with county, city and zip code boundaries.
    - Click the overlay->County/City/Zipcode on the menu bar to show the County/City/Zipcode boundary overlaid on the currently selected variable. Click the item again to remove the overlaying boundaries.



Users and Uses of the Interactive Map

The interactive map has wide ranging applications to diverse audiences, including residents, health care providers, community groups and institutions, and local and state officials.

Residents: Residents may use the map to understand the health scores and conditions affecting health in the places where they live and work and how they compare to other places in the state. This knowledge may enable residents to make more informed decisions about where they live and work and better communicate with their health care providers about conditions potentially affecting health in their environments (e.g., the opportunity to use nearby parks and open space for exercise).

Health Care Providers: Health care providers may use the interactive map to understand conditions potentially affecting health in the neighborhoods where their patients live and work. Knowledge of these conditions may help providers offer higher quality and more targeted care (e.g., asthma screening for children living in high traffic volume communities).

Community Groups and Institutions: Community groups and institutions can draw on data provided by the interactive map in building a narrative about target communities for grant applications. The map also provides insight to community groups and institutions working in different sectors about how their work might overlap. Finally, community groups and institutions can use information about conditions in the places that they serve to advocate for policy and planning changes in these places (e.g., hazardous land use zoning changes during a general plan update).

Local and State Officials: Local and state officials may use data from the interactive map to guide planning and policy decisions (e.g., planning for transit, targeting a housing rehabilitation fund).

Appendix 1: Description of Indicators

ACCESS TO CARE

Health Facilities Access

Definition: The number of health facilities.

Evidence-Based Effect on Health:

- 0.5; weak health promoting effect
- Dai 2010: Living in areas with greater black segregation and poorer mammography access is associated with significant increases in the risk of late diagnosis of breast cancer.
- Matthews & Yang 2010: The availability of healthcare resources isn't associated with health outcomes at the community level.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2018 Medical Licensing Database created by Arizona Department of Health Services on July 13th, 2018. The dataset contains the location of each medical facility.
- Calculations: Medical facilities data were imported into ArcGIS as a point layer. A buffer was created for each spatial unit. A spatial join operation was conducted to calculate the number of medical facilities within the buffer area of each unit.
- Metadata: Following completion of calculations, metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: A few medical facilities are not included in this indicator because addresses provided in the raw data were inaccurate. Buffer distance is not used because there is not consensus about the appropriate range of the buffer. Therefore, the influence of health facilities in neighboring geographies is not considered.

Insured Population

Definition: The percentage of the total population with at least one type of health insurance coverage.

Evidence-Based Effect on Health:

- -0.17; weak health detracting effect
- St. Peter et al. 1992: Medicaid is associated with better access to care for poor children; however, Medicaid is not associated with access to similar locations or continuity of care as available to other children.
- Cunningham 2006: Communities with higher rates of people with insurance have higher levels of emergency department use.
- Suruda et al. 2005: Having Medicaid or not having insurance as a child is associated with higher rates of emergency department use for non-traumatic reasons.

Inclusion in Existing Health Maps:

- 6 of 11 (55%) maps include

Rationale for Inclusion: Intuitive link to health, despite mixed evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on June 7 and June 13, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B27010 – Types of Health Insurance Coverage by Age was selected due to its availability at the census tract and block group levels. The total population insured and the percent total population insured were calculated. As the block group level data was downloaded by county, an additional step to merge the data sheets was necessary before performing calculations.
- Calculations: Data not necessary to perform calculations were removed. In excel, for the census tract level data, two new columns were created. In one, the total

number of individuals with at least one type of health insurance was summed. In the second column, the total number of insured individuals was divided by the total population for the tract and multiplied by 100. All percentages are expressed as such in the excel documents. After merging data sheets, the same process of calculating totals and percent totals was completed for the block group level.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Variable B27010 was selected because it was accessible for both the census tract and block group levels. Variable S2701 – Selected Characteristics of Health Insurance Coverage in the United States would have simplified data processing as the percent insured was already calculated, but this variable was only available for census tracts. Therefore, in order to maintain consistent data, variable B27010 was used to determine the percentage of the total population insured for both block groups and census tracts.

AFFORDABLE QUALITY HOUSING

Percent Loans Denied

Definition: The percent of home purchase loan applications denied.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) maps include

Rationale for Inclusion: Advisory board member suggestion.

Data:

- Collection: The data used to calculate this indicator was collected from the 2016 HMDA database created by the Federal Financial Institutions Examination Council. The dataset contains the tract id and status of each home mortgage application in 2016.
- Calculations: Percent of home purchase applicants denied was calculated using the variable Action Type. Action Type =1 means the loan was originated; Action Type = 3 means the loan was denied. The formula is Action Type = 3 / (Action Type = 1 or Action Type = 3). The calculation was done at the tract level. Values were multiplied by negative one such
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Only tract level data is available.

Percent Loans at Risk

Definition: The percent of home purchase loan originated that had high cost interest rates.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) maps include

Rationale for Inclusion: Advisory board member suggestion.

Data:

- Collection: The data used to calculate this indicator was collected from the 2016 HMDA database created by the Federal Financial Institutions Examination Council. The dataset contains the tract id and status of each home mortgage application in 2016.
- Calculations: Percent of home purchase loans originated that have high interest rates was calculated using the variables Action Type and Rate Spread. A numeric value for Rate Spread signifies a high interest loan. The formula is (Action Type = 1 & Rate Spread>=1.50) / Action Type=1. The calculation was done at the tract level.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Only tract level data is available.

Housing Cost Burden

Definition: The percentage of renters who are spending 30% or more of their household income on rent.

Evidence-Based Effect on Health:

- -0.75; strong health detracting effect
- Burgard et al. 2012: Renters behind on rent are more likely to have depression.
- Coley et al. 2013: Housing costs have an unclear effect on kids' emotional and behavioral functioning.
- Pollack et al. 2010: People living in unaffordable housing have poorer self-rated health and higher hypertension, arthritis and high-cost related healthcare non-

adherence, with renters with affordability issues being especially likely to have poorer self-rated health and heath care non-adherence.
- Roberts et al. 1997: People living in neighborhoods with higher median rents were more likely to have a low birthweight child.

Inclusion in Existing Health Maps:

- 8 of 11 (73%) maps include

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on May 24 and June 6, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B25070 – Gross Rent as a Percentage of Household Income in the Past 12 Months was selected due to its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform calculations were removed. In excel, for the census tract level data, two new columns were created. In one, the total number of individuals spending 30 percent of their income or more on housing was summed. In the second column, the total number of individuals spending 30 percent or more of their income on housing was divided by the total population for the tract and multiplied by 100. All percentages are expressed as such in the excel documents. After merging data sheets, the same process of calculating totals and percent totals was completed for the block group level.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Housing Instability

Definition: The percentage of households that moved into the neighborhood within the last year.

Evidence-Based Effect on Health:

- -0.75; strong health detracting effect
- Burgard et al. 2012: People who move for cost reasons are more likely to have an anxiety attack. However, frequent moves or eviction are not associated with poorer health after controlling for characteristics associated with these outcomes.
- Coley et al. 2013: Housing stability has an unclear effect on kids' emotional and behavioral functioning.
- Cutts et al. 2011: Households who move fewer than 2 times a year have children who have better health and a lower risk of experiencing food insecurity.
- Jelleyman & Spencer 2008: Children who move more often in childhood are more likely to have behavior and emotional problems and reduced health care continuity over their lives, as well as depression in adolescence, based on a review of literature that assessed this relationship.
- Kushel et al. 2006: Low income people who move homes more frequently are more likely to postpone medical care and medications and use emergency departments and become hospitalized than low income people who move less frequently.
- Leventhal & Newman 2010: Children who move frequently are more likely to have emotional problems, based on a systematic review of studies assessing this relationship.
- Ma et al. 2008: Children who have greater housing instability are more likely to postpone medical care and medications and visit emergency departments more frequently than children who have greater housing stability.
- Rollins et al. 2012: People who have more housing instability (e.g., receive an eviction notice, report problems with landlord, or move frequently) have a higher likelihood of depression and hospital and emergency department use and report a lower quality of life.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on May 31 and June 6, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B25038: Tenure by Year Householder Moved into Unit was selected due its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. In excel, for the census tract level data, two new columns were created. The first column, the total number of households that have moved in the last year (2015 or later). Based on these values, the percent that moved in the last year was calculated by dividing this number by the total number of households per census tract and multiplied by 100 to be expressed as a percentage. After merging data sheets, the same process of calculating totals and percent totals was completed for the block group level.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Severe Overcrowding

Definition: The percentage of households who are severely overcrowded. Households qualify as severely overcrowded if there are 1.5 occupants or more per room (including all rooms in the unit).

Evidence-Based Effect on Health:

- -0.36; weak health detracting effect
- Bradman et al. 2005: Homes that are severely overcrowded are more likely to have a cockroach infestation.

- Cutts et al. 2011: Households that are severely overcrowded (more than 2 people per bedroom or more than 1 family in the home) have household members and children who are more likely to be food insecure.
- Evans 2003: People living in overcrowded housing are more likely to experience psychological distress, according to a review of studies that have assessed this relationship.
- Gove et al. 1979: People living in more overcrowded housing are more likely to experience poor mental and physical health.
- Lepore et al. 1991: College students living in more crowded homes have greater psychological distress than college students living in less crowded homes.
- Leventhal & Newman 2010: Children living in crowded homes have higher infectious disease rates, based on a systematic review of studies that have assessed this relationship.
- Roberts et al. 1997: People living in more crowded households are less likely to have a low birthweight child.
- Solari & Mare 2012: Children living in more crowded homes are perceived to have poorer quality health by their parents.
- Dunn & Hayes 2000: People who express greater satisfaction with their housing space are more likely to have higher self-rated health.
- Wasserman et al. 1998: Neighborhoods with higher rates of overcrowding are more likely to have children born with neural tube defects than neighborhoods with lower rates of overcrowding.
- Stockdale et al. 2007: Neighborhoods that have higher levels of household occupancy have a lower incidence of alcohol, drug, and mental disorders than neighborhoods that have lower levels of household occupancy.

Inclusion in Existing Health Maps:

- 3 of 11 (27%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

a. Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on May 24 and June 6, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B25014: Tenure by Occupants per Room was selected due its availability at both the census tract and block group levels.

b. Calculations: Data not necessary to perform calculations were removed. In excel, for the census tract level data, two new columns were created. In one column, the total number of renter and owner-occupied housing units with 1.51 or more occupants per room was calculated. Based on the total, the percent total of all occupied households was calculated in the second column by dividing the total count with 1.51 persons or more by the total number of households in the census tract. This number was multiplied by 100 to be expressed as a percentage. After merging data sheets, the same process of calculating totals and percent totals was completed for the block group level.
c. Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
d. Limitations: No significant data limitations were encountered when calculating these values.

Subsidized Housing Density

Definition: The number of subsidized housing units per 1,000 housing units.

Evidence-Based Effect on Health:

- 0.21; weak health promoting effect
- Anderson et al. 2003: It is unclear what effect receiving a rental voucher has on an individual's physical or mental health, based on a systematic review of studies testing this effect.
- Buchanan et al. 2009: Homeless people with HIV who lived in permanent supportive housing were healthier and more likely to be alive than homeless people with HIV who did not live in permanent supportive housing.
- Coley et al. 2013: Receiving subsidized housing has an unclear effect on kids' emotional and behavioral functioning.
- Fertig & Reingold 2007: People who live in public housing are more likely to be obese. Mothers who live in public housing have poorer health status.

