

Scaling Regenerative Design

AN OVERVIEW OF SOCIAL DETERMINANTS OF
HEALTH AND THEIR IMPACT ON CHRONIC
DISEASES IN TENNESSEE

green|spaces and Master of Public Health Program at the
University of Tennessee at Chattanooga. Research Report.
August 2022





Report Author

Amir Alakaam, PhD. MS. RDN. LDN. MBChB.

Program Director and Associate Professor, Master of Public Health
University of Tennessee Chattanooga

Emory Evans

Graduate Research Assistant, Master of Public Health
University of Tennessee Chattanooga

Report Reviewer

Michael Walton AIA, NCARB, LEED AP
Executive Director, green|spaces

Place direct correspondence to:

Dr. Amir Alakaam

Department of Health and Human Performance
University of Tennessee Chattanooga
310 Metro Building, Dept 6606
518 Oak Street
Chattanooga, TN 37403-2598
Office: (423) 425-4745
Email: amir-alakaam@utc.edu

Acknowledgements

This report was supported by the Kendeda Fund and green|spaces.

Suggested citation:

Alakaam, A. & Evans, E. (2022). An overview of social determinants of health and their impact on chronic diseases in Tennessee. green|spaces. Chattanooga. Tennessee.

Table of Contents

Abstract 4

An Overview of Social Determinants of Health and their Impact on Quality of Health 5

Common Chronic Diseases 6

Social and Environmental Factors Associated with Incidence of Chronic Diseases 9

Social Network and Community Support 17

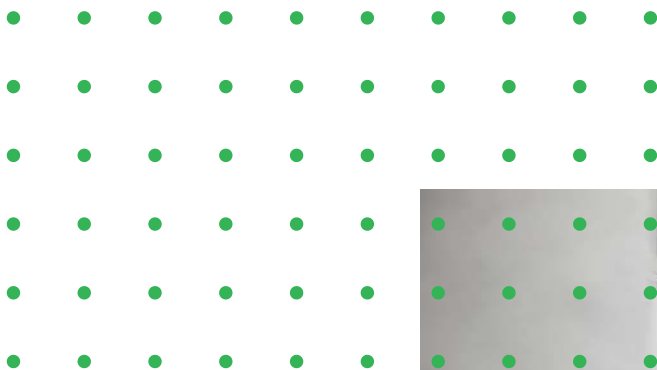
Understanding the Health Status of Tennessee and Hamilton County 18

Social Determinants of Health in Tennessee and Hamilton County 24

Conclusion 27

Appendix 28

References 31



Abstract

Nearly 52% of the U.S. population suffers from at least one chronic disease. Social and personal factors that influence health outcome and chronic diseases are known as the social determinants of health (SDOH), defined as *“conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks,”* such as education, language skills, job opportunities, safe housing, air quality, and income (U.S. Department of Health & Human Services, 2022a). The risk behaviors associated with the occurrence of chronic disease are all incidents that can be avoided. However, SDOH does help to determine whether access to

preventable measures is available for communities. Built environment, individuals’ economic standing, access to education, access to healthcare all attribute to the risk and prevalence of chronic diseases in the community.

There have been many studies linking social and environmental determinants to the health and wellbeing of populations. This report provides a review of data and literature that outline determinants of health, especially those driven by neighborhood, housing, and built environment, and their impact on chronic diseases to acknowledge community partners with unique health and social needs of individuals in Chattanooga, Tennessee.

An Overview of Social Determinants of Health and their Impact on Quality of Health

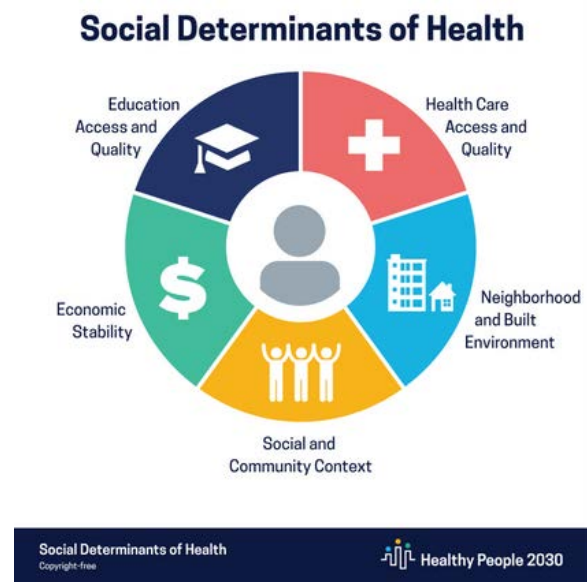
Social Determinants of Health: An Introduction

According to U.S. Department of Health and Human Services (DHHS; 2022a), **social determinants of health (SDOH)** are defined as “the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” There are five categories that SDOH focuses on that can influence the health outcome of an individual: See Figure 1.

1. Economic stability
2. Education access and quality
3. Health care access and quality
4. Neighborhood and built environment
5. Social and community context

Several SDOH are associated with the development of chronic diseases, which are long-lasting health issues that affect one’s health daily, creating limitations in certain activities (Pantell et al., 2019). **Studies show that three in five adults in the United States have a chronic disease and two out of five adults suffer from two or more chronic diseases.** Some of the most common chronic diseases that the United States faces are heart disease, hypertension, diabetes, and obesity (Centers for Disease Control and Prevention [CDC], 2022a).

