

CHAPTER 4

PHYSICAL ENVIRONMENT



INTRODUCTION

The places we live, learn, work, play, and age make up our physical environment. That environment is defined by structures, such as sidewalks, homes, and stores, but also by the air we breathe, the food we eat, and the water we drink, cook, and bathe with. These components of our environment directly and indirectly affect our health.

- **DIRECT EFFECTS ON HEALTH** – The cleanliness of our water determines what contaminants we are exposed to, such as lead-poisoning hazards, that can have long-term impacts on our health and likelihood of disease morbidity. Access to safe and healthy food impacts both short- and long-term well-being. The air we breathe can determine our exposure to particulate matter and other toxins that can cause or exacerbate asthma or other respiratory conditions. Exposure to secondhand smoke is an independent risk factor for coronary heart disease, stroke, low birthweight babies, lung cancer in adults as well as Sudden Infant Death Syndrome and respiratory and middle ear disease in children.
- **INDIRECT EFFECTS ON HEALTH** – Built environments and public policy (e.g., tobacco-free policies) often determine our proximity to safe places to play or participate in other physical activities, our ability to get from place to place, and exposure to harmful conditions in our own homes and communities.

Many of the environmental conditions we are exposed to are determined by the social and economic factors we have in our lives, such as income and employment. The environments we live in often determine our ability to make choices about things like what we eat, how we spend our time, whether we exercise, and how long we spend commuting.

The HNC 2030 health indicators for the physical environment look at access to healthy food, proximity to places for physical activity, and prevalence of housing quality problems. However, these issues do not stand alone. Transportation, community safety, and health education are among the cross-cutting factors that play into the choices people make about how they navigate their environment and their opportunity to make choices that are good for their health.

TRANSPORTATION: Lack of public or personal transportation remains an obstacle for many people. Regardless of proximity, lack of sidewalks and unsafe pedestrian thoroughfares may mean people need to use public transportation to reach parks and other recreational facilities. Physical disabilities too may affect people's ability to navigate their communities.

NEIGHBORHOOD SECURITY: Neighborhoods experiencing crime or lacking in pedestrian-friendly areas (e.g., well-maintained sidewalks, crosswalks across busy roads, and well-lit pathways) may effectively keep in residents and prevent them from accessing parks or grocery stores within walking distance.

HEALTH EDUCATION: Measures of access prioritize proximity to facilities or structures and do not evaluate individual motivation to seek out resources. What people know about activities that promote health, or their level of health education, plays a role in boosting or inhibiting their ability to make healthy choices. For example, people who are less knowledgeable about healthy ways to eat may not take advantage of access to grocery stores with healthy foods regardless of how close they are to them.

Read an example below of how social and economic factors can impact an individual's opportunities to achieve health and well-being.^R For each health indicator, this report includes recommended evidence-informed policies and practices to address that indicator of interest. We recommend community coalitions use multi-sector partnerships to pursue all the strategies recommended.

Physical Environment and Health - Diego's Experience

Diego is a farm worker in rural North Carolina. He lives 15 miles from the nearest grocery store, so he often shops at a nearby corner store, where he buys packaged meat and canned goods. His cholesterol and blood pressure are high due to his diet. He shares a small home with five other farm workers with poor plumbing that the landlord refuses to repair. Diego and his roommates share one car between them, leaving him isolated from family and social activities.

^R Examples are of hypothetical scenarios commonly faced by individuals with health-related social needs.

HEALTH INDICATORS:**7 ACCESS TO EXERCISE OPPORTUNITIES**

Increase Physical Activity

8 LIMITED ACCESS TO HEALTHY FOODS

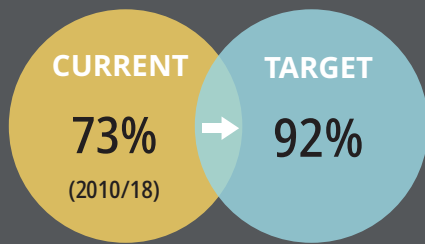
Improve Access to Healthy Foods

9 SEVERE HOUSING PROBLEMS

Improve Housing Quality

HEALTH INDICATOR 7: ACCESS TO EXERCISE OPPORTUNITIES

DESIRED RESULT: INCREASE PHYSICAL ACTIVITY



DEFINITION

Percent of the population living half a mile from a park in any area, one mile from a recreational center in a metropolitan area, or three miles from a recreational center in a rural area