- Fitzpatrick-Lewis et al. 2011: Homeless people who live in abstinent supportive housing after hospital discharge are less likely to have substance abuse problems and more likely to have improved mental health than homeless people who do not live in this housing after discharge.
- Keene & Geronimus 2011: African Americans living in public housing have greater social support and a lower risk of food insecurity compared to African Americans receiving other sources of housing assistance.
- Kimbro et al. 2010: Children living in public housing play outside for more hours than children not living in public housing.
- Kyle & Dunn 2008: Formerly homeless people with severe and persistent mental illness have better health outcomes when provided supportive and/or permanent housing, based on a review of studies that address this relationship.
- Leventhal & Newman 2010: It is unclear what effect receiving subsidized housing has on children's health, based on a systematic review of studies that address this relationship.
- Meyers et al. 2004: Low income children who are living in subsidized housing are less likely to have poor nutrition than low income children who are not living in subsidized housing, especially those who are prone to food insecurity.
- Northridge et al. 2010: Children living in public housing have a higher incidence of asthma, a finding potentially explained by the higher incidence of cockroaches and other deficiencies in quality in public housing.
- Ruel et al. 2010: People who live in public housing do not have an increased risk of being diagnosed with a health condition.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) maps reporting

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator was collected from the 2016 National Housing Preservation Database. The dataset contains the latitude and longitude of each subsidized housing property and its attributes.
- Calculations: Each record was mapped as a point in ArcGIS according to its coordinates. Then the point layer was spatial joined with the tract and block group map to calculate, for each spatial unit, the number of subsidizing housing units within. The number of subsidized housing units was then divided by the

total number of housing unit (2016 ACS 5-year data B25001) to calculate the rate.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

COMMUNITY SAFETY

Property Crime Rate

Definition: An index accounting for how the rate of property crimes in the neighborhood likely compares to the national rate.

Evidence-Based Effect on Health:

- -0.5; weak health detracting effect
- Carroll-Scott et al. 2013: Living in an area with more property crimes is associated with higher BMI.
- Grafova 2008: Living in an area with more violent crime and property crime is associated with a higher likelihood of obesity.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data was downloaded from the 2017 Crime Risk map provided by ArcGIS online on July 13th, 2018. Redundancy data columns were removed.
- Calculations: No calculation needed.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The index is based on estimated not actual raw counts of property crime. Counts of property crime are estimated using a model that accounts for neighborhood conditions that are correlated with crime. This data is not available for neighborhood-level display or downloading in the interactive map due to the licensing issues.

Street Lighting

Definition: The brightness of the street lights, as determined by the annual mean of NPP VIIRS Day Night Band radiance (unit: nW/cm2sr-1).

Evidence-Based Effect on Health:

- 0.75; strong health promoting effect
- Addy et al 2003: People who have good street lighting are more likely to be regularly active.
- Balfour & Kaplan 2002: People who live in neighborhoods with excessive noise, inadequate lighting, and heavy traffic are at increased risk of overall functional loss and lower-extremity functional loss.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator was collected from the 2015 annual mean of NPP VIIRS Day Night Band radiance created by the National Oceanic and Atmospheric Administration (NOAA). The data was downloaded on July 13th, 2018. The dataset is a raster with approximately 250 meters spatial resolution.
- Calculations: NPP VIIRS DNB data was imported into ArcGIS as a raster layer. To get the mean radiance for each areal unit, zonal statistics were calculated for block groups and tracts using the “Zonal Statistic to Table” tool.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The value of NPP VIIRS DNB radiance is also affected by other sources of light, which might bias the results.

Violent Crime Rate

Definition: An index accounting for how the rate of violent crimes in the neighborhood compares to the national rate.

Evidence-Based Effect on Health:

- -0.86; strong health detracting effect
- Augustin et al. 2008 Neighborhood psychosocial hazards (violent crime, abandoned buildings, and signs of incivility) are associated with self-reported cardiovascular disease after adjustment for individual-level risk factors.
- Beard et al. 2009: High crime levels in a community are associated with physical disability.
- Clark et al. 2008: Women who witness violent acts in their neighborhoods are more likely to experience depressive and anxiety symptoms compared to women who do not witness community violence.
- Curry et al. 2008: Violence is associated with psychological distress through perceptions of neighborhood disorder, and through experiences of violence.
- Wilson Genderson et al. 2013: Violent crime and poorer perceptions of neighborhood safety are associated with higher levels of depressive symptoms.
- Gary et al. 2008: Neighborhood problems are associated with more smoking and higher blood pressure, both of which have significant implications for cardiovascular risk.
- Gomez et al. 2004: Neighborhood violent crime may be a significant environmental barrier to outdoor physical activity for urban dwelling Mexican-American adolescent girls.
- Gupta et al. 2010: Violent crime is associated with childhood asthma prevalence.
- Hanson et al. 1999: Violent crime is a predominant contributing factor to the development of mental health problems, most commonly, posttraumatic stress disorder (PTSD).
- Hill & Angel 2005: Living in a neighborhood characterized by problems with drugs, crime, teen pregnancy, unemployment, idle youth, abandoned houses, and unresponsive police can be psychologically distressing.
- Kuo et al 2011: Neighborhood violence is not associated with physical activity.
- Mair et al. 2009: Neighborhood violence is associated with the presence of depressive symptoms in residents.
- Masi et al. 2007: Violent crime is negatively associated with birth weight.
- Messer et al. 2006: Neighborhood violent crime is positively associated with preterm birth and low birth weight among non-Hispanic white and black women.
- O’Campo et al. 1997: The per capita crime rate is positively correlated with low birth rate.

- Wright et al. 2011: Increased exposure to violence is associated with a higher number of (asthma) symptom days and more nights that caretakers lose sleep.
- Grafova 2008: Violent crime and property crime have positive influences on the risk of obesity.
- Mair et al. 2010: Perceived violence and disorder correlate positively with stress.
- Morenoff 2003: Violent crime has a negative association with birth weight.
- Stockdale 2007: Violence-exposed individuals in high crime neighborhoods are more vulnerable to depressive and anxiety disorders.

Inclusion in Existing Health Maps:

- 7 of 11 (64%) of maps include

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data was downloaded from the 2017 Crime Risk map provided by ArcGIS online on July 13th, 2018. Redundancy data columns were removed.
- Calculations: No calculation needed.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The index is based on estimated not actual raw counts of violent crime. Counts of violent crime are estimated using a model that accounts for neighborhood conditions that are correlated with crime. This data is not available for neighborhood-level display or downloading in the interactive map due to the licensing issues.

ECONOMIC OPPORTUNITY

Long Commute

Definition: The percentage of people who commute to work by car, truck, or van alone who drive longer than 30 minutes to work each day.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 6 of 11 (55%) of maps include

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on June 8 and June 13, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B08134: Means of Transportation to Work by Travel Time to Work was selected due to its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. In excel, for the census tract level data, two new columns were added. The total number of individuals who drive a car, truck, or van alone to work with a commute of 30 minutes or more was calculated in one column. In the second column, the percent total was calculated using the total number of individuals who commute alone to work by car, truck, or van within each census tract as the denominator and the aforementioned calculation as the numerator. The percentage was expressed as such in the excel sheet.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets

provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Underemployment

Definition: a. Definition: The ratio of part-time to full-time employment among employed workers 16 years and older. Full-time employment is defined as working 35 hours or more per week for 50 to 52 weeks in the past 12 months.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Advisory board member suggestion. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract level and block group level data were downloaded on May 24 and June 6, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B23027: Full-Time, Year-Round Work Status in the Past 12 Months by Age for the Population 16 Years and Over was selected due to its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations was removed. In excel, for the census tract level data, three new columns were added. The total number of individuals working full-time, year-round in the past 12 months was summed. The total number of individuals working less than full-time, year-round in the past 12 months was summed. The ratio of part-time to full-time workers

who worked in the past 12 months was calculated by dividing the total part-time by the total full-time. The ratio is expressed as a decimal.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The underemployment ratio may not reflect the nuances of being underemployed in Arizona. The number and consistency of hours an individual works is highly variable. When reporting the hours worked per week in the past 12 months, those with considerably variable hours were to report an approximate average of hours worked per week. This information does not include the consistency of work in the past year. The underemployment ratio also fails to account for education, income, and place of work which could indicate whether an individual is underemployed based on salary or educational attainment. The underemployment ratio also assumes that those who are working less than full-time, year-round are able to work full-time, year-round which is not always the case. The ratio merely illustrates the potential for full-time employment.

Unemployment

Definition: The percentage of unemployed workers in the civilian workforce.

Evidence-Based Effect on Health:

- -0.75; strong health detracting effect
- Dubowitz et al. 2012: Household income and employment rate are negatively associated with BMI and blood pressure.
- Giatti et al. 2010: Being unemployed and living in a low-income household are associated with poor self-rated health.
- Joy et al. 2008: Unemployment is associated with delayed access to HIV treatment.
- Pearl et al. 2001: High-poverty or high-unemployment neighborhoods are associated with lower birthweight.

Inclusion in Existing Health Maps:

- 9 of 11 (88%) of maps include.

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. The census tract and block group level data were downloaded on June 7 and June 13, 2018 respectively. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of data available at the block group level, the data was downloaded by county rather than as a whole. B25025: Employment Status for the Population 16 Years and Over was selected due to its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. In excel, for the census tract level data, one new column was added. The percentage of the total population for each census tract that is unemployed was calculated using the variable HD01_VD05 – Estimate; In labor force: - Civilian labor force: - Unemployed. HD01_VD05 was divided by the total number of individuals in the labor force per tract and multiplied by 100. All percentages are expressed as such in the excel documents. After merging data sheets, the same process of calculating the percent totals was completed for the block group level.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

EDUCATIONAL OPPORTUNITY

College Degree

Definition: The percentage of adults 25 years and older with a college degree or higher. College degrees or higher include Associate's, Bachelor's, Master's, Professional School, and Doctorate degrees.

Evidence-Based Effect on Health:

- 0.75; strong health promoting effect
- Elreedy et al. 1999: Men without high school degrees living in less educated neighborhoods have higher bone lead concentrations than men without high school degrees living in more educated neighborhoods.
- Galea & Ahern 2011: Neighborhoods with more diverse educational levels have lower infant mortality and low birth weight rates but no different cardiovascular, cerebrovascular, liver or lung disease rates than neighborhoods with more homogenous educational levels.
- Ross 2000b: People living in neighborhoods where more people have college degrees are more likely to walk than people living in neighborhoods where fewer people have college degrees.
- Subramanian et al. 2006b: Low birth weight babies are more common in neighborhoods where a lower proportion of adults have high school degrees than in neighborhoods where a higher proportion of adults have high school degrees.
- Wasserman et al. 1998: Children with neural tube defects are more common in less educated neighborhoods than in high educated neighborhoods.
- Wight et al. 2006: Older adults living in less educated communities have poorer cognitive function than older adults living in more educated communities.

Inclusion in Existing Health Maps:

- 6 of 11 (55%) of maps include

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 24, 2018 and

June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B15003: Educational Attainment for the Population 25 Years and Over was selected due to its availability at both the census tract and block group levels.

- Calculations: Data not necessary to perform the calculations were removed. In excel, for the census tract level, four new columns were added. The same excel document was used to calculate the total number of individuals with college degrees, the percent total with college degrees, the total number of individuals without a high school degree, and the percent total without a high school degree. The same variable was used to calculate the values for both indicators (college degree and dropouts), so to simplify, all calculations were completed in the same excel document and a copy was created for each folder, with the appropriate naming conventions. In one column, the total number of individuals within each tract with a college degree was summed. Based on this value, the percent total within each tract with a college degree was calculated.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method. Two copies of the metadata files were created with appropriate naming conventions for both the college degree and dropout folders.
- Limitations: No significant data limitations were encountered when calculating these values.

High School Dropouts

Definition: The percentage of adults 25 years and older without a high school degree.