Figure 1
Social Determinates of Health



Note. From U.S. Department of Health and Human Services. Healthy People 2030.

Common Chronic Diseases:

Definition & Overview

Cardiovascular Disorder

Heart disease, the leading cause of death in the United States, can refer to many types of heart conditions, like a heart attack or heart failure (CDC, 2021a). Cardiovascular disorder (CVD) is one of the most common forms of heart disease. Cardiovascular disorder is when the blood flow to and from the heart is disrupted due to the buildup of fat deposits on the walls of the arteries or other conditions (CDC, 2021a). In 2019, CVD was the underlying cause of death for 874,613 Americans, revealing that **CVD leads to higher mortality rates than cancer and respiratory disease combined** (American Heart Association, 2022).

Hypertension

Hypertension, commonly known as high blood pressure, is when one's blood pressure (the pressure that the blood is putting on the walls of arteries while traveling out of the heart) exceeds normal levels. If one experiences consistent levels of hypertension, then they are putting themselves more at risk of heart disease (CDC, 2021b). Trends show that the existence of hypertension can increase with age and are more frequent in men (51.0%) than women (39.7%). During a survey performed

from 2017 to 2018, it was found that 57.1% of non-Hispanic African Americans, 43.6% of non-Hispanic Whites, and 43.7% of Hispanics suffered from hypertension in the United States (CDC, 2020).

Diabetes

Diabetes is another common chronic disease in the United States that affects the way one's body breaks down food and processes it into energy. There are two types of diabetes (Type 1 and Type 2). The least common of the two is Type 1, which is developed at an early age and serves as an autoimmune response to the body's inability to naturally produce enough insulin. Type 2 is when the body is not producing or using insulin properly (CDC, 2022c). Type 2 develops over time and is more prevalent in adults but is becoming more common in children. Poor diet, lack of physical activity, and obesity can lead to Type 2 Diabetes (CDC, 2022c). In 2019, the American Diabetes Association (ADA; 2022) found that **11.3% of the U.S. population suffered from diabetes**, with 12.2% non-Hispanic African Americans, 11.8% Hispanics, and 7.4% non-Hispanic Whites. Of that 11.9%, 35% of youths under the age of 20 are estimated to have either Type 1 or Type 2 diabetes (ADA, 2022).

Obesity

Obesity is not only a chronic disease within itself but can also lead to the suffrage of other chronic diseases, like heart disease, diabetes, and hypertension. Obesity is determined by one's body weight versus their height. If one has an excessive amount of body weight for their height, then they are determined obese (CDC, 2022d). A tool used to establish whether one is obese is to measure one's Body Mass Index (CDC, 2022e). Unhealthy eating habits, lack of sleep, an inactive lifestyle, and genetics may increase the risk of obesity (CDC, 2022e). In a review of statistics on obesity, the years 1999 to 2000 through 2017 to 2020 showed an increase in the incidence of obesity from 30.5% to 41.9% within the United States, affecting all ages and races. Non-Hispanic African American adults had the highest frequency of obesity with 49.9%, followed by Hispanic adults with 45.6%, and then non-Hispanic Whites with 41.4% (CDC, 2022d).

Asthma

Asthma is a chronic disease in which the respiratory airways become narrow or inflamed due to the body's response to certain triggers, sometimes creating extra mucus within the airways (Mayo Clinic, 2022). As the body's response worsens it can lead to either a minor or a more severe asthma attack. Asthma triggers are smoking, physical exercise, indoor and outdoor allergies, exposure to chemicals, and respiratory infections (CDC, 2021c). Though it is unclear what exactly causes asthma, studies show that one's environment and family history can play a role in the development of asthma. The severity of asthma varies from person to person and can affect both children and adults (American Lung Association, 2022). In 2019, it was recorded that 10.6% non-Hispanic African Americans, 7.7% of non-Hispanic Whites, and 6.6% of Hispanics suffered from asthma (CDC, 2022f).





Social and Environmental Factors Associated with Incidence of Chronic Diseases

Just as many chronic diseases are connected, so are the social determinants of health. When exploring social and environmental factors, it is important to keep in mind the socioeconomic disparities that already exist and determine the best course of action to deplete such inequalities.

Economic Standing

An individual's economic standing can determine access to proper healthcare, quality education, and a healthy environment. Poverty is determined by the median income of a state and is defined by the household's ability to afford essential needs, like housing, clothes, food, and healthcare. U.S. Census Bureau's data (2022a) can reveal how poverty rates can be more dominant within certain ethnicities, but it is important to understand that under a smaller scale, such as a neighborhood, poverty rates can still vary and be determined by SDOH (Levy et al., 2022). **The poverty rate varies for each state and neighborhood, but as a nation, the United States reached an all-time low in 2019 since 1959 with a poverty rate of 10.5%** (Creamer, 2020). In 2020, the poverty rate increased for Hispanics to 17% and non-Hispanic Whites to 8.2%. non-Hispanic African Americans had a slight increase to 19.5% after reaching a historic low in 2019 (U.S. Census, 2022a).