DETAILS

Exercise access is based on census tract proximity to public parklands or recreational facilities such as “gyms, community centers, dance studios, pools,” and other exercise facilities

NC ACCESS TO EXERCISE OPPORTUNITIES (2010/18)

73% of population

2030 TARGET

92% of population

RANGE AMONG NC COUNTIES

6 – 100%

RANK AMONG STATES

Tied for 40th*

DATA SOURCE

County Health Rankings and Roadmaps - Business Analyst, Delorme map data, ESRI, & US Census Tiger line Files

STATE PLANS WITH SIMILAR INDICATORS

Not Applicable

*Rank of 1st for state with best access to exercise opportunities

Rationale for Selection:

Exercise is linked to positive physical, psychological, and social outcomes. Communities that create spaces for physical activity have healthier people with decreased risks of obesity, heart disease, and other chronic conditions that increase morbidity and mortality.⁷

Context

One of the most important things communities can do to improve the health of their people is to provide opportunities for physical activity.⁵⁷ Research shows that everyone, regardless of health status, benefits from being physically active. Regular physical activity fosters positive growth and development, improves brain health, and reduces the risk of a large number of chronic diseases.⁵⁷ Physical activity, or exercise, is a protective factor for many chronic health conditions, premature mortality, and poor cardiovascular health.⁵⁸

“Regular physical activity fosters positive growth and development, improves brain health, and reduces the risk of a large number of chronic diseases.”

The U.S. Department of Health and Human Services recognizes physical activity as a means of improving health and preventing negative health outcomes.⁵⁷ However, in order to exercise, people must have access to safe places to be physically active. Such spaces include crime-free neighborhoods with sidewalks and bike lanes, well-maintained parks and recreation facilities, playgrounds, senior centers, sports fields, and other designated spaces to exercise.⁵⁷ Studies have shown that those who live in communities that facilitate easy access to exercise opportunities are better able to engage in physical activity.⁵⁸