Evidence-Based Effect on Health:

- -0.75; strong health detracting effect
- Elreedy et al. 1999: Men without high school degrees living in less educated neighborhoods have higher bone lead concentrations than men without high school degrees living in more educated neighborhoods.
- Galea & Ahern 2011: Neighborhoods with more diverse educational levels have lower infant mortality and low birth weight rates but no different cardiovascular,

cerebrovascular, liver or lung disease rates than neighborhoods with more homogenous educational levels.

- Ross 2000b: People living in neighborhoods where more people have college degrees are more likely to walk than people living in neighborhoods where fewer people have college degrees.
- Subramanian et al. 2006b: Low birth weight babies are more common in neighborhoods where a lower proportion of adults have high school degrees than in neighborhoods where a higher proportion of adults have high school degrees.
- Wasserman et al. 1998: Children with neural tube defects are more common in less educated neighborhoods than in high educated neighborhoods.
- Wight et al. 2006: Older adults living in less educated communities have poorer cognitive function than older adults living in more educated communities.

Inclusion in Existing Health Maps:

- 11 of 11 (100%) of maps include.

Rationale for Inclusion: Evidence of association with health. Included in existing health maps.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On June 8, 2018 and June 13, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B15003: Educational Attainment for the Population 25 Years and Over was selected due to its availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. New columns were created in order to calculate the total number of individuals without high school degrees and the percent total without high school degrees. Just as with the ACS data, metadata and descriptive fields were filled out. Metadata field names were created for each new variable. To calculate the number of individuals without a high school degree, all those whose highest level of education was “12th grade, no diploma” or lower were summed. The total population without a high school degree for each spatial unit was then divided by the total population per spatial unit and converted to a percentage.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method. Two copies of the metadata files were created with appropriate naming conventions for both the college degree and dropout folders.
- Limitations: No significant data limitations were encountered when calculating these values.

Opportunity Youth

Definition: The percentage of youth, ages 16 to 19, not enrolled in school and unemployed.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 3 of 11 (27%) of maps include.

Rationale for Inclusion: Advisory board member suggestion.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 24 and June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B14005: School Enrollment by Educational Attainment by Employment Status for the Population 16 to 19 Years was selected to calculate the percentage of opportunity youth.
- Calculations: Data not necessary to perform the calculations was removed. New columns were created in order to calculate the total number of individuals between ages 16 and 19 who were not in school and not employed and the percent total opportunity youth. Just as with ACS data, metadata and descriptive

fields were filled out. Metadata field names were created for each new variable. To calculate the number of individuals who qualify as opportunity youth, all combinations of unemployed and not in school were summed, regardless of high school graduation status. The total opportunity youth per spatial unit was then divided by the total population per spatial unit and converted to a percentage.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Preschool Enrollment

Definition: The percentage of children between the ages of 3 and 5 enrolled in nursery school or preschool.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 4 of 11 (36%) of maps include.

Rationale for Inclusion: Advisory board member suggestion.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 24, 2018 and June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B14007: School Enrollment by Detailed Level of School for the Population 3 Years and Over and B09002: Own Children Under 18 years by Family Type and Age were selected to calculate the percentage of preschool aged children enrolled in preschool.

- Calculations: Data not necessary to perform the calculations were removed. In excel, for the census tract level, two new columns were created. The total number of children in each tract ages 3, 4, and 5 was calculated using the data from variable B09002. The number of children enrolled in nursery school and preschool were grouped together by ACS, so this variable HD01_VD03, was used to calculate the final variable – the percentage of all 3, 4, and 5 year olds enrolled in nursery school or preschool.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Data availability limited the accuracy of our calculations for the percentage of children between ages 3 and 5 enrolled in preschool. ACS groups enrollment in nursery school and preschool into one category. Nursery school and preschool are often used interchangeably, but nursery school may refer to daycare or childcare centers which provide care to children under age 3. B09002 – Own Children Under 18 Years by Family Type and Age details the number of children per age group, not each age level specifically. The categories "3 and 4 years" and "5 years" were selected as preschool age due to variability in age of enrollment. These values may capture some 4 and 5 year olds who are already in kindergarten. For these reasons, some values exceed 100 percent preschool enrollment, while other values may be lower than is accurate.

School Facilities Access

Definition: Number of schools within 0.5 miles of the boundary of the neighborhood.

Evidence-Based Effect on Health:

- 0.08; weak health promoting effect
- Lin & Moudon 2010: People living in neighborhoods with more schools within a 1 km buffer walk fewer minutes than people living in neighborhoods with fewer schools within that buffer.
- Rodriguez et al. 2012: Adolescent females who are in neighborhoods with schools are more physically active than adolescent females who are in other kinds of neighborhoods.

- Sallis & Glanz 2006: Children living in neighborhoods with more proximity to schools are more physically active, based on a systematic review of research assessing this relationship.
- Ukkusuri et al. 2012: Pedestrian crashes are more likely in neighborhoods with more schools than in neighborhoods with fewer schools.
- Babey et al. 2009: Adolescents who live closer to a school are more likely to actively commute to school.
- McDonald 2008: Children who live closer to school are more likely to walk to school than children who live further from school.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the Arizona Department of Education (ADE) website on June 13th, 2018. The data was last updated in 2017. The data contains the name and address of each school in Arizona.
- Calculations: The school data were first geocoded into coordinates and then loaded into ArcGIS as a point layer. A 0.5 mile buffer was created for each spatial unit. A spatial join operation was conducted to calculate the number of schools within the buffer area of each unit.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Less than 2% of schools were not geocoded due to inaccurate addresses provided by ADE.

ENVIRONMENTAL QUALITY

Air Quality

Definition: PM 2.5 level in the air.

Evidence-Based Effect on Health:

- -0.86; strong health detracting effect
- Hankey et al. 2012: Exposure to air pollution may offset the health benefits of greater physical inactivity in more walkable neighborhoods.
- Macintyre et al. 2011: Exposure to air pollution is associated with otitis media.
- Mohai et al. 2011: Schools within areas of highest air pollution levels have lowest attendance rates - an indicator of poor health.
- Schootman et al. 2006: Neighborhood characteristics (including air quality) are an independent contributor to the risk of incidence of lower-body functional limitations in middle-aged African Americans.
- Suglia et al. 2007: Higher black carbon levels predict decreased cognitive function (verbal, non-verbal, memory) in children.
- Wilhelm et al. 2009: Children living in high O_3, PM_{10}, and CO areas appear to have worse asthma morbidity rates.
- Evans & Kantrowitz 2002: Income is often directly related to environmental quality (toxins, noise air quality), which are inversely related to physical and psychological health outcomes.

Inclusion in Existing Health Maps:

- 5 of 11 (45%) of maps include.

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: Arizona EJSCREEN data were downloaded from the Environmental Protection Agency's Environmental Justice Screening tool on June 19, 2018. The data were compared to the metadata to determine which variables were appropriate for the hazardous land use indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Data not necessary for inclusion was removed. No additional variables were created. PM 2.5 Level in Air was used to characterize air quality.

- Metadata: Metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The publicly available NATA, PM 2.5 and ozone data are at the tract level. Each block group was assigned with the PM score of the tract containing it. No other significant data limitations were encountered.

Extreme Heat

Definition: Average number of days with a high temperature of over 105F during the past 10 years.

Evidence-Based Effect on Health:

- -0.63; strong health detracting effect
- Harlan et al. 2006: Higher community temperatures are associated with greater vulnerability to heat exposure.
- Uejio et al. 2011: The impact of heat exposure on heat-related mortality and heat distress calls is mediated by city-level factors, i.e. neighborhood stability, socioeconomic vulnerability, built environment, housing vacancy rates, etc.
- Rosenthal et al. 2014: Summertime heat coupled with neighborhood-level characteristics, such as poor housing conditions, impervious land cover, surface temperatures, etc. has a positive association with mortality rate ratios among those aged 65 and over.
- Johnson et al. 2012: Living in a community that is more vulnerable to extreme heat is associated with a higher likelihood of heat-related mortality.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include.

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The raw data was downloaded from Daymet daily weather data from ORNL DAAC. The data contain the daily highest temperature from 1/1/2008 to

12/31/2017 for North America in NetCDF format. The spatial resolution of the data is 1km.

- Calculations: The Arizona data was extracted from the dataset and then aggregated to calculate for each cell the number of days the highest temperature was over 105 F in the past 10 years. Then, the aggregated data was spatially joined to the block group and tract layer to calculate for each areal unit the number of days of having extreme heat.
- Metadata: Following completion of the calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method. Two copies of the metadata files were created with appropriate naming conventions.
- Limitations: No significant data limitations were encountered when calculating these values.

Hazardous Land Use

Definition: the proximity of superfund to each areal unit.

Evidence-Based Effect on Health:

- -0,70; strong health detracting effect
- Downey & Willigen 2005: Residential proximity to industrial activity has direct and perception-mediated negative impacts on mental health.
- Gould 1986: Neighborhood proximity to hazardous sites (abandoned toxic waste sites) correlates with higher cancer mortality rates.
- Matthews et al. 2010: Presence of hazardous waste facilities in a neighborhood impacts health by enhancing stress levels.
- Ozonoff et al. 1987: Airborne hazardous waste exposure is associated with more self-reported complaints of respiratory system and constitutional health.
- Shusterman et al. 1991: Physical symptoms (headaches, nausea, eye and throat irritation) are mediated by odor perception frequency and degree of worry.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: Arizona EJSCREEN data were downloaded from the Environmental Protection Agency's Environmental Justice Screening tool on June 19, 2018. The data were compared to the metadata to determine which variables were appropriate for the hazardous land use indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Data not necessary for inclusion was removed. No additional variables were created. Superfund proximity was used to describe hazardous land use.
- Metadata: Metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered.

Major Roads or Highways

Definition: Traffic proximity and volume.

Evidence-Based Effect on Health:

- -0.68; strong health detracting effect
- Balfour & Kaplan 2002: Neighborhood problems (includes traffic, noise, crime, trash/litter, lighting, & public transit) are associated with greater risk of functional deterioration in older people compared to neighborhoods with few problems.
- Becerra et al. 2013: Prenatal air pollution exposure, mostly related to traffic sources, is associated with autism.
- Casagrande et al. 2009: Light traffic is positively associated with physical activity.
- Clougherty et al. 2007: The association between traffic related air pollution and asthma exists solely among urban children exposed to violence.
- Currie et al. 2009: Carbon monoxide exposure, primarily through vehicles, is associated with reduced birth weights and gestation times, particularly if exposure occurs during 3rd trimester.
- Davison & Lawson 2006: Children's participation in physical activity is negatively associated with traffic density and speed.
- Ding et al. 2011: Traffic speed/volume is negatively associated with children's physical activity.
- Juhn et al. 2005: Households who live in non-inner cities who face an intersection with highways or roads have a higher likelihood of childhood asthma.