Poverty and unemployment can affect several aspects of health negatively by ensuing the feeling of no self-worth and potentially leading to depression and other stress-related illnesses that can cause hypertension and heart disease (DHHS, 2022b). Being able to bring home a paycheck is not the only thing that can assist in the health of a population. Having employers that offer paid sick days, parental leave and health insurance are all benefits of employment that contribute to a healthy work environment (DHHS, 2022b).



Access to Education

Studies have shown an association between level of education and risk of chronic diseases, individuals with a low level of education tend to have higher rates of chronic disease and are more likely to be unhealthy (Alakaam et al., 2022; DHHS, 2022c; Krueger et al., 2015). Additionally, those who maintain healthier habits like being physically active, avoiding unhealthy foods, and sustaining from alcohol and drug abuse, tend to perform better in school and achieve higher levels of education (DHHS, 2022c; Krueger et al., 2015).

“

Today, lack of health insurance, limited financial resources, and inadequate transportation are some barriers to accessing health services in the United States.

”



Access to Health Care Services

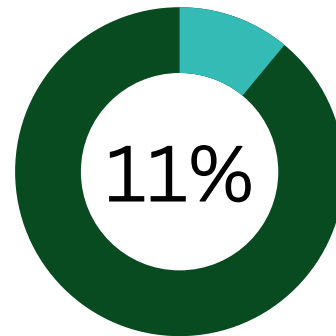
The Institute of Medicine (1993) defined access to health care as “the timely use of personal health services to achieve the best possible outcome.” Today, lack of health insurance, limited financial resources, and inadequate transportation are some barriers to accessing health services in the United States. One of the biggest obstacles to healthcare access and quality of care is lack of insurance coverage, either an employer does not offer health benefits to their employees, or an individual is unable to purchase coverage themselves. Without access to primary or secondary care, individuals are less likely to seek medical attention when necessary or to proceed with preventative measures that may avert the development of chronic diseases, like annual medical screenings and checkups (DHHS, 2022d). If individuals are expected to pay for medical visits out-of-pocket, they are less likely to pursue medical attention at all (Taber et al., 2015). One also must consider how an individual may get to a healthcare facility. Transportation is an issue in urban as well as rural areas alike. Though public transportation can be more common in urban areas, the location of healthcare facilities in relevance to the population they serve is much to be considered (DHHS, 2022d).

Food Environment

Having a grocery store nearby contributes to a neighborhood's health by offering access to nutritional foods to the surrounding patrons. The placement of a grocery store can help to determine whether a community is food secure. Lack of access to nutritious food due to a household's economic standing or geographic location can lead to chronic diseases like obesity, heart disease, and diabetes. As of 2019, 11.1% of households in the United States were not able to attain adequate food (United Health Foundation, 2022). **Of the 11.1% that were food insecure, 6.9% were households with children.** Within this percentage, it is recorded that household members would sustain from eating for an entire day to subsidize the needs of others to eat.

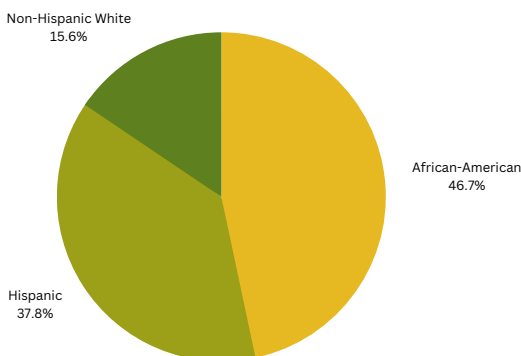
In 2020, 21.2% non-Hispanic African American, 17.2% Hispanic, and 7.1% of food insecure households were non-Hispanic White (Coleman-Jensen et al., 2021). Of the areas of residence that exemplified food insecure households, 14.6% were recorded as being inside the metropolitan area, 18.4% were in principal cities, 12.4% were not principal cities, and 16.1% were outside metropolitan areas (Coleman-Jensen et al., 2021).

Percentage of U.S. Households in 2019 Experiencing Food Insecure



Note. From United Health Foundation, 2022

Racial Demographics of U.S. Households Experiencing Food Insecurity



Note. From Coleman-Jensen et al., 2021



Home Environment

The quality of a home influence the health of a population. **Adults and children spend 90% of their time inside their homes, where the air quality can be two to five times worse in pollutant concentrations than in outdoor air** (The Environmental Protection Agency [EPA], 2021). The existence of mold, cockroaches, mice, and other housing code violations all play a part in the indoor air quality of a home and have led to an increase in asthma and respiratory infections (American Lung Association, 2020; CDC, 2009).

Overcrowding a home can also lead to respiratory infections and other diseases (Braveman et al., 2011; Melton, 2017). Smoking indoors, a habit that is more prevalent in low-income housing, and improper ventilation also aid in health disparities associated with the housing (DHHS, 2022e). Exposure to lead, which occurs mostly inside homes, can lead to permanent brain damage (Melton, 2017). Moreover, children that live in an overcrowded environment have been known to experience mental strain and tend to be aggressive (Melton, 2017).

Another example of the impact of quality of home on health is the lack of adequate plumbing system.

“

Adults and children spend 90% of their time inside their homes, where the air quality can be two to five times worse in pollutant concentrations than in outdoor air.