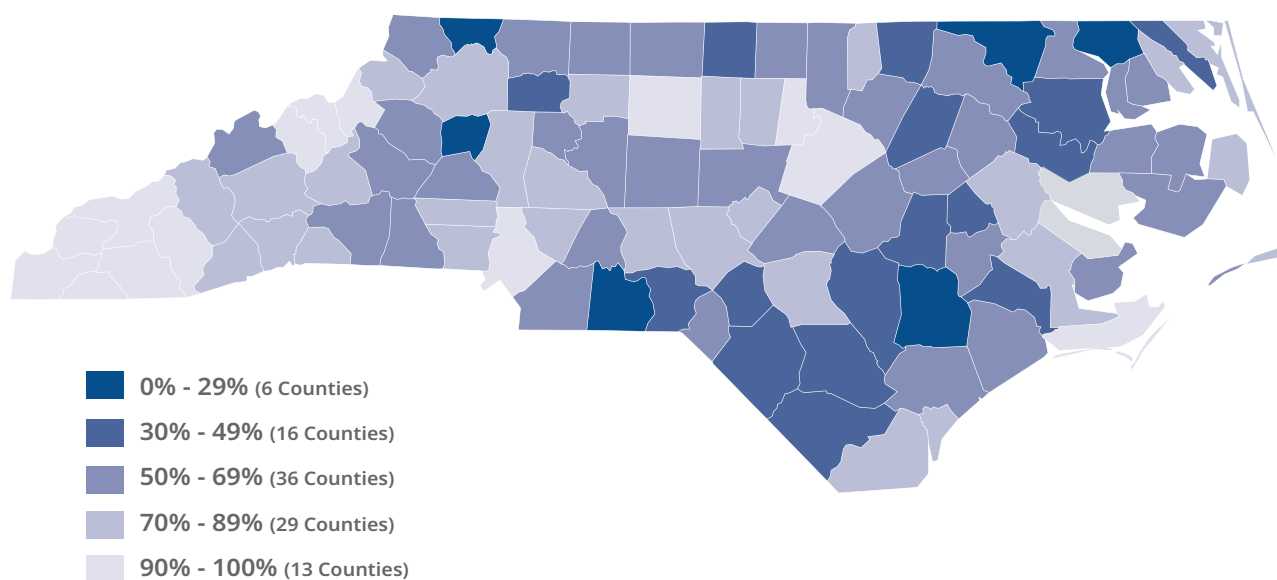
Disparities

Income level, race/ethnicity, and geography all have an impact on one’s access to exercise opportunities. Low-income communities may not have as many parks or as many recreational facilities as their more affluent counterparts.⁵⁹ People of color are less likely to live in areas with accessible parks or development of recreational facility systems.⁵⁸ Rural areas face more barriers to exercise access than their metropolitan counterparts.⁶⁰ Additionally, persons with physical disabilities may face difficulties accessing parks and recreational facilities that have necessary accommodations.⁶¹

⁷ This measure does not account for sidewalks or other non-parkland spaces that can be used for exercise (CHR, 2019). Additionally, it measures access on distance alone, without taking into account physical barriers that might complicate access, such as busy roads or limited entryways to the park (CHR, 2019). Finally, it has no cost measure, and includes recreation facilities that may have financial barriers for the residents of the census block (CHR, 2019).

FIGURE 15

Percent of People with Access to Exercise Opportunities in North Carolina Counties, 2018



Source: County Health Rankings & Roadmaps; <https://www.countyhealthrankings.org/app/north-carolina/2019/measure/factors/132/data>

2030 Target and Potential for Change

The HNC 2030 group reviewed data across several years and projected a future level to develop a target for exercise access. The group chose 92% of the population having access to exercise opportunities as the target for 2030. This would reflect an acceleration in the current slow positive trend and signal a substantive step toward improving the physical health and well-being of North Carolina communities.

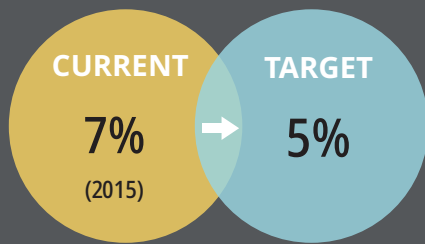
Levers for Change

(CDC, 2017; County Health Rankings, 2019)

- Increase number of community parks, particularly in rural areas
- Expand transit options to include places for physical recreation
- Maintain safe and well-lit sidewalks
- Increase number of biking, walking trails, and greenways
- Support community walking clubs and public fitness classes
- Increase access to evidenced-based and informed interventions that support physical activity in childcare, schools, churches, workplaces and other community-based settings
- Increase the number of joint use agreements for school playground facilities
- Provide public access to municipal recreation facilities (NC DHHS, 2018)

HEALTH INDICATOR 8: LIMITED ACCESS TO HEALTHY FOODS

DESIRED RESULT: IMPROVE ACCESS TO HEALTHY FOODS



DEFINITION

Percent of people who are low-income that are not in close proximity to a grocery store

DETAILS

For metropolitan communities, living close to a grocery store is defined as being less than a mile from a store; in rural areas, the threshold proximity is 10 miles from a grocery store

NC LIMITED ACCESS TO HEALTHY FOOD (2015)

7% of population

2030 TARGET

5% of population

RANGE AMONG NC COUNTIES

0 - 35%

RANK AMONG STATES

Tied for 26th*

DATA SOURCE

County Health Rankings and Roadmaps - United States Department of Agriculture (USDA)

STATE PLANS WITH SIMILAR INDICATORS

Not Applicable

*Rank of 1st for state with least limitations in access to healthy foods

Rationale for Selection:

Food is a basic building block of health that affects weight, blood pressure, and countless other health outcomes. Access to healthy foods is strongly influenced by where someone lives. People in rural or underserved areas of North Carolina are particularly affected by lack of access to stores where they can purchase ingredients for healthy meals.