- Kim et al. 2004: Traffic-related air pollution is associated with respiratory symptoms in children, including chest illness, asthma, and bronchitis.
- McConnell et al. 2015: Exposure to tobacco smoke and near-roadway pollution exposure is associated with childhood obesity, with potential synergistic effects.
- Miles et al. 2011: Chronic noise exposure due to high density of auto commuters relative to land area is associated with more symptoms of depression.
- Owen et al. 2004: The perception of traffic has a mixed effect on walking.
- Rosso et al. 2011: High-traffic volume is positively associated with walking.
- Seto et al. 2007: Increased street traffic is associated with increased urban noise exposure. Bus and heavy truck traffic are the most important contributors to noise. Living along arterial streets also is associated with an increased risk of annoyance.
- Schootman et al. 2006: Neighborhood characteristics (including noise pollution - traffic, industry, etc.) are independent contributors to the risk of incidence of lower-body functional limitations in middle-aged African Americans.
- Stansfeld et al. 2011: Transport, industry, and neighbor-related noise is associated with increased blood pressure, sleep and activity interference, catecholamine secretion, long-term memory in children, and psychiatric disorders.
- Yen et al. 2006: Perceived neighborhood problems (traffic, noise) are associated with poorer QOL, physical functioning, and increased depressive symptoms among adults with asthma.
- Berry et al. 2010: Socioeconomic status and perceived traffic (that makes it difficult to walk) are related to increased BMI.
- Gauderman et al. 2005: Living close to a freeway is associated with an Increased incidence of asthma. Asthma is not associated with traffic volumes on roadways within 150 meters of homes or with model-based estimates of pollution from nonfreeway roads.
- Leslie and Cerin 2008: Neighborhood satisfaction with traffic and noise is associated with self-reported mental health.
- Brownson et al. 2001: Heavy traffic is positively associated with physical activity.
- Clarke et al. 2009: Older adults who live in neighborhoods characterized by more motorized travel have higher mobility disability.
- Giles-Corti et al. 2011: Children are less likely to walk to school when they live among street networks designed for heavy traffic.
- Timperio et al. 2004: Heavy traffic in a neighborhood is associated with a lower likelihood of walking to school among some children but a higher likelihood of walking to school among other children.
- Zhu and Lee 2009: The likelihood of walking to school is lower in communities with highways and freeways.

- Wier et al. 2009: Traffic is positively associated with vehicle pedestrian injury collisions.
- Currie & Walker 2011: Efforts to reduce traffic congestion and vehicle emissions are associated with reduced prematurity and low birth weight among mothers.
- Gee and Takeuchi 2004: Perceived traffic stress (traffic, auto maintenance and accidents) is associated with poorer general health status and depression.
- Suglia et al. 2008: Exposure to traffic-related black carbon independently predicts decreased lung function in urban women, adjusting for tobacco, smoke, asthma, and socioeconomic status.
- Jerrett et al. 2008: Exposure to traffic-related air pollution in children is associated with the onset of asthma.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: Arizona EJSCREEN data were downloaded from the Environmental Protection Agency's Environmental Justice Screening tool on June 19, 2018. The data were compared to the metadata to determine which variables were appropriate for the hazardous land use indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Data not necessary for inclusion was removed. No additional variables were created. Traffic proximity and volume was used to describe hazardous land use.
- Metadata: Metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered.

Toxins

Definition: The risk of cancer caused by air toxins.

Evidence-Based Effect on Health:

- -1.00; strong health detracting effect
- Bevc, Marshall, & Picou 2005: Perceived and objective exposure to harmful chemicals is associated with poorer physical health and psychological well-being.
- Evans 2003: Certain types of toxins are linked to behavioral disturbances.
- Evans & Kantrowitz 2002: Toxins are inversely related to physical and psychological health outcomes.

Inclusion in Existing Health Maps:

- 2 of 11 (18%) of maps include.

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: Arizona EJSCREEN data were downloaded from the Environmental Protection Agency's Environmental Justice Screening tool on June 19, 2018. The data were compared to the metadata to determine which variables were appropriate for the hazardous land use indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Data not necessary for inclusion was removed. No additional variables were created. Air toxics cancer risk was used to describe toxins.
- Metadata: Metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered.

Water Discharge Proximity

Definition: Water discharge proximity considering pollutant loadings from the Discharge Monitoring Report (DMR) Loading Tool for toxic chemicals reported to the Toxics Release Inventory.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 3 of 11 (27%) of maps include.

Rationale for Inclusion: Intuitive association with health.

Data:

- Collection: Arizona EJSCREEN data were downloaded from the Environmental Protection Agency's Environmental Justice Screening tool on June 19, 2018. The data were compared to the metadata to determine which variables were appropriate for the hazardous land use indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Data not necessary for inclusion was removed. No additional variables were created.
- Metadata: Metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: Very little data on water quality is available at the census tract and/or block group level; hence the water discharge proximity data was used.

FOOD ACCESS

Low Income Low Access

Definition: Neighborhoods that lack supermarkets within a mile for the urban area and 10 miles for the rural area. Values are weighted by the number of low-income people living in the neighborhood.

Evidence-Based Effect on Health:

- 0.36; weak health promoting effect
- Black et al. 2010: Living in a community with large supermarkets is associated with a lower risk of obesity.
- Bodor et al. 2010: Having access to supermarkets in a community is associated with reduced obesity.
- Casagrande et al. 2009: The presence of supermarkets and specialty stores is associated with meeting fruit and vegetable guidelines.
- Caspi et al. 2012: Various food accessibility measures are inconsistently correlated with dietary outcomes.
- Cummins et al. 2014: The arrival of a supermarket into a community is not associated with changes to reported fruit and vegetable intake or body mass Index.
- Drewnowski et al. 2012: Distance to nearest supermarket is not associated with obesity.
- Dubowitz et al. 2012: Older women who live near a supermarket have lower BMI.
- Liu et al. 2007: People who live in lower population density regions have an increased risk of being overweight when they live further from a supermarket.
- Lopez 2007: The presence of a supermarket in a community is negatively associated with obesity risk.
- Morland and Evenson 2009: The prevalence of obesity is lower in areas that have supermarkets and higher in areas with small grocery stores or fast food restaurants.
- Shier and Sturm 2012: There is mixed evidence to support the hypothesis that improved access to large supermarkets results in lower youth BMI using various measures of access (counts of a particular type of food outlet per population, food environment indices, and indicators for the presence of specific combinations of types of food stores).
- Dubowitz et al. 2015: Having a supermarket in the neighborhood is associated with improved perceived access to healthy food but is not associated with fruit and vegetable intake, whole grain consumption, or body mass index.

- Morland et al. 2002: Living near a supermarket is associated with increased fruit and vegetable intake.
- Zenk et al. 2009: Having a large grocery store in the neighborhood is associated with increased fruit and vegetable intake.
- Black et al. 2010: Neighborhoods with supermarkets have lower rates of obesity.
- Carroll-Scott et al. 2013: People who live further from grocery stores have higher BMI.
- Rundle et al. 2009: People living in neighborhoods with a higher density of healthy food outlets (supermarkets, fruit and vegetable markets, and natural food stores) have lower BMI.
- Laraia et al. 2004: Pregnant women living in neighborhoods with food retail outlets nearby (supermarkets, grocery and convenience stores) have a higher quality diet.
- Boone-Heinonen et al. 2011: There is mixed evidence that the availability of supermarkets is associated with diet outcomes.
- Hattori et al. 2013: There is mixed evidence that living near a supermarket is associated with a lower risk of obesity.
- Pruchno et al. 2014: People who live near supermarkets are less likely to be disabled.

Inclusion in Existing Health Maps:

- 5 of 11 (45%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: Food access data at the tract level were downloaded from the U.S. Department of Agriculture on July 20, 2018. The data were compared to the metadata to determine which variables were appropriate for the food access indicator. Those variables were separated out and added to a new appropriately named excel document.
- Calculations: Only the low access, low-income population variable was kept to provide the information on the amount of people who are low-income and have their closest supermarket beyond 1 mile of the neighborhood for urban areas and 10 miles of their neighborhood for rural areas.
- Metadata: Metadata sheet was created for the census tract level. Using the metadata sheet provided in the ACS variable downloads, metadata was edited in

excel and then converted into .txt files. Each text file was edited using the aforementioned method.

- Limitations: The food access data were only available at the tract level. Neighborhoods at a finer scale (e.g., block group level) were assigned the same score as the tract containing the neighborhoods.

SNAP Enrollment

Definition: The percentage of income-eligible households enrolled in the Supplemental Nutrition Assistance Program.

Evidence-Based Effect on Health:

- No evidence for effect in literature reviewed.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) of maps include.

Rationale for Inclusion: Advisory board member suggested.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On June 29, 2018, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B17017: Poverty Status in the Past 12 Months by Household Type by Age of Household and B22010: Receipt of SNAP in the Past 12 Months by Disability Status for Households were selected to calculate SNAP enrollment due to their availability at both the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. Only four variables and their margins of error were kept to perform calculations: total population, households receiving food stamps/SNAP in the last 12 months, households not receiving food stamps/SNAP in the last 12 months, and total households with an income in the past 12 months below the poverty level. One

new column was created for calculations. Just as with ACS data, metadata and descriptive fields were filled out. To calculate the percentage of income-eligible households enrolled in SNAP, the number of households receiving food stamps/SNAP in the last 12 months was divided by the number of households below the poverty level for each spatial unit. This value was then converted into a percentage.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: In order to calculate values for this variable, research was done to determine how to represent the income eligibility component. According to the United States Department of Agriculture (USDA), income eligibility standards for fiscal year 2016 was either 130 percent of poverty level for gross monthly income or 100 percent of poverty level for net monthly income. The income values vary from year to year, but the standard percent of poverty level remains the same. Due to limitations in data availability, we were unable to find more specific information on income in relation to poverty level. Instead, B17017 was as a proxy. This variable does not specify whether income below the poverty line is gross or net. Certain individuals were also left out of the survey including people living in college dormitories and institutionalized people and people living in military group quarters. SNAP enrollment data was gathered from B22010. This variable was selected over other variables representing SNAP enrollment due to its availability at the block group level.

HEALTHY COMMUNITY DESIGN

Bikeability

Definition: The miles of bike lanes in the neighborhood.

Evidence-Based Effect on Health:

- 0.50; weak health promoting effect
- Rahman et al. 2011: People living in neighborhoods with more bikeability are more physically active than people living in other kinds of neighborhoods.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data was collected from Open Street Map on June 13th, 2018. The raw data was downloaded using QGIS and only the bike lane features were kept.
- Calculations: The bike lane data were first intersected with the areal unit layer. Then the bike lane segments were joined with the areal unit file base on the intersection relationship to get the length of bike lanes in each areal unit.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Pedestrian Deaths

Definition: Number of pedestrian deaths occurring from pedestrian-car accidents.

Evidence-Based Effect on Health:

- -0.50; weak health detracting effect
- Lovasi et al. 2011: The pedestrian–auto injury rate, an indicator of traffic safety problems, is associated with physical activity and adiposity.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used in calculating this indicator were the 2016 pedestrian deaths in pedestrian-car accidents provided by the Arizona Department of Transportation. The data was downloaded on July 13th, 2018. The data contains the locations of each pedestrian death in Arizona.
- Calculations: A spatial join was conducted to calculate the number of pedestrian deaths within each areal unit.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Walkability

Definition: A composite score accounting for how walkable the neighborhood is. The score is based on: street intersection density, proximity to transit stops, and diversity of land uses.

Evidence-Based Effect on Health:

- 0.38; weak health promoting effect
- Adams et al. 2011: Neighborhoods with more walkable environments have more physically active residents.
- Berke et al. 2007a: Neighborhoods with more walkable environments have more physically active older residents. Neighborhoods with more walkable environments have lower likelihood of depression among men.

- Berke et al. 2007b: Men living in more walkable neighborhoods are less likely to be depressed than men living in less walkable neighborhoods.
- Boehmer et al. 2007: Neighborhoods lacking access to nonresidential destinations have more obese residents.
- Brown et al. 2009: Neighborhoods with more of a mix of land uses have lower BMIs.
- Carlson et al. 2012a: People living in neighborhoods with more destinations nearby were more likely to destination walk. People living in neighborhoods with a greater density of road connections were more likely to destination walk.
- Carlson et al. 2012b: Older people living in neighborhoods with more walkable environments were more physically active when they also had social support for physical activity.
- Clarke & George 2005: Older people living in neighborhoods with more land use diversity were less likely to experienced disabilities affecting activities of daily living. Older people with functional limitations living in higher housing density neighborhoods were less likely to report self-care disability.
- Coleman et al. 2008: Dog walkers who walked their dogs were more likely to live in walkable neighborhoods than dog walkers who did not walk their dogs.
- Craig et al. 2002: People who lived in neighborhoods with more pleasing environments (including a greater number and variety of destinations) were more likely to walk to work.
- Ding et al. 2011: Existing research shows that children and adolescents who live in neighborhoods with more residential density and land use mix are more physically active; children who live in more walkable neighborhoods are more physically active.
- Miles et al. 2011: People living in neighborhoods with higher residential density were less likely to experience depression than people living in neighborhoods with less residential density.
- Coogan et al. 2009: African American women who live in neighborhoods with higher housing density are more likely to engage in physical activity than African American women who live in neighborhoods with less housing density.
- Ewing 2005: People who live in more compact neighborhoods are more likely to travel by walking, based on a systematic review of studies assessing this relationship.
- Frank et al. 2006: People living in more walkable neighborhoods are more physically active and have lower BMI than people living in less walkable neighborhoods.
- Hirsch et al. 2013: People living in more walkable neighborhoods have higher odds of walking for transport than people living in less walkable neighborhoods.