”

Without adequate plumbing, families are at risk for waterborne diseases like E. Coli or Giardia. For urban areas, the issue is more related to pollution from landfills, septic tanks, and agricultural runoff contaminating the ground water. In rural areas, water systems rely more on private wells. Private well systems can become contaminated with chemicals depending on their proximity to industrial mining and wastewater systems as well as agricultural runoff (DHHS, 2022e).

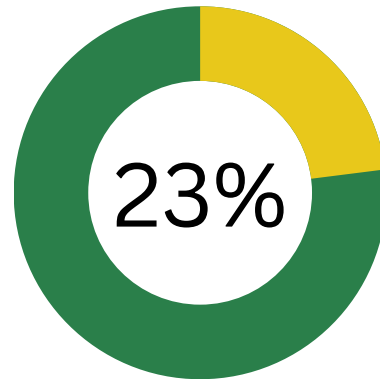
Another issue within a home's-built environment that can lead to respiratory and non-respiratory diseases is the presence of mold. Mold impacts indoor and outdoor air quality, and without proper ventilation, when inhaled, can lead to asthma, sinusitis, and pneumonia (EPA, 2021).

Indoor Air Quality

When considering environmental factors associated with the incidence of chronic diseases one must consider indoor air quality (IAQ). As individuals are more directly exposed to poor IAQ within a home or a school environment the individuals' health and well-being are directly affected. Absenteeism becomes more substantial as well as other health side effects, like asthma, are highly influenced by poor IAQ (EPA, 2022b). Globally, 23% of the deaths recorded have been contributed to exposure to poor air quality (Gonzales & Whalen, 2022). **Cracks in walls, opening windows, or gaps in building foundations can allow harmful chemicals like radon to enter a home** (radon exposure is the second leading cause of lung cancer after smoking). As the climate outside of the home shifts from season to season, the use of heaters, air conditioners, dehumidifiers, and opening of windows can all shift the status of the air quality of a home (EPA, 2022c).

Additionally, the ozone layer and the levels of Particulate Matter (microscopic particles of solid or liquid substance

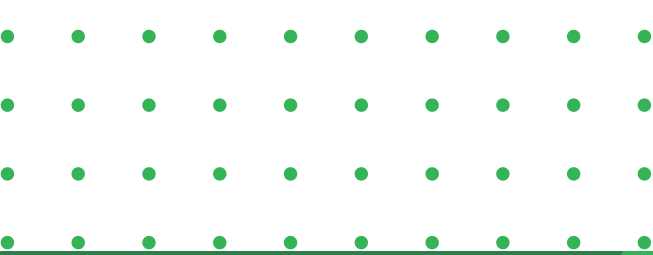
Percentage of Reported Deaths Caused by Exposure of Poor Air Quality



Note. From Gonzales & Whalen, 2022

suspended in the air) can contribute to the air quality of an area.

As the ozone and Particulate Matter levels shift, so does the climate of an area, which can affect an individual's health (Gonzales & Whalen, 2022). There are federal regulations that exist within the United States to help prevent poor air quality; however, the 2021 State of the Air report shows that **41% of the U.S. population will continue to live in areas that illustrate elevated levels of Particulate Matter and unsafe levels of ozone** (Gonzales & Whalen, 2021). Those that are more at risk for health effects due to air pollution are children, pregnant women, the elderly, and those with pre-existing heart or lung disease (EPA, 2022c).



Housing Insecurity

Housing insecurity can present health issues to a population. **Affordability and quality are two aspects of housing that affect one's health.** If one can afford the home that they live in, then they are more likely able to afford other things like health care, education, proper food, clothing, and transportation. If the housing market is out of economic range, financial stress occurs, having a negative impact on an individual's mental health. If a household spends more than 30% of its income on housing the household is a "cost-burdened" (DHHS, 2022f). Cost-burdened households may experience housing instability, within housing instability, there are struggles to pay rent, overcrowding, and frequency of moving. If a household moves habitually, it is difficult for the members of the household to establish any sort of roots or belonging (DHHS, 2022f).

In a built environment, housing insecurity can vary due to a residence being owned or rented. Typically, in a landlord and renter relationship, one of the two will take on the cost of the energy bill. **Studies have shown that when a landlord oversees the energy bill then there is more incentive to invest in energy-efficient appliances and building materials,** like new windows and proper insulation, resulting in a lower energy bill (Melvin, 2018). However, if the renter is responsible for the energy bill the initial investment for an energy-efficient home is not as enticing (Melvin, 2018). As mentioned before, without proper ventilation or insulation the IAQ can be at risk, placing the tenants of a residence at a greater health risk (EPA, 2022c).



Home Neighborhood

The environment of the home is not the only type of environment that affects the health of a home. The geographic location of the home and its exposure to outdoor environmental factors also influence the health of a home. Water quality, air pollution, noise pollution, and extreme heat all help to determine the status of one's health and home. In urban areas, those who are exposed to greater percentages of air and noise pollution tend to suffer more from hypertension, which, in turn, influences heart disease (DHHS, 2022e).