Context

Good nutrition is an essential factor in individuals' mental and physical health. However, in many communities, affordable and nutritious food is not easily accessible. In some areas, fast food and convenience stores abound yet access to supermarkets is limited.⁶² While individuals' food choices are important, food choices are constrained by what is available.⁶³ Limited access to healthy foods has been linked to obesity, cardiovascular conditions, nutritional deficiencies, diabetes, and chronic kidney disease.^{64,65} Obesity and obesity-related conditions are now the second leading preventable cause of disease and death in the United States.⁶⁶

"Limited access to healthy foods has been linked to obesity, cardiovascular conditions, nutritional deficiencies, diabetes, and chronic kidney disease."

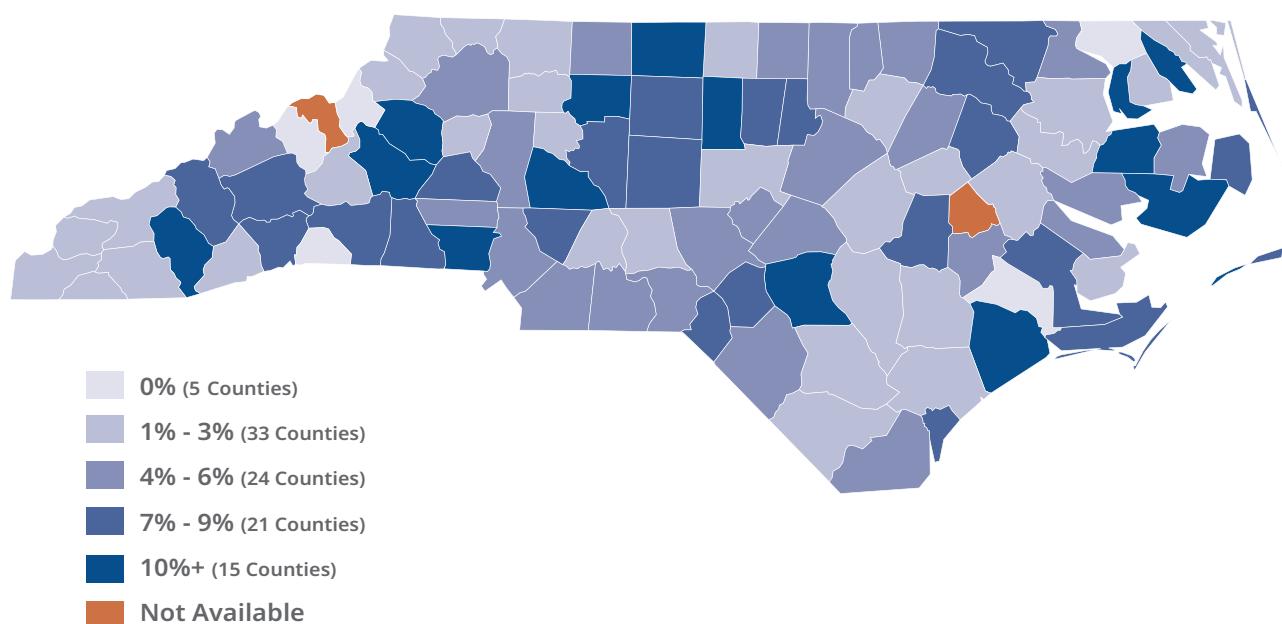
Areas with populations of individuals who have limited access to healthy foods are considered to be "food deserts." In North Carolina, there are more than 340 food deserts, affecting more than half a million residents in the state.⁶⁷ Although persons living in food deserts may still have access to small food retailers such as corner or convenience stores, the food sold by these stores rarely meets nutritional needs.⁶⁸ Additionally, farmers' markets or other farm stands may be helpful supplementary sources of healthy food, but their limited offerings, higher prices, and short operating hours may limit benefits to low-income communities.⁶⁵ As such, this measure only includes proximity to grocery stores and supermarkets, which has been linked to increasing access to healthy foods.⁶⁹

Disparities

Race and income influence access to healthy food and likelihood of living in a food desert. Low-income neighborhoods and those with large minority populations are less likely to have supermarkets or other grocery stores, and the available stores often have more limited healthy options and may have higher prices than their counterparts in wealthier communities.^{70,71}

FIGURE 16

Percent of People with Limited Access to Healthy Foods in North Carolina Counties, 2015