- Handy et al. 2008a: Children living in neighborhoods with cul-de-sacs are more physically active outdoors than children living in neighborhoods without cul-de-sacs.
- Holt et al. 2008: Young children (grade K-2) living in neighborhoods with cul-de-sacs are more physically active outdoors than older children (grade 3-6) living in neighborhoods with cul-de-sacs.
- Humpel et al. 2004: Women who perceived their neighborhoods as being more accessible (comprised of various factors related to walkability) were more likely to walk for pleasure than women who perceived their neighborhoods as being less accessible.
- King 2008: Older adults are more physically active in less walkable neighborhoods than more walkable neighborhoods.
- King et al. 2011: Older adults are more physically active and have lower BMIs in more walkable neighborhoods than less walkable neighborhoods.
- Kozo et al. 2012: People living in less walkable neighborhoods were no more or less likely to spend time sitting than people living in more walkable neighborhoods.
- Lee & Moudon 2006: People living in neighborhoods with more specific land uses closer by, like grocery stores, are more likely to walk.
- Li et al. 2005: Older people living in neighborhoods with more employment density, household density, and street intersections are more likely to walk than older people living in neighborhoods without these characteristics.
- Li et al. 2009: Older and middle age adults who live in walkable neighborhood and increase their physical activity over the year are more likely to lose weight and waist circumference than those in less walkable neighborhoods/who don't increase their physical activity.
- Lin & Moudon 2010: People living in neighborhoods with more sidewalks walk more minutes than people living in neighborhoods with fewer sidewalks.
- Lovasi et al. 2011. Low-income preschoolers living in more walkable neighborhoods are more physically active than low-income preschoolers living in less walkable neighborhoods.
- Lund 2003: People who perceive their neighborhoods as being more walkable are more likely to walk.
- Mobley et al. 2006: Low-income women living in neighborhoods that have more mixed land uses have lower BMIs and risks of coronary heart disease than low-income women living in neighborhoods that have more single land uses.
- Mujahid et al. 2008a: People living in more walkable neighborhoods with more access to healthy foods have lower BMIs than people living in less walkable neighborhoods with less access to healthy foods.

- Mujahid et al. 2008a: People living in more walkable neighborhoods are less hypertensive than people living in less walkable neighborhoods.
- Nagel et al. 2008: Older people living in more walkable neighborhoods are not more likely to walk than older people who live in less walkable neighborhoods. Older people who walk who live in more walkable neighborhoods spend more time walking than older people who walk who live in less walkable neighborhoods.
- Napier et al. 2011: Parents and children living in more walkable neighborhoods perceived fewer barrier to walking to school than parents and children living in less walkable neighborhoods.
- Oakes et al. 2007: People living in more dense areas are more likely to walk for travel; people living in areas with less street connectivity are more likely to walk for leisure. Residential density and street connectivity are not strongly associated with people's total walking or physcial activity.
- Oliver et al. 2007: People living in neighborhoods with 1) more institutional land use spend more time walking for leisure, 2) more residential land use spend less time walking for errands, and 3) commercial land use spend more time walking for errands than people living in neighborhoods without these characteristics.
- Rahman et al. 2011: People living in neighborhoods with more walkability, accessible destinations, and mixed land uses are more physically active than people living in other kinds of neighborhoods.
- Renalds et al. 2010: People living in neighborhoods that are more walkable for leisure or destinations are more physically active and less likely to be overweight, depressed, alcoholic than people living in different kinds of neighborhoods.
- Rhodes et al. 2006: People living in neighborhoods with more retail land use are more likely to walk than people living in neighborhoods with less retail land use.
- Rodriguez et al. 2006: People living in more walkable New Urbanist neighborhoods are no more physically active than people living in less walkable conventional suburban neighborhoods, though people in New Urbanist neighborhoods are more likely to be physically active in their neighborhood.
- Rodriguez et al. 2009: People living in more dense neighborhoods with more retail land uses and proximity to destinations and ease of walking are more likely to walk than people living in different neighborhoods.
- Roemmich et al. 2007: Children living in neighborhoods with greater street connectivity are more physically active than children living in neighborhoods with less street connectivity.
- Rosso et al. 2011: Older adults who live in neighborhoods with more walkable features (residential density, mixed land uses) do not consistently walk more than older adults living in other neighborhoods, based on a systematic review of studies assessing this relationship. Some aspects of walkability (e.g., residential

density and proximity to shopping and retail) affect walking but other aspects do not affect walking.

- Rundle et al. 2007, 2008: People living in neighborhoods with more mixed land uses have lower BMIs than people living in other kinds of neighborhoods.
- Saelens et al. 2003a: People living in more walkable neighborhoods are more physically active and less likely to be obese than people living in less walkable neighborhoods.
- Saelens et al. 2003b: People living in more walkable neighborhoods are more likely to walk than people living in less walkable neighborhoods, based on a systematic review of research assessing this relationship.
- Sallis et al. 2009: People of diverse incomes living in more walkable neighborhoods are more physically active and have lower rates of obesity/overweight than people of diverse incomes living in other kinds of neighborhoods.
- Sallis et al. 2012: It is unclear whether people who live in more walkable neighborhoods are less likely to be overweight/experience obesity, based on a systematic review of research assessing this relationship.
- Shigematsu et al. 2009: Older adults who live in neighborhoods with mixed land uses are more likely to walk for transportation than older adults who live in neighborhoods with more residential land uses.
- Smith et al. 2008: People living in more walkable neighborhoods are less likely to be obese or overweight than people living in less walkable neighborhoods.
- Spence et al. 2011: Girls living in more walkable neighborhoods are less likely to be overweight or obese than girls living in less walkable neighborhoods.
- Tappe et al. 2013: Children living in areas with higher street connectivity are less physically active than children living in areas with lower street connectivity.
- Ukkursuri et al. 2012: Pedestrian crashes are higher in neighborhoods with more land devoted to industrial, commercial, and open uses than in neighborhoods with more land devoted to residential uses.
- Wells & Yang 2008: Low-income African American women are more likely to walk if they move to areas with fewer cul-de-sacs but less likely to walk if they move to areas with more diverse land uses.
- Wier et al. 2009: Pedestrian injury collisions are higher in neighborhoods with more land zoned for commercial or residential/commercial land uses than in other neighborhoods.
- Atkinson et al. 2005: People living in neighborhoods with more housing density are more likely to be physically activity, but people living in neighborhoods with more mixed land uses, access to mixed land uses, and street connectivity are not more likely to be physically active.

- Frank et al. 2007: People who live and prefer to live in walkable neighborhoods walk more and are less likely to be obese than people who do not live/prefer to live in walkable neighborhoods.
- Frank et al. 2010b: People who live in walkable neighborhoods are more likely to walk and less likely to be overweight than people who do not live in walkable neighborhoods.
- Handy et al. 2008b: People who live in neighborhoods with more businesses nearby exercise more frequently than people who live in neighborhoods with fewer businesses nearby.
- Heinrich et al. 2008: Low-income public housing residents living in neighborhoods with more street connectivity have lower BMIs than low-income public housing residents living in areas with less street connectivity.
- Kligerman et al. 2007: Adolescents living in more walkable neighborhoods are more physically active than adolescents living in less walkable neighborhoods.
- Kerr et al. 2006: High income children living in more walkable neighborhoods are more likely to actively commute to school than higher income children living in less walkable neighborhoods.
- Carlson et al. 2012b: Older people living in neighborhoods with more walkability and social support are more physically active than older adults living in neighborhoods with less walkability and social support.
- Yen et al. 2009: People living in more walkable neighborhoods are more likely to walk than people living in less walkable neighborhoods, based on a systematic review of studies assessing this relationship.
- Black et al. 2010: People living in neighborhoods with a higher proportion of residential land uses are more likely to be obese than people living in neighborhoods with more mixed land uses.

Inclusion in Existing Health Maps:

- 2 of 11 (18%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data for this indicator were collected from the U.S. Environmental Protection Agency's National Walkability Index. The data was downloaded on July 5th, 2018. The raw data were collected in 2013.
- Calculations: No calculations were performed on the data.

- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when incorporating these values.

PARKS & RECREATION

Greenness

Definition: The greenness of the neighborhood, as determined by the Normalized Differential Vegetation Index (NDVI) for the neighborhood. The NDVI accounts for the intensity and quality of vegetation in an area using data on red (RED) and near infrared bands (NIR) of a multi-spectral image. The more positive the NDVI value, the greener the area.

Evidence-Based Effect on Health:

- 0.61; strong health promoting effect
- Bell et al. 2008: More greenness in a community is associated with lower BMI.
- Beyer et al. 2014: Higher levels of neighborhood green space are associated with lower levels of symptoms for depression, anxiety and stress.
- Branas et al. 2011: The greening of vacant lots is associated with residents' reporting less stress and more exercise.
- Cohen-Cline et al. 2015: Access to green space is negatively associated with depression but not associated with stress or anxiety.
- Dadvand et al. 2012: Access to green space is not associated with birth weight or gestational age.
- Gascon et al. 2016: Higher residential greenness is negatively associated with the risk of cardiovascular disease (CVD) mortality.
- Grigsby-Toussaint et al. 2011: Higher levels of neighborhood greenness are associated with higher levels of outdoor playing time among preschool-aged children.
- Groenewegen et al. 2012: Greenspace in residential areas is positively related to health, but there is no association with more physical activity.
- James et al. 2015: Greenness is protective against adverse mental health outcomes, cardiovascular disease, and mortality and positively associated with child birth weight.
- Liu et al. 2007: Increased neighborhood vegetation is associated with a decreased risk for being overweight.
- Mitchell & Popham 2008: Higher access to green space is associated with lower all cause and circulatory disease mortality.
- Pereira et al. 2012: Greenness in a community is negatively associated with the odds of hospitalization for heart disease or stroke.

- Sugiyama et al. 2008: Having a perception of high neighborhood greenness is positively associated with physical and mental health.
- Tilt et al. 2007: Areas that have more greenness are associated with lower BMI.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data for this indicator were collected from the MODIS product archive provided by the National Aeronautics and Space Administration (NASA). The data was downloaded on June 13th, 2018. The raw data were collected by MODIS Terra satellite on mid-2017. The original data contain multiple bands. Only the NDVI band is kept, all the other bands are removed.
- Calculations: Zonal statistics were performed to calculate the mean NDVI for each areal unit.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Open Space Access

Definition: The area of parks within a 1-mile radius of the neighborhood.

Evidence-Based Effect on Health:

- 0.38; weak health promoting effect
- Tappe et al. 2013: Children who live near play areas are more physically active.
- Babey et al. 2008: Access to a safe park is positively associated with regular physical activity for youth.
- Blank et al. 2012: Access to parks is associated with a lower risk of obesity.
- Boehmer et al. 2006: People who live further from recreational facilities have a higher risk of obesity.