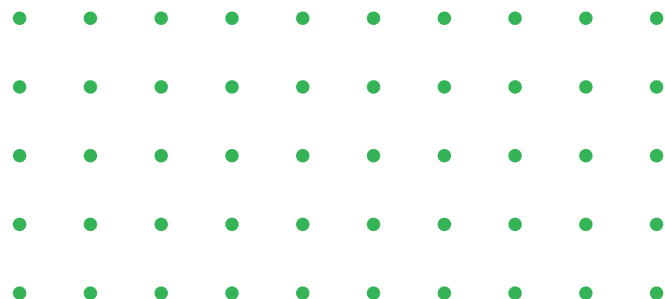
Neighborhoods with high rates of violence can also have a direct effect on families and their health. If a park is not well lit and there are known violence in an area, the community is less likely to get out and enjoy physical activity as well as social engagements with each other. Something as simple as a sidewalk can help promote neighbor-to-neighbor interaction as well as physical activity within the community (DHHS, 2022g). The amount of sleep that a household receives can be also reflected in the stressors of the surrounding area as well as the social capital (Robbins et al., 2019).

A deficient feeling of safety in a neighborhood also leads to mental instability. Fearing crime within a neighborhood not only makes the residents of a community feel unsafe but also leads to a lack of physical activity within a neighborhood (Pearson et al., 2021). For example, if residents feel they are to be victims of a crime within a neighborhood they are less likely to go on walks.

“

Something as simple as a sidewalk can help promote neighbor-to-neighbor interaction as well as physical activity within the community.

”





Social Network and Community Support

Relationships between one's community benefit the health status of a household. The sense of belonging can contribute psychologically and physically. Factors that help to define the strengths and benefits of community relationships include social capital, social networks, social support, and civic participation.

Social Capital

Social capital refers to group resources that are shared between one another. For example, hearing of a job from another person within one's community or receiving a referral for a medical professional. This type of relationship is the result of one's social network that can provide social support or instrumental support within a community. A facet of social capital is collective efficacy, which is the ability of a community or neighborhood to make a change. Working together through collective efficacy can result in improving food environment, increasing access to health care, enhancing public facilities, and decreasing violence in neighborhood (DHHS, 2022h).

Civic Participation

One may build social capital and expand one's social network by participating in civic opportunities. Civic participation, meaning volunteering, voting, and joining in on other community activities, can lead to extending one's social network. Studies show those who are more involved in civic groups are more likely to be physically active (DHHS, 2022h). Volunteering does not only develop one's social network but has been shown to improve the emotional and mental well-being of individuals (DHHS, 2022i).

Social Networks

Social networks can be used as positive or negative influences (DHHS, 2022h). If a community is participating in healthy habits the influence of the surroundings will contribute to healthier neighborhoods. For example, if a community holds events that encourage access to a public park, chances are the park will see more use, resulting in the influence of physical activity and the potential for the decrease of chronic disease. On the other hand, if a community supports the idea of littering or the spread of crime or violence then chances are that community members are more likely to isolate themselves and stay indoors, taking away from the strength of a community (DHHS, 2022h; Tan, 2014).

Understanding the Health Status of Tennessee and Hamilton County

Tennessee

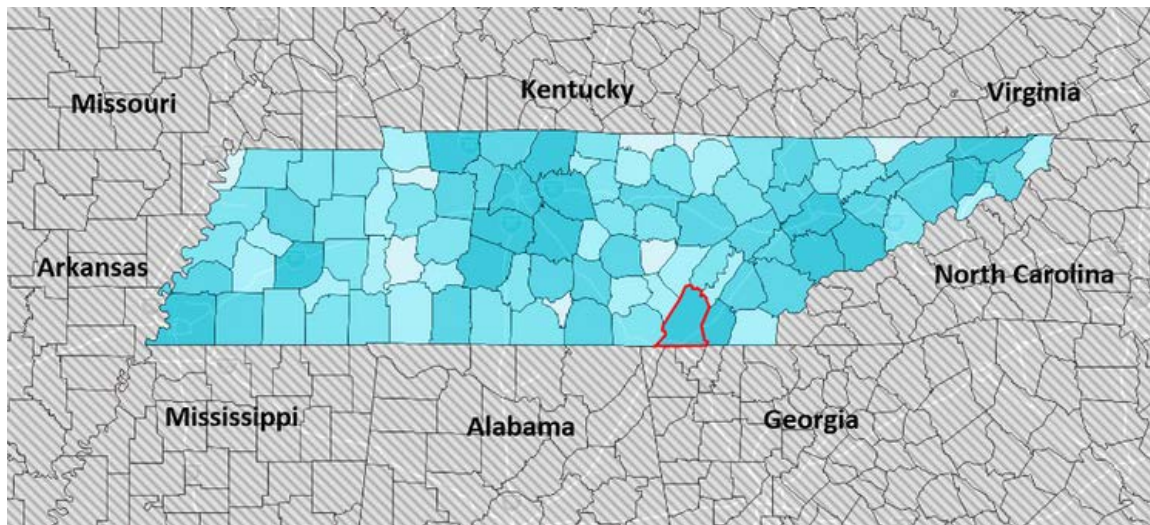
Tennessee (TN) is home to 6,910,840 residents, leaving it to be the 16th most populous state in the United States (Cubit, 2022; U.S. Census Bureau, 2020). It is recorded that 77.7% of the TN population are 18 years or older, 22.3% are under the age of 18, 16.4% are the age of 65 years or older, and 6% are under the age of five (U.S. Census Bureau, 2020). About 73% of the TN population is non-Hispanic White, 17% are African American, and 6% are Hispanic (U.S. Census Bureau, 2020).