County Health Rankings & Roadmaps; <https://www.countyhealthrankings.org/app/north-carolina/2019/measure/factors/83/data>

2030 Target and Potential for Change

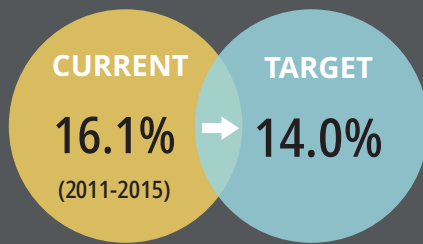
The HNC 2030 group reviewed data across several years and projected a future level to develop a target for access to affordable food. The HNC 2030 group chose 5% as the target for the percent of the population that is low-income who are not in close proximity to a grocery store. The percent of the low-income population facing lack of access to grocery stores has remained static at 7% for the last 5 years after decreasing from 10% from 2006 to 2010. This target would bend the curve and be a meaningful step toward ensuring that all North Carolinians have access to healthy foods, regardless of income level.

Levers for Change

- Increase technological support for SNAP/ EBT payments at food retailers
- Expand transit options in rural and low-income communities
- Support tax-incentive programs designed to encourage grocery stores and farmers markets to move into food deserts
- Support nonprofit grocery stores working to meet the needs of residents of food deserts
- Support school-based meal programs
- Increase access to healthy foods in childcare, schools, churches, workplaces and other community-based settings

HEALTH INDICATOR 9: SEVERE HOUSING PROBLEMS

DESIRED RESULT: IMPROVE HOUSING QUALITY



DEFINITION

Percent of households with at least 1 of 4 housing problems

DETAILS

Housing problems included are overcrowding, high housing costs, or lack of kitchen or plumbing facilities

NC SEVERE HOUSING PROBLEMS (2011-2015)

16.1% of population

2030 TARGET

14.0% of population

RANGE AMONG NC COUNTIES

10 - 26%

RANK AMONG STATES

28th*

DATA SOURCE

County Health Rankings and Roadmaps - Comprehensive Housing Affordability Strategy (CHAS) data

STATE PLANS WITH SIMILAR INDICATORS

Early Childhood Action Plan^U includes indicators of safe and secure housing

*Rank of 1st for state with least severe housing problems

Rationale for Selection:

People who live in homes that cost a large portion of their income, or where there is overcrowding or poor maintenance, are exposed to a variety of health risk factors. In many areas of North Carolina, there are insufficient affordable, quality housing options for low-income people and their families.^U

Context

Housing quality is an important determinant of overall health and well-being. Studies show that there is a direct link between housing quality and physical and mental health.⁷² In North Carolina, 1 in 6 households across the state face severe housing problems, which means that at least one of the following problems is present: overcrowding,^V high housing costs,^W or lack of kitchen and/or plumbing facilities.^{X,67} In North Carolina, utilizing best-available data, approximately 14,000 households are overcrowded, 18,000 households lack complete plumbing, 24,000 households lack sufficient kitchen facilities, and half a million households face severe cost burden.^{67,26}

Severe housing problems can exacerbate other housing quality issues such as environmental contaminant and repair issues. Environmental triggers, such as exposure to mold, pests (cockroaches, mice, dust mites), chemicals, dust, pet dander, secondhand smoke and thirdhand smoke - which lingers in carpets, drapes and other surfaces and can re-aerate - can exacerbate asthma and may be worsened by overcrowding, which increases risk of respiratory infections and psychological stressors that impact chronic conditions.⁷³

OVERCROWDING: Overcrowding can lead to many negative health consequences—particularly respiratory conditions such as asthma and tuberculosis, and mental health conditions that may be exacerbated by chronic stress produced by space-sharing conflicts.^{74,75}

HIGH HOUSING COSTS: High housing costs² have an interactive effect on the other housing problems—increasing the likelihood that individuals are forced to reduce spending on food, health care, and other necessities in order to pay housing expenses.^{76,74} Individuals facing high housing costs are also less likely to have established health care providers, are less likely to get sufficient care for chronic conditions, and are more likely to seek care from emergency departments.⁷⁷ Severe cost burden forces families to choose between disproportionately allocating income for housing at the expense of other necessities, or alternatively, choosing poor quality housing options that are more affordable. This choice is particularly acute for renters, who face severe housing problems at higher rates than homeowners. Faced with severe cost burden, renters may be forced to choose housing options in unsafe neighborhoods that are poorly maintained, lack sufficient facilities, and are plagued by environmental issues such as lead paint and mold. These hazards produce additional mental stress, are linked to negative health outcomes, and compound preexisting chronic conditions.^{76,74}