- Burdette et al 2004: There is no association between child’s risk of being overweight and proximity to playgrounds.
- Coombes et al 2010: Access to formal parks is negatively associated with physical activities but not associated with the risk of being overweight/obesity.
- Epstein et al. 2006: Greater access to parks is associated with greater physical activity when sedentary behaviors were reduced.
- Hughey et al. 2017: There is mixed evidence that access to playgrounds is associated with girls’ BMI.
- Kaczynski & Henderson 2007: Proximity to parks or recreation is associated with increased physical activity.
- Kaczynski & Henderson 2008: People who have greater access to parks or recreation are more physically active.
- Kaczynski et al. 2008: Proximity to parks is not associated with physical activity.
- Norman et al. 2006: Girls who live near more parks and recreational facilities are more physically active.
- Prince et al. 2012: Having more community space devoted to parks is associated with higher odds of physical activity but also overweight/obesity for women.
- Roemmich et al. 2007: The percentage of park area in a community is positively associated with physical activity.
- Rundle et al. 2013: Having greater proximity to large park space is associated with lower BMI.
- Veugelers et al. 2011: Children in neighborhoods with good access to playgrounds, parks and recreational facilities are more active and were less likely to be overweight or obese.
- Wen et al. 2007: Access to a park, playground, or open space is associated with walking.
- Wolch et al. 2011: children with better access to parks and recreational resources are less likely to experience significant increases in BMI.
- Carroll-Scott et al. 2013: Access to parks, playgrounds, and gyms is associated with more frequent healthy eating and exercise.
- Lee & Moudon 2004: Accessibility to recreational facilities and local destinations is associated with increased physical activity.
- Lovasi et al. 2011: Children living in areas with more park access have less risk of obesity.
- Miles et al. 2011: Community green space is not associated with the risk of depression.
- Popkin et al. 2005: Activity-related facilities and resources are associated with health promoting behavior and physical activity

- Rodriguez et al. 2012: The prevalence of parks is positively associated with physical activity intensity.
- Rosso et al. 2011: Proximity to parks is positively associated with mobility in older adults.
- Sallis et al. 2012: The density of parks is positively associated with physical activity.

Inclusion in Existing Health Maps:

- 5 of 11 (45%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data for this indicator were collected from AZGEO Clearinghouse. The raw data contain the polygons of each park in Arizona. The data was collected on June 13th, 2018. The last update of the raw data was in 2013.
- Calculations: Buffers of 1 mile were created for each areal unit. The park data was first intersected with the areal unit buffer layer. The park fragment data was next joined with the areal unit buffer file base on the intersection relationship to get the area of parks in the buffer of each areal unit.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

SOCIAL & CULTURAL COHESION

Community Stability

Definition: The percentage of households who have lived in the neighborhood for 7 or more years.

Evidence-Based Effect on Health:

- 0.50; weak health promoting effect
- Bures 2003: Children who have more neighborhood stability are more likely to rate their health higher and have better mental health in midlife.
- Beard et al. 2009: Older people who live in neighborhoods with more residential instability are more likely to experience disability than older people who live in neighborhoods with less residential instability.
- Boardman 2004: Stress detracts less from health for people living in neighborhoods with a greater percent of residents living there for at least five years.
- Browning & Cagney 2002: People living in neighborhoods with a greater percent of residents living there for at least five years do not have better overall health than people living in other neighborhoods.
- Browning & Cagney 2003: Whether the percent of residents living in a neighborhood for at least five years is associated with more positive health among residents depends on the affluence of the neighborhood; less affluent and more stable neighborhoods have adverse health effects on residents.
- Cagney et al. 2005: Older people living in less affluent neighborhoods with a greater proportion of residents having lived there 5 years or more have poorer self-rated health than older people living in other neighborhoods.
- Kirby & Kaneda 2006: People living in neighborhoods with more residential turnover have worse health care access than people living in other kinds of neighborhoods.
- Mair et al. 2010: Women living in neighborhoods with a higher proportion of households having been there 5 or more years are less likely to be depressed than women living in neighborhoods with a lower proportion of households having been there 5 or more years.
- Matthews & Yang 2010: People who have high stress living in neighborhoods with a higher proportion of households having been there 5 years or more have better health than people who have high stress living in other neighborhoods.

- Ross et al. 2000: People living in poorer neighborhoods with a greater proportion of residents having lived there 5 years or more have greater psychological distress than people living in poorer neighborhoods with a lower proportion of residents having lived there 5 years or more. People living in wealthier neighborhoods with a greater proportion of residents having lived there 5 years or more have lower psychological distress than people living in wealthier neighborhoods with a lower proportion of residents having lived there 5 years or more.

Inclusion in Existing Health Maps:

- 0 of 11 (0%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 31 and June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B25038: Tenure by Year Household Moved into Unit was selected to calculate the percentage of households living in the same community for seven years or more based on its availability at the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. New columns were created in order to calculate the total number of individuals living in the same community for seven or more years, and the percentage of the total population living in the same community for seven or more years. Just as with the ACS data, metadata and descriptive fields were filled out. The total for each spatial unit was calculated by summing all households that moved in 2009 or earlier, including both owner and renter occupied households. The total was then divided by the total number of households within each spatial unit and converted to a percentage.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.

- Limitations: Our intended measure of community stability was the percentage of households living in the same community for 5 years or more, but data limitations prevented this. ACS separates the moving period into categories including: moved in 2015 or later, moved in 2010 to 2014, and moved in 2000 to 2009. As the 5-year mark falls within the range of moving between 2010 and 2014, we opted to use the category ‘moved in 2000 to 2009’ as the cutoff and define community stability as living in the same household for a minimum of 7 years. The alternative would have been to use ‘moved in 2010 to 2014’ which would have made the minimum years of living the same household only 2 years. The literature review indicated that a stable community remains consistent in composition for longer than 2 years.

Homeowners

Definition: The percentage of households who own their homes.

Evidence-Based Effect on Health:

- 0.41; weak health promoting effect
- Dietz & Haurin 2003: It is unclear whether homeownership affects health, based on a systematic review of studies that have assessed this relationship.
- Leventhal & Newman 2010: It is unclear whether homeownership affects children’s health, based on a systematic review of studies that have assessed this relationship.
- Nepomnyaschy & Reichman 2006: Asthma is more prevalent among children living in neighborhoods with higher levels of renter-occupied housing.
- Shenassa et al. 2004: Children living in neighborhoods with more owner-occupied homes are less likely to become injured.
- Dunn & Hayes 2000: There is no difference in self-rated health among homeowners and renters.
- Boardman 2004: Stress detracts less from health for people living in neighborhoods with a greater percent of homeowners.
- Browning & Cagney 2003: Whether the percent of households who are homeowners in a neighborhood is associated with more positive health among residents depends on the affluence of the neighborhood; less affluent and high homeowner neighborhoods have adverse health effects on residents.
- Cagney et al. 2005: Older people living in less affluent neighborhoods with a greater proportion of households being homeowners have poorer self-rated health than older people living in other neighborhoods.

- Mair et al. 2010: Women living in neighborhoods with a higher proportion of homeowners are less likely to be depressed than women living in neighborhoods with a lower proportion of homeowners.
- Matthews & Yang 2010: People who have high stress living in neighborhoods with a higher proportion of homeowners have better health than people who have high stress living in other neighborhoods.
- OCampo et al. 2011: The tenure mix of the neighborhood does not affect babies' risk of experiencing low birth weight.

Inclusion in Existing Health Maps:

- 2 of 11 (18%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 25 and June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B25003: Tenure was selected to calculate the percentage of households who own their homes based on its availability at the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. A new column was created in order to calculate the percentage of the population per spatial unit that are homeowners. Just as with the ACS data, metadata and descriptive fields were filled out. The total number of homeowners was divided by the total population per spatial unit and converted to a percentage.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Linguistic Homogeneity

Definition: The extent of concentration of the languages spoken in a community.

Evidence-Based Effect on Health:

- 0.50; weak health promoting effect
- Cagney et al. 2007: Foreign-born Latinos living in neighborhoods with a higher foreign-born proportion have lower rates of asthma and other respiratory conditions than foreign-born Latinos living in neighborhoods with a lower foreign born proportion.
- Do et al. 2007: Latinos living in neighborhoods that have more Latinos have higher BMIs than Latinos living in neighborhoods that have fewer Latinos.
- Gresenz et al. 2011: Mexican American immigrants living in neighborhoods with more Spanish speakers or Hispanic immigrants have better access to care than Mexican American immigrants living in other neighborhoods.
- Kimbro 2009: Latinos living in neighborhood with a higher foreign-born proportion are less likely to binge drink than Latinos living in other neighborhoods.
- Osypuk et al. 2009: Hispanics and Chinese who live in neighborhoods with more immigrants are less likely to consume high fat foods, but Hispanics in these neighborhoods are less likely to be physically active.
- Osypuk et al. 2010: U.S. born Mexican American women have higher birth weight babies when they live in immigrant enclaves than when they live in other kinds of communities.
- Vega et al. 2010: Long stay Latino immigrants and U.S. born Latinos were less likely to be depressed if they lived in a more linguistically isolated neighborhood than long stay Latino immigrants and U.S. born Latinos who lived in a less linguistically isolated neighborhood.

Inclusion in Existing Health Maps:

- 2 of 11 (18%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

a. Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On June 8 and June 13, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B16004: Age by Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over was selected to calculate the entropy score, which is a measure of the spatial distribution of multiple groups simultaneously. In this case groups refers to groups of individuals who speak the same primary language.

b. Calculations: Data not necessary to perform the calculations were removed. Eleven new columns were created to perform a series of calculations. Just as with the ACS data, metadata and descriptive fields were filled out. Five columns were used to calculate the total number speakers whose primary language is English, Spanish, Indo-European, Asian and Pacific Island, or other. A total for each language per spatial unit was calculated. The total was then used to calculate the proportion of the total population per spatial unit speaking each language. Finally, using the proportions for each language, the entropy score was calculated for each spatial unit. In order to calculate the entropy score, all value proportions equaling zero were substituted with ones as the ln of 0 produces an error, while the ln of 1 is equal to 0. This is no way impacted the validity of the indices. The formula for the entropy score is as follows:

$$E_i = \sum_{g=1}^{g} (\prod_{gi}) \ln[\,1/\prod_{gi}]$$

where E_i is the entropy score for neighborhood *i*, and $\prod_{gi}$ represents a particular linguistic group's population proportion in neighborhood *i*.

c. Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.

d. Limitations: Two other health mapping projects included language in some form as contributing to health, however in both cases linguistic isolation was used rather than linguistic homogeneity. The inclusion of linguistic isolation rather than homogeneity enabled them to use variables calculated by ACS – Limited English Proficiency and Speak a language other than English at home – as proxies for isolation. The ACS variables do not describe linguistic homogeneity, so the entropy score was calculated using language spoken at home to determine concentration.

SOCIAL JUSTICE

Income Inequality

Definition: The extent to which the neighborhood has concentrated wealth or poverty.

Evidence-Based Effect on Health:

- -0.33; weak health detracting effect
- Kimmel et al. 2013: Income inequality is positively associated with the mortality rate of hemodialysis patients with ESRD (end-stage renal disease)
- Pickett & Wilkinson 2015: There is mixed evidence of the effects of income inequality on health, based on a systematic review of studies assessing this relationship.
- Wen et al. 2003: Neighborhood income inequality is not associated with health.
- Acevedo Garcia et al. 2003: People have higher mortality in regions where neighborhoods are more segregated based on income than in regions where neighborhoods are less segregated based on income, based on a systematic review of research assessing this relationship.
- Black & Macinko 2008: Neighborhood income inequality has mixed effects on obesity, based on a systematic review of research assessing this relationship.
- Nkansah-Amankra et al. 2009: Mothers more often give birth to low birthweight babies in neighborhoods with medium levels of income inequality than in neighborhoods with high or low levels of income inequality.