Hamilton County

Hamilton County (HC) is in the southern part of East TN on the border of northern Georgia, see Figure 2. As of 2020, HC holds a population of 366,207 residents, making HC the fourth largest county in TN (Cubit, 2022; U.S. Census Bureau, 2022b). The population of HC has increased by 10% from 2010 to 2020 with the fastest growing population being the age group of 65 years or older. In 2010, the 65 years or older percentage was 14.7% of the population and in 2020 it increased to 18.3% (USA Facts, 2022). In 2021, it was recorded that 75.9% of the HC population is non-Hispanic White, 19.3% are African American, and 6% are Hispanic (U.S. Census Bureau, 2022b).

Figure 2

Hamilton County in the state of Tennessee with the Surrounding States



Note. Hamilton County is highlighted in red. Taken from The U.S. Census Bureau. QuickFacts, Hamilton County, Tennessee, Map.

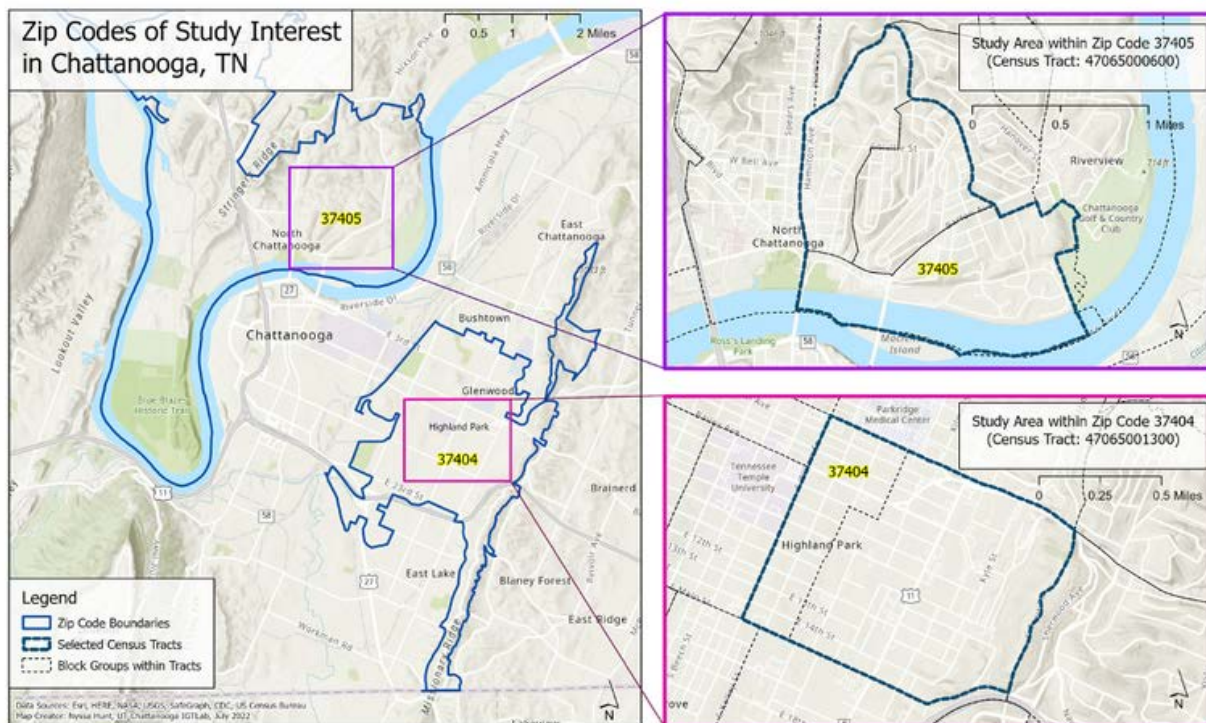
Highland Park and North Chattanooga Area

There are two zip codes within HC that this report specifically explores: 37405 and 37404. The area of concentration within zip code 37404 is the neighborhood Highland Park (HLP). Highland Park is more centralized in the downtown area of Chattanooga, TN. See Figure 3.

As of 2019, HLP held a population of 2,064 people all of whom demonstrate diverse socioeconomic backgrounds. In 2021, it was recorded that 53.2% of the HLP population is African American, 29.1% is non-Hispanic White, and 21.3% is Hispanic (City-Data, 2022). There are two zip codes within HC that this report specifically explores: 37405 and 37404. The area of concentration within zip code 37404 is the neighborhood Highland Park (HLP). Highland Park is more centralized in the downtown area of Chattanooga, TN.

Figure 3

Zip Codes 37404 and 37405 within Hamilton County, Tennessee



Note. The highlighted areas in purple and pink represent a general boundary of each area of focus in this report. The exact coordinates are represented in the smaller figures on the right. Map from ArcGIS (2022).

In Highland Park, the highest level of educational attainment in 2019 for those who are 25 years and older is a high school diploma with the median household income being \$36,486 (City-Data, 2022; Statistical Atlas, 2018). Of the homes owned, 74.2% of housing units within HLP pay a mortgage, and those who rent pay an average of \$603 a month. A sizable portion of the homes in HLP was built in 1939 or earlier (City-Data, 2022; Statistical Atlas, 2018).