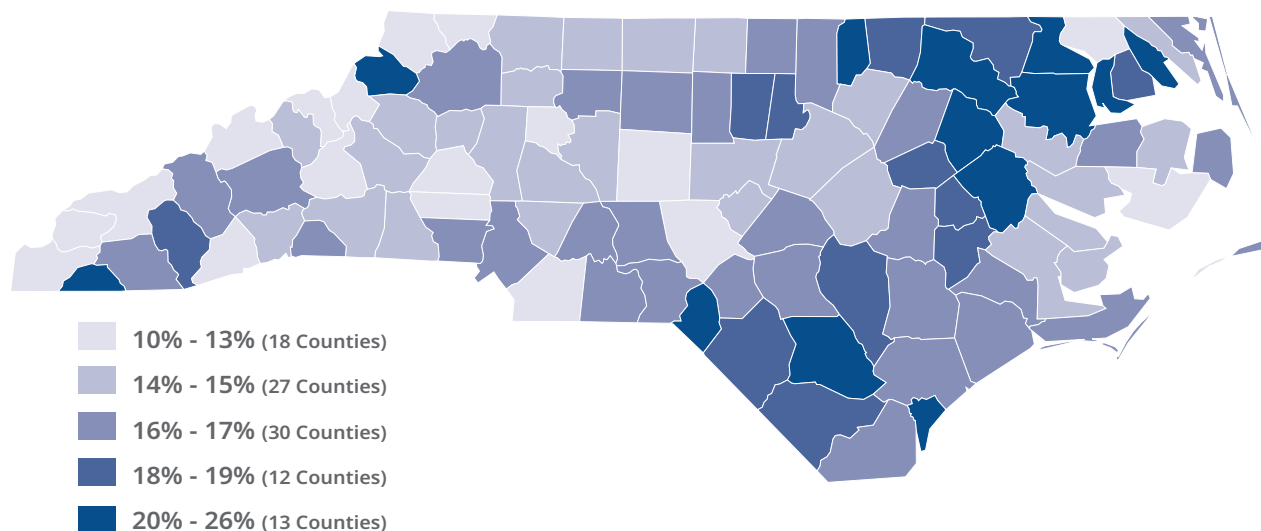
^U North Carolina Department of Health and Human Services. North Carolina Early Childhood Action Plan. February 2019. <https://files.nc.gov/ncdhhs/ECAP-Report-FINAL-WEB-f.pdf>

^V Overcrowding is defined as having more than 1 person per room of a residence, not inclusive of bathrooms.

^W High housing costs are assessed according to a cost burden analysis. An individual is severely cost burdened if his or her monthly housing costs exceed 50% of his or her monthly income. "Housing costs" are defined by the U.S. Department of Housing and Urban Development as mortgage payments, rent payments, insurance payments, property taxes, and utility bills.

FIGURE 17

Percent of People with Severe Housing Problems in North Carolina Counties, 2018



Source: Source: County Health Rankings & Roadmaps; <https://www.countyhealthrankings.org/app/north-carolina/2019/measure/factors/136/data>

LACK OF KITCHEN AND/OR PLUMBING FACILITIES: Lack of sufficient plumbing can pose sanitation risks that put inhabitants' and others' health at risk.⁷⁵ Untreated wastewater (effluent) surfacing outdoors or backing up into a home is a pathogen exposure concern and may also contaminate drinking water wells and nearby surface water. In addition, surfacing effluent provides breeding areas for mosquitoes and flies. Lack of kitchen facilities and inability to cook within the home has been connected to food insecurity and poor nutrition, both of which contribute to negative health outcomes such as diabetes and obesity.⁷⁸