Inclusion in Existing Health Maps:

- 5 of 11 (45) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On June 30 and 13, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B19001: Household Income in the Past 12 Months (In 2016 Inflation-Adjusted Dollars) was selected to calculate income concentration at the extremes based on data availability at the census tract and block group levels.

- Calculations: Data not necessary to perform the calculations were removed. Three new columns were created to perform a series of calculations. Just as with the ACS data, metadata and descriptive fields were filled out. The sum of all households with incomes in the bottom quintile and all households with incomes in top quintile were calculated. ICE is calculated by subtracting the number of households in bottom quintile from the number of households in the top quintile and dividing this number by the total number of households within each spatial unit. Values ranged from -1.0 to +1.0. A value of 0 was optimal, signaling equal proportions of high- and low-income households in the neighborhood. A score of -1.0 meant that all households were in the bottom quintile of income distribution, while a score of +1.0 meant the opposite – all households were in the top quintile. ICE values greater than zero were multiplied by 1, so as to interpret higher values as signifying greater high or low household income concentration in a neighborhood.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: The cut off points for the 80th and 20th percentiles of income distribution in Arizona were used to calculate the ICE, however these values did not align perfectly with household income categories provided by ACS. The income cut off for the 20th percentile in Arizona is $21,400 and the income cutoff for the 80th percentile in Arizona is $97,900.00 (Statistical Atlas 2015), whereas the closest income groups cutoff points in ACS were $20,000 to $24,999 and $75,000 to $99,999. Even though the income distribution exceeded the 20th percentile, the first income grouping was included in the bottom quintile grouping. The second income grouping was not included in the 80th percentile effectively changing the cut off point for the top quintile to $99,999. The limitations of the ACS household income categories resulted in the bottom quintile containing more households than is accurate and the top quintile containing fewer households than is accurate. Therefore, the ICE values are general representations of income inequality rather than precise measures of income inequality.

TRANSPORTATION

Lack of Car

Definition: The percentage of households without access to a car.

Evidence-Based Effect on Health:

- -0.30; weak health detracting effect
- Flores et al. 1998: Parents who lack cars are less likely to bring their children for medical visits.
- Pendola and Gen 2007: People who use cars to commute to work/school or the grocery store have higher BMI.
- Hoefer et al. 2001: Adolescents whose parents transport them to activities have higher physical activity out of school.
- Syed et al. 2013: Lacking a car is associated with low health care use.
- Yang et al. 2006: Lacking a care is associated with a higher likelihood of missing an appointment.

Inclusion in Existing Health Maps:

- 3 of 11 (27%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On May 25 and June 6, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a whole. B25044: Tenure by Vehicles Available was selected to calculate the percentage of households without access to a car based on availability on the census tract and block group levels.
- Calculations: Data not necessary to perform the calculations were removed. Two columns were added to complete the necessary calculations. Just as with the ACS data, metadata and descriptive fields were filled out. First, the total number of households with no vehicle available was calculated for each spatial unit.

Second, the percentage of all households without access to a car was calculated. All percentages are represented as such.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

Public Transit Commuters

Definition: The percentage of workers age 16 and older who commute to work by public transportation.

Evidence-Based Effect on Health:

- 0.50; weak health promoting effect
- MacDonald et al. 2010: People who commute to work using light rail transit have lower BMI and are less likely to be obese.
- Wasfi et al. 2013: Using public transportation has mixed effects on physical activity.
- Pucher et al. 2010: Use of public transit is positively associated with physical activity and negatively associated with diabetes.

Inclusion in Existing Health Maps:

- 3 of 11 (27%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

1. Collection: The data used to calculate this indicator were collected from the 2012 – 2016 American Community Survey 5-Year Estimates. On June 8 and 13, 2018 respectively, the census tract and block group level data were downloaded. Both census tract and block group level data for the entire state of Arizona were downloaded from American Factfinder. Due to the volume of the data available at the block group level, the data was downloaded by county rather than as a

whole. B08134: Means of Transportation to Work by Travel Time to Work was selected to calculate the percentage of workers 16 and older who commute to work by public transportation based on availability at the census tract and block group levels.

2. Calculations: Data not necessary to perform the calculations were removed. Two columns were added to complete the calculations. Just as with the ACS data, metadata and descriptive fields were filled out. First, the total number of individuals who commute to work by public transportation was calculated. This number was then used to calculate the percentage of all workers who commute by public transit. All percentages are represented as such.
3. Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Using the metadata sheets provided in the ACS variable downloads, metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
4. Limitations: No significant data limitations were encountered when calculating these values.

Transit Accessibility

Definition: Number of bus stops within 0.5 miles of the neighborhood.

Evidence-Based Effect on Health:

- 0.54; strong health promoting effect
- Brown and Werner 2008: The entry of light rail into a community is associated with fewer care rides among new riders of the light rail. New riders also have lower obesity rates than non-riders.
- Brown et al. 2009: People who live in neighborhoods with nearby light rail stops have lower BMI.
- Davison & Lawson 2006: The availability of public transportation in a community is positively associated with children's physical activity.
- Edwards 2008: Access to public transit is associated with more walking and lower obesity-related medical costs.
- Leyden et al. 2011: Residents are happier in places that have easy access to convenient public transportation.
- Rosso et al. 2011: The presence of nearby transit stops is not associated with walking.

- Rundle et al. 2007: People who live in areas with a higher density of bus stops and subway stops have lower BMI.
- Coogan et al. 2009: Black women with higher availability of public transit are more likely to engage in utilitarian walking.
- Knuiman et al. 2014: Local access to public transit stops is associated with walking for transportation.
- Leyden et al. 2011: People who have easy access to convenient public transportation are happier.
- Rodríguez et al. 2008: People who perceive having easier access to transit are less likely to report walking.
- Samimi et al. 2009: Transit-oriented development is positively associated with general health and negatively associated with obesity.
- White et al. 2010: Access to public transportation is associated with lower perceptions of disability in older adults.

Inclusion in Existing Health Maps:

- 1 of 11 (9%) of maps include

Rationale for Inclusion: Evidence of association with health.

Data:

- Collection: The data for this indicator was collected from Transitfeeds.com, which is a website that provides worldwide public transportation information. The public transportation information for each city in Arizona was downloaded in General Transit Feed Specification (GTFS) format, which contains bus stop locations, route information, and schedule. The data was downloaded on July 13th, 2018.
- Calculations: The stop location information was derived from GTFS data for each city that provides public transportation services in Arizona. The stop location information was then combined into one point layer in ArcGIS. A buffer of 0.5 miles was created for each areal unit to join with stop locations.
- Metadata: Following completion of calculations metadata sheets were created for the block group and census tract levels individually. Metadata was edited in excel and then converted into .txt files. Each text file was edited using the aforementioned method.
- Limitations: No significant data limitations were encountered when calculating these values.

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Appendix 2: Advisory Board Member Names and Affiliations

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Appendix 3: Literature Review Keywords

Search process:

1. General keywords + first tier keyword (1)
2. General keywords + first tier keyword (1) + second tier keyword (1)
3. General keywords + first tier keyword (1) + second tier keyword (2)
4. General keywords + first tier keyword (1) + second tier keyword (3)
5. General keywords + first tier keyword (2) + second tier keyword (1)
6. General keywords + first tier keyword (2) + second tier keyword (2)
7. General keywords + first tier keyword (2) + second tier keyword (3)
8. … General keywords + first tier keyword (x) + second tier keyword (3)

General:

- health
- neighborhood

Access to Care:

- First tier
    - hospital
    - doctor
    - dentist
    - community center
    - urgent care
    - optometrist
    - insurance
    - clinic
    - pharmacy
    - service
- Second tier
    - equity
    - land use
    - senior
    - child
    - poor
    - disabled

Affordable Quality Housing:

- First tier
    - housing
- Second tier
    - equity
    - land use
    - affordability
    - cost
    - quality
    - availability
    - design
    - tenure
    - own
    - rent
    - evict
    - homeless
    - pest
    - utility
    - yard
    - pool
    - lead
    - secure

Community Safety

- First tier
    - safety
    - crime
- Second tier
    - equity
    - land use
    - violent

- property
- domestic
- delinquency
- injury
- death
- vacancy
- gated community
- police
- officer
- traffic
- theft
- street light

Economic Opportunity

- First tier
  - job
  - employment
  - work
- Second tier
  - equity
  - land use
  - income
  - commute
  - home business
  - local business
  - small business

Educational Opportunity

- First tier
  - education
  - school
- Second tier
  - equity
  - land use
  - degree
  - teacher
  - student
  - class
  - elementary
  - middle
  - high
  - college
  - university
  - dropout
  - public
  - private
  - charter
  - day care
  - magnet
  - library

Environmental Quality

- First tier
  - environment
  - infrastructure
- Second tier
  - equity
  - land use
  - air
  - water
  - land
  - toxin
  - pollution
  - hazard
  - heat
  - cold
  - garbage
  - waste
  - chemical
  - disposal
  - noise
  - smell
  - light
  - electric

Food Access

- First tier
  - food
- Second tier
  - equity

- land use
- desert
- grocery
- supermarket
- fast
- farmer's market
- community garden
- obesity
- overweight
- starvation
- hungry
- security
- urban agriculture
- diet
- meal
- access
- restaurant

Community Design

- First tier
  - design
  - planning
- Second tier
  - equity
  - land use
  - street
  - road
  - housing
  - walk
  - bike
  - sidewalk
  - public space
  - shade

Parks

- First tier
  - park
  - playground
  - recreation
  - open space
  - green space
  - nature
  - trail
- Second tier
  - equity
  - land use
  - access
  - shade

Social & Cultural Cohesion

- First tier
  - social
  - cultural
  - ethnic
  - racial
- Second tier
  - equity
  - land use
  - lanugage
  - stability
  - capital
  - engagement
  - collective efficacy
  - cohesion
  - community of interest

Social Justice

- First tier
  - social justice
  - equity
  - equality
  - integration
  - segregation
- Second tier
  - land use
  - race
  - ethnicity
  - politics
  - voting
  - income

- wealth
- poverty
- disability

Transportation

- First tier
  - transportation
  - transit
- Second tier
  - equity
  - land use
  - bike
  - walk
  - car
  - auto
  - train
  - rail
  - bus
  - station
  - stop
  - commute
  - disability
  - mobility
  - road
  - highway
  - interstate
  - service
  - shade
  - rideshare
  - bike share
  - carpool
  - taxi

Example Iterations for Access to Care:

Iterations	**Keywords**			
1	health	neighborhood	hospital	
2	health	neighborhood	hospital	equity
3	health	neighborhood	hospital	land use
4	health	neighborhood	hospital	senior
5	health	neighborhood	hospital	child
6	health	neighborhood	hospital	poor
7	health	neighborhood	hospital	disabled
8	health	neighborhood	doctor	
9	health	neighborhood	doctor	equity
10	health	neighborhood	doctor	land use
11	health	neighborhood	doctor	senior
12	health	neighborhood	doctor	child
13	health	neighborhood	doctor	poor
14	health	neighborhood	doctor	disabled
15	health	neighborhood	dentist	
16	health	neighborhood	dentist	equity
17	health	neighborhood	dentist	land use
18	health	neighborhood	dentist	senior