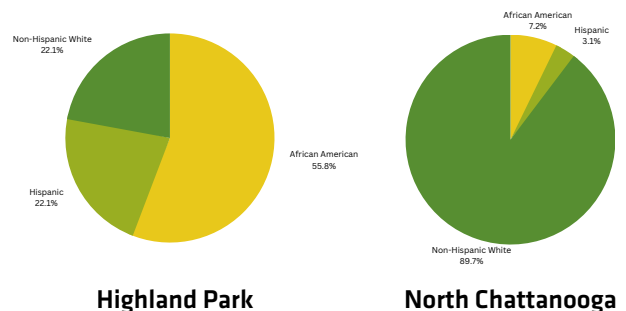
Zip code 37405 is a neighborhood in HC called North Chattanooga (NCH). North Chattanooga encompasses the community that is North of the TN River. In 2019, NCH had a population of 3,003 residents, 86.7% is non-Hispanic White, 7.4% is African American, and 3.3% are Hispanic (City-Data, 2022; Statistical Atlas, 2018). Statistics show that 35.4% of NCH residents (25 years or older) have obtained a high school diploma and 55.6% have a higher degree (City-Data, 2022; Statistical Atlas, 2018).

The median household income in 2019 was \$89,657 and the poverty rate was 8.1% (City-Data, 2022). Of the NCH population, 69.6% pay a mortgage, while those who rent pay, on average, \$1,068 a month. North Chattanooga has

more housing units than HLP, but both show similar data when comparing homes that have been built in or before 1939 (City-Data, 2022; Statistical Atlas, 2018).

The following are statistics and data about the prevalence of chronic diseases and SDOH that are specifically related to TN. Information about Hamilton County (and the specific zip codes) is also included in each section when available. For data related to NCH, this report focuses on the specific area of NCH that is within the boundaries of North Market Street, Mississippi Avenue, and the TN River.

Population of Highland Park and North Chattanooga, by race



Note: City Data, 2022; Statistical Atlas, 2018

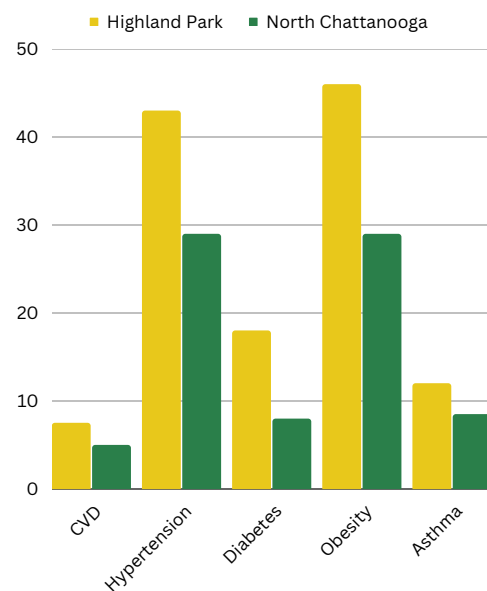
Cardiovascular Disorder

Twenty-four percent of deaths in TN were contributed to CVD (TN Department of Health, 2017). **In 2020, TN surpassed the national percentage (8.1%) of those who suffer from CVD with a percentage of 11.1%** (United Health Foundation, 2022). As mentioned before, CVD is one of the leading causes of death in the United States (American Heart Association, 2022). In 2014, it was reported that 73,397 individuals in TN were diagnosed with heart disease (TN Department of Health, 2017).

When compared to the rest of the nation, TN is one of the ten top states who have the highest mortality rate due to all forms of heart disease (CDC, 2022g). Hamilton County is of the least affected counties in TN by heart disease, but it is still prevalent (Chattanooga-Hamilton County Health Department, 2019). Statistics that spoke specifically to CVD within the two zip codes are not available, but general statistics regarding heart disease are accessible. **As of 2019, HLP has a percentage of 7.5% of their population suffering from heart disease, whereas NCH has 4.8% (CDC, 2022g).**

Hypertension

Among the adults in TN, ages 18 and older, 39.3% suffer from hypertension. **This statistic is among the highest in the United States (CDC, 2022g; United Health Foundation, 2022).** About 42% are African American, 38.9% are non-Hispanic Whites, and 13% are Hispanic (CDC, 2022d). Like CVD, TN holds a position in one of the top eight states in the nation in mortality rates due to hypertension, with Hamilton County having a 17% mortality rate on account of hypertension (United Health Foundation, 2022). Both NCH and HLP have high percentages of hypertension, with HLP showing that 43.2% of residents suffer from hypertension and 29.3% in NCH (CDC, 2022h). When reviewing data, HLP shows a higher percentage of those who suffer from hypertension (43.2%) than the state of TN (United Health Foundation, 2022).