Disparities

Severe housing problems do not affect the population uniformly, and distribution tracks with high rates of poverty and historic segregation that have confined people of color to under-resourced residential areas.⁷⁹ Therefore, disparities primarily arise along geographic, racial, educational, and income lines. Metropolitan residents and racial and ethnic minorities are more likely than their rural and white counterparts, respectively, to face all components of severe housing problems. Severe housing problems are also most prevalent among the poorest residents of North Carolina and affect renters at higher rates than homeowners.⁷⁶ Illustrating this fact, approximately 65% of residents own their homes, but homeowners are disproportionately white.⁸⁰ Among white residents living in the state, 71.2% live in a

Levers for Change (RWJF, How home affects health)

- Increase living wage employment opportunities
- Enforce fair housing laws
- Improve access to social services and resources for affordable housing
- Increase involvement of community members in decision-making
- Support programs designed to increase home ownership for people of color

^XThe Census Bureau evaluates household facilities according to the presence of six features: hot and cold running water, a flushing toilet, a bathtub or shower, a sink with a faucet, a stove, and a refrigerator. If a home does not have one of these factors, the census recognizes it as lacking in critical facilities (County Health Rankings, Severe Housing Problems).

^YThese additional environmental contaminants are not included in the measure of severe housing problems.

^ZA contributing factor to cost burden is increasing energy costs. Across North Carolina, many homeowners spend 3-8% of their incomes on energy while renters may face energy costs in excess of 8% of their incomes. Although there is no conventional measure for energy costs disaggregated from housing cost burden, the Federal Department of Health and Human Services considers costs in excess of 6% of one's income to be "unaffordable" (NC Housing Coalition, Mapping Housing Affordability in North Carolina).

home they own, compared with only 43.9% of African American residents, and 43% of Hispanic residents.³ Renters often do not have the ability to make changes to their residences to improve plumbing and kitchen facilities and face high housing costs/severe cost burden at higher rates than homeowners.

In addition, the multidimensional impacts of major natural disasters like Hurricanes Matthew (October 2016), Florence (September 2018), and Dorian (September 2019) illuminate the lack of safe and affordable housing in North Carolina in general, and expose interconnected layers of social vulnerability that have existed for decades in the housing sector throughout the state. Hurricane Matthew damaged or destroyed nearly 100,000 homes and displaced thousands of people. In some communities Matthew destroyed a significant amount of previously available rental housing stock - including low-income housing options.⁸¹ Before Hurricane Florence made landfall, North Carolina had a shortage of 190,000 affordable housing units, in its wake there's a shortage of 300,000 units.⁸² As a result, developing strategies to help facilitate access to safe and affordable housing has quickly emerged as a short- and long-term recovery priority for the state.

2030 Target and Potential for Change

The HNC 2030 group reviewed data across several years and projected a future level to develop a target for severe housing problems. The group chose 14% as the target percent of households affected by one or more of the four severe housing problems as the target for 2030. The current measure of 16.1% is a slightly lower percentage than was seen in the state from 2012-2014, but the percentage is expected to trend upwards again over the next decade. Achieving the 14% target would reflect a meaningful reversal in the projected trend.

PHYSICAL ENVIRONMENT: DEVELOPMENTAL MEASURES

Below are physical environment measures that the HNC 2030 group feels are important to population health, but do not have reliable or robust data available at this time. A description of the data needed for these measures is listed as “developmental data needs.” State and local public health or other entities should consider identifying methods for collecting this data.

Air and Water Quality

The public is frequently exposed to environmental contaminants. Some environmental contaminants may not yet be identified and still others are not yet regulated. A better understanding of health effects of these contaminants and the risk of combined exposures is essential to better policies around environmental exposures.^{AA}

Developmental data needs:

- Advancements in analytical, research, and health sciences are needed to identify and quantify specific chemicals and classes of chemicals present in the environment to which people are exposed and at what exposure concentrations adverse health effects are a concern to the exposed generation and subsequent generations. This work would be followed by measures to reduce potentially harmful exposures.

Access to Food

The Physical Environment Work Group chose the measure “Limited access to healthy foods” to draw attention to the needs of populations that are low income and do not have close access to foods. This measure is slightly limited in its scope, specifically measuring proximity to grocery stores and supermarkets. While this is an important measure, it may not fully represent a population’s access to foods.