19	health	neighborhood	dentist	child
20	health	neighborhood	dentist	poor
21	health	neighborhood	dentist	disabled
22	health	neighborhood	community center	
23	health	neighborhood	community center	equity
24	health	neighborhood	community center	land use
25	health	neighborhood	community center	senior
26	health	neighborhood	community center	child
27	health	neighborhood	community center	poor
28	health	neighborhood	community center	disabled
29	health	neighborhood	urgent care	
30	health	neighborhood	urgent care	equity
31	health	neighborhood	urgent care	land use
32	health	neighborhood	urgent care	senior
33	health	neighborhood	urgent care	child
34	health	neighborhood	urgent care	poor
35	health	neighborhood	urgent care	disabled
36	health	neighborhood	optometrist	
37	health	neighborhood	optometrist	equity
38	health	neighborhood	optometrist	land use
39	health	neighborhood	optometrist	senior
40	health	neighborhood	optometrist	child
41	health	neighborhood	optometrist	poor
42	health	neighborhood	optometrist	disabled
43	health	neighborhood	insurance	
44	health	neighborhood	insurance	equity
45	health	neighborhood	insurance	land use
46	health	neighborhood	insurance	senior
47	health	neighborhood	insurance	child
48	health	neighborhood	insurance	poor
49	health	neighborhood	insurance	disabled
50	health	neighborhood	clinic	
51	health	neighborhood	clinic	equity
52	health	neighborhood	clinic	land use

53	health	neighborhood	clinic	senior
54	health	neighborhood	clinic	child
55	health	neighborhood	clinic	poor
56	health	neighborhood	clinic	disabled
57	health	neighborhood	pharmacy	
58	health	neighborhood	pharmacy	equity
59	health	neighborhood	pharmacy	land use
60	health	neighborhood	pharmacy	senior
61	health	neighborhood	pharmacy	child
62	health	neighborhood	pharmacy	poor
63	health	neighborhood	pharmacy	disabled
64	health	neighborhood	service	
65	health	neighborhood	service	equity
66	health	neighborhood	service	land use
67	health	neighborhood	service	senior
68	health	neighborhood	service	child
69	health	neighborhood	service	poor
70	health	neighborhood	service	disabled

Appendix 4: Literature Review Protocol

1. What texts to include:
    a. Only review texts that meet criteria b-h; if the text does not meet these criteria, move the text to the subfolder “Criteria Not Met” in the element folder.
    b. Research-based
        i. Must use data and derive findings from data; if conceptual or theoretical, move to “Other” → “Conceptuals & Overviews” folder
        ii. Data can include reviews of existing literature in a systematic way
    c. Peer reviewed
        i. Must be published in a peer-reviewed journal
            1. Make sure there is a literature review discussion; should relate to existing scholarship
            2. Look up journal if unsure about peer-review status
        ii. No reports or opinion pieces
    d. Citations
        i. Must have at least 50 citations according to Google Scholar
    e. Geography
        i. Data
            1. Data must come from U.S. or Canada
        ii. Relationship of interest
            1. Must be at neighborhood level (block, block group, census tract, zip code or comparable geography) OR
            2. Point to point distances between individuals and local infrastructure, resources, or amenities
    f. Independent variable
        i. Focus only on element of interest
        ii. If other elements are independent variables, make sure text is in the folder for that element. If not, add the text.
    g. Dependent variable
        i. Must be a direct or indirect health outcome
        ii. Direct health outcomes
            1. Mortality/suicide, birth outcome, health condition that you would see a doctor for treatment for (e.g., heart or lung issues (asthma), diabetes, hypertension, cancer, injuries, depression, etc.), allostatic load, life satisfaction/wellbeing/happiness, emotional/behavioral functioning, tooth retention, etc.
        iii. Indirect health outcomes
            1. Behaviors that are indirectly associated with a direct health outcome (e.g., stress, high blood pressure, overweight/obesity/BMI, physical activity/exercise, fruit & vegetable consumption, showing up to doctor’s visits, smoking, alcohol & drugs consumption, gun ownership)
    h. Research method

        i. Can use any research method, e.g., quantitative or qualitative; experimental or observational

2. How to review:
    a. Abstract & Data/Methods first
    b. Results/Tables and/or Discussion/Conclusion only if effects are unclear from abstract
    c. If you find another text that is frequently cited in the text that is not in your element folder, check to see if article is in Conceptual & Overview or Methods folders (in Other folder). If not in either of these, search and download and add to element folder & review.
3. What to report:
    a. Indicator excel:
        i. Identify the indicator on our indicator list; if not included, add the indicator and fill out as many of the missing fields as you can, drawing on info on the indicator in the article.
            1. Indicators added to the list should be qualitatively different from existing indicators. For example, the indicators 1) crosswalks per square mile, 2) crosswalks per capita, 3) feet in between crosswalks all can be grouped under the indicator “crosswalk density;” however, presence of walk signs at crosswalks would be qualitatively different.
        ii. Use the “Citation” rows to report the direction of the relationship (or no relationship) with the indirect or direct health outcome and what the outcome is.
            1. Example:
                a. Indicator: crosswalk density
                b. Citation 1: low ped fatalities; Hannah et al. 2018
                c. Citation 2: no ped fatalities; Smith 2017
                d. Citation 3: no phys activity; Tong 2014
                e. Citation 4: high phys activity; Wu 2018
    b. Technical report:
        i. Add the name of the indicator under the element in the technical report. Write a sentence or two describing the effect and citing the source.

<u>Community Design</u>

Crosswalk density

Hannah et al. 2018: Neighborhood crosswalk density is associated with a lower rate of pedestrian fatalities in that neighborhood.

Smith 2017: Neighborhood crosswalk density is not associated with pedestrian fatalities in that neighborhood.

Tong 2014: Neighborhood crosswalk density is not associated with physical activity in that neighborhood.

Wu 2018: Neighborhood crosswalk density is associated with a higher level of physical activity in that neighborhood.

Appendix 5: Healthy Community Map Review Protocol

1. A google key word search was conducted in order to compile a list of projects with similar goals regarding health and equity mapping.
2. Key words, and variations of those words, were organized in a table to simplify the key word search process. Given the aims of the project and the proposal title, ‘Arizona Healthy Community Mapping,’ four terms – Arizona, Health, Score, Map – were identified to begin the key word search process. The table listing the variations of each keyword used for the search is provided below (Figure 1).
3. An example of the search process is also listed below in Figure 2.
4. Google was the only search engine used for the search. Upon entering each iteration of the key terms, the first two pages of search results received a cursory review to determine their relevance to the goals of the search. Links containing at least two of the key words were opened and viewed. Projects focusing on the social and environmental determinants of health were noted in a spreadsheet along with the following information: Organization/Creators, the title of the map, the name(s) of contact(s) for the project as well as emails and phone numbers, and the website link.
5. Organization contacts were emailed as the maps were discovered. For those who were willing and able, interviews to discuss the indicator selection and map making processes were set up.
6. A total of three phone interviews were conducted using a script developed to the guide the discussion.
    a. The interviews were not recorded, however detailed notes were taken and all the documents received from the interviewees following the conversation were saved in the project Dropbox folders.
7. A total of eleven similar health maps were reviewed in depth, including the website and associated maps and interactive elements, the technical reports, annual reports, and indicator lists. Any materials available which illuminated elements of the decision making and research processes were saved and reviewed.
8. In order to determine the validity of the indicators included on our proposed list, a comprehensive review of the indicators used by each of the eleven maps was conducted. An excel document was created including five sheets. The first sheet included a key to decipher the acronyms created for each of the projects reviewed. The remaining sheets were used to categorize indicators based on how often they are included by other projects and whether or not they were a proposed indicator for this project. Indicators could be categorized as one of the following: Proposed by us and used frequently, proposed by us and used infrequently, proposed by us and never used, or not proposed by us, but used by

other health maps. Indicators were organized into their respective categories with the following information included in the table: 1) Indicator, 2) Who uses the indicator, 3) element/category for use, 4) the data source, 5) the scale of data collection, and 6) any notes necessary for inclusion.

9. It was not possible to include complete information for each listed indicator due to the limited number of documents published which account for the methods and scope of work.

Arizona	Health	Score	Map
State	well being	grade	visualization
country	health status	rank	graphic
county	health outcome	number	depiction
community	wellness	mark	
neighborhood	vitality	aggregate	
census tract	prosperity		
	welfare		
	healthy		
	healthiness		
	fitness		

Example Iteration for State and Health Key Words			
State	Health	Score	Map
			Visualization
			Graphic
			Depiction
State	Health	Grade	Map
			Visualization
			Graphic
			Depiction
State	Health	Rank	Map
			Visualization
			Graphic
			Depiction

State	Health	Number	Map
			Visualization
			Graphic
			Depiction
State	Health	Mark	Map
			Visualization
			Graphic
			Depiction
State	Health	Aggregate	Map
			Visualization
			Graphic
			Depiction

Appendix 6: Data Collection Protocol

American Community Survey Data

Certain processes were completed for all of the indicators created using 2012 – 2016 American Community Survey 5-Year Estimates data retrieved from factfinder.census.gov. The advanced search function was utilized to find the appropriate data. For census tract level data, census tract – 140 was selected as the geographic type, Arizona was selected for the state, and all census tracts in Arizona was then added my selections. The variable(s) was then searched and the 2016 ACS 5-year estimates dataset was selected for download. Data was downloaded as a useable spreadsheet/database. Due to the size of the dataset with all block groups combined, block group level data had to be downloaded by county and subsequently combined in a single excel sheet. Data processing was different for each indicator.

Metadata processing for each indicator followed similar methods. After data processing, the metadata file was edited to reflect the changes made to the data. Any fields deleted from the data file were removed from the metadata as well. Fields added to the data file were added to the metadata using the same formatting as those from the original metadata file. The following fields were added to every file.

- Author: American Community Survey
- Year: 2012 – 2016
- Data Source: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
- Access Date: Date of data download
- Unit: 5-Year Estimates
- Description: ACS variable titles and description should be listed here
- Fields: Includes all fields kept from original data file, as well as added fields
    - For added fields, metadata names were created using recognizable, abbreviated descriptors. For example, the total number of individuals without high school degrees was calculated in a new column. This variable was given the name TOT_NO_HS_DGR. No specific naming conventions were followed, but words were abbreviated in the same way regardless of the variable.

Naming Conventions

All data and metadata documents are named using standard naming conventions.

For data: Indicator_spatial unit_year
For metadata: Indicator_spatial unit_year

An example, using the Insured Population indicator:

> For data: InsuredPopulation_tract_2016
> For metadata: InsuredPopulation_tract_2016_meta

Data and metadata files should follow the exact same naming conventions with the only difference being the addition of meta at the end of the file name.

Description of Process

For each indicator:

1. Create a folder inside the project Dropbox folder ("\AZ Health Map\Data") containing the each element, and within each element folder, each indicator (e.g., " \AZ Health Map\Data\Access to care\Insured"). Store data for each indicator within the appropriate indicator folder.
2. Store spatial data in .shp format. Store non-spatial dat in .xls .xlsx, or .csv format. Collect both the block group level and the census tract level data for American Community Survey (ACS) data. Keep the GEOID field for the data.
3. Name each kind of data file using the following rules:
    a. For polygon data: <IndicatorName>_<scale>_<year>.<extension> (e.g., “UninsuredPopulation_tract_2014.shp” and “MedianHouseHoldIncome_BlockGroup_2014.xlsx”)
    b. For point or line data: <IndicatorName>_<Point,Line>_<year>.<extension>, (e.g., “AADT_Line_2015.shp” and “PrimaryCareFacilities_Point_2018.csv”)
4. Create a metadata file (.txt file) for each data file. Record the author of data, data source, time of data, access time, and unit of the value in a “Data Source” section. Record a very brief description of the data in the “Description” section. Include a description of each field that is relevant to the project. Also include information on how to download the raw data and any cleaning/calculations that were made in compiling the variable. Include enough detail that someone could replicate the process of downloading and cleaning and calculating the data and come up with the same results. Name the metadata with a “_meta” suffix. Ensure that. the name of the metadata file and the data file exactly match, including the letter case.(e.g., the metadata for “AADT_Line_2015.shp” should be named as “AADT_Line_2015_meta.txt”).
5. Save the original data file along with the cleaned data file.