Developmental data needs:

- In addition to data on limited access to healthy foods, as measured for the HNC 2030 indicator, attention should be given to other potential approaches to provide access to food. Communities across the state have implemented healthy corner store initiatives, SNAP/ EBT support, payment incentive programs for farmers’ markets, and other methods to bring people closer to healthier options. Additionally, nonprofit organizations like the Inter-Faith Food Shuttle have worked to bring farmers’ market goods directly to low-income communities. To better capture these strategies and the effect that they have on North Carolinians, surveys such as the BRFSS and other county-level survey systems could be used to collect data on people’s access to healthy foods and evaluate remaining barriers.

Access to Exercise Opportunities

The chosen HNC 2030 indicator of access to exercise opportunities is also limited in scope. The measure is calculated using Census data on the location of parks and recreational facilities using standard industry classification codes. It does not include access to sidewalks, malls, schools, and other locations that may provide opportunities for recreation. It also does not measure whether the recreational facilities are meaningfully accessible for community members as it does not capture cost barriers, time restrictions that may limit access to public spaces, and physical restrictions such as busy streets. However, it is an important and reliable data source to identify communities where there may be fewer places for physical activity.

Developmental data needs:

- Communities across the state have used additional methods to increase access to physical activity, such as building sidewalks and implementing shared use agreements designed to increase public access to school fields and playgrounds. While communities monitor the HNC 2030 indicator of access to exercise opportunities, they should also evaluate other ways their population can increase access that work best for them.

Transportation and Access to Needed Destinations

A consistent concern shared by community members who provided input was access to reliable public transportation. Transportation is vital to sustained employment, maintaining social connections, and accessing food, medical care, and other resources. Despite the importance of this driver of health, there are few robust and reliable measures of public transportation availability and the ability of individuals to reach a desired location.

Developmental data needs:

- Comprehensive measures of transportation needs, availability, and transit system effectiveness would help local and state health and transportation policymakers and planners to target the areas with the most need. North Carolina’s varying geography, from coastal areas to the mountains, provides different challenges to transportation access. These varying challenges must be accounted for when considering best measures for transportation needs.

^{AA} Based on perspective shared by North Carolina Department of Environmental Quality participant in HNC 2030 process.

Climate Change and Disaster Preparedness

According to the CDC, climate change has led to precipitation extremes, with heavy precipitation and drought events across the country that are projected to increase in all U.S. regions.⁸³ Heavy precipitation that causes flooding has immediate dangers to life and long-term ramifications on housing (discussed on [Page 60](#)), mental health, and stress. Globally, warming temperatures are contributing to sea level rise. In North Carolina, estimates show that sea levels will rise one to four feet over the next century, drastically impacting people living in coastal areas.⁸⁴ Increased temperatures may impact crop yields and reduce livestock productivity.⁸⁴ An increasing number of days with high heat will impact populations vulnerable to heat-related illnesses like heat stroke and dehydration, such as children, older adults, and people who live in poverty.⁸⁴ High heat also creates more ground-level ozone, which can lead to increased asthma and risk of death from heart or lung disease.⁸⁴

North Carolina is beginning state-level efforts to decrease the amount of greenhouse gases, such as carbon dioxide, produced in the state that contribute to global climate change. Governor Roy Cooper signed Executive Order Number 80 in October 2018, supporting the 2015 Paris Agreement and calling on state agencies to collaborate on the reduction of energy use and development of climate adaptation and resiliency planning.⁸⁵ Regardless of actions taken now, projections show that coastal communities will continue to experience impacts of heavy precipitation events and rising sea levels. Disaster preparedness and resiliency planning is vital to ensuring the health, safety, and economy of the eastern half of North Carolina.

Developmental data needs:

- Ongoing monitoring of county-level and regional greenhouse gas production and climate change resiliency planning will be important in coming years. Resiliency planning will vary by region of the state and should account for the needs of various populations, such as individuals living in poverty. A variety of measures can be used to evaluate the impacts of climate change on populations, from number of days schools close for adverse weather events and number of extreme heat days, to the percent of the population in counties impacted by extreme weather who live in poverty.