Diabetes

According to the 2020 America's Health Ranking's Annual Report (2022), **14% of the TN population suffer from diabetes**, ranking TN as the 45th most prevalent state among those whose health is affected by diabetes. Of these 14%, 17.6% are African Americans, 13.7% are non-Hispanic Whites, and 3.7% are Hispanic. In 2019, 13% of the HC population that is 20 years of age and older was diagnosed with diabetes (CDC, 2022g). For diabetes, HLP's statistics surpass those of HC, and TN, and are more than double that of NCH (United Health Foundation, 2022; CDC, 2022h). In 2019, 18.3 % of residents of HLP reported having suffered from diabetes, whereas 8.2% of residents of NCH reported having the same illness (CDC, 2022h).

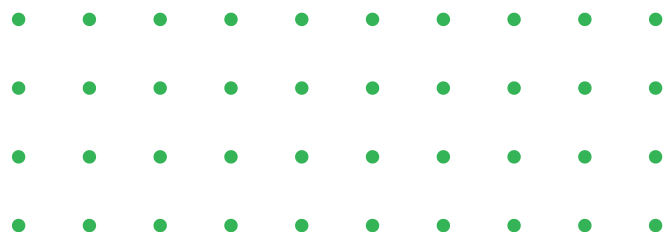
Obesity

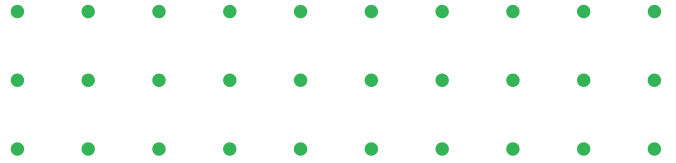
In 2019, TN surpassed the national percentage of obesity with 36.5% of the state's population being obese. Of that 36.5%, 42.6% were African Americans, 34.3% were Hispanics, and 34.2% were non-Hispanic Whites (CDC, 2022h). **Hamilton County recorded 34.6% of the adult population that is 20 years of age and older to suffer from obesity in 2019**

(CDC, 2022h). Obesity is another statistic where HLP surpasses the other areas of comparison. With TN and HC sitting around 34% to 36%, and NCH showing 29.1%, HLP comes out with the highest percentage for those who suffer from obesity with 45.8% (United Health Foundation, 2022).

Asthma

Trends show that those who fall below the poverty line are twice as likely to suffer from asthma than those who do not in TN. It was recorded that 10.3% of the TN population suffers from asthma, resulting in 92 deaths (CDC, 2022h). Of this 10.3%, 9.7% are non-Hispanic Whites, 14.8% are African Americans, 5.6% are Hispanics (Kaiser Family Foundation, 2022). In 2019, those who suffered from asthma in TN decreased to 8.8%, leaving HC to exceed the state percentage at 9.4% (CDC, 2022h). Once more, HLP's percentage exceeds the others with 12% of its population suffering from asthma in 2019. North Chattanooga's statistics stated 8.5%. (CDC, 2022h).





Social Determinants of Health in Tennessee and Hamilton County

The risk behaviors associated with the occurrence of chronic disease are all incidents that can be avoided. However, SDOH does help to determine whether access to preventable measures is available for communities that could potentially suffer from the chronic diseases mentioned above. Individuals' economic standing, access to education, access to healthcare, and the surrounding environment all attribute to the risk and prevalence of chronic diseases in the community.

Throughout the subsequent segment, SDOH data on TN and HC will be discussed to provide a better understanding of the chronic disease status in TN and HC.

Economic Standing

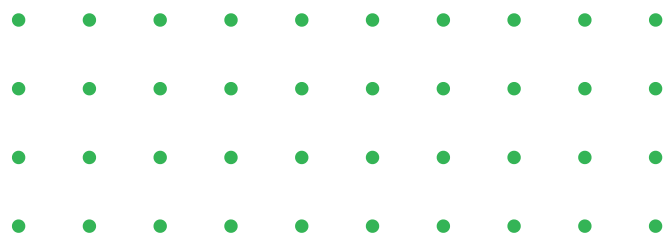
As of 2018, the median household income for TN was \$52,375, **leaving 15.3% of the TN population to fall under the poverty line, 22.3% of which are under the age of 18.** Of this 15.3%, 24.5% are Hispanic, 24.2% are African Americans, and 12.7% are non-Hispanic Whites. In 2017, 3.7% of the TN population was unemployed (U.S. Census Bureau, 2022b)

In 2020, the median household income for HC was \$56,606 with 12.6% of the population living under the poverty rate (U.S. Census Bureau, 2022b), of that 12.6%, 12.2% fall within the age group of 18 to 64 years of age. There was little data to be found regarding current

information on unemployment in HC, but as of 2020, it was recorded that HC held an employment rate of 59.6% (U.S. Census Bureau, 2022b).

Access to Education

According to the U.S. Census Bureau (2022b), 28.2% of the population in TN have a bachelor's degree or higher. In 2020, 33.3% of the HC population was recorded as having a bachelor's degree or higher.

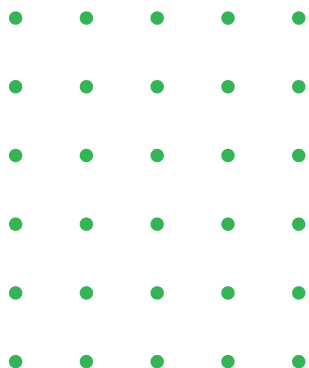


Access to Health Care Services

More than 12% of the TN population, under the age of 65, do not have health insurance (U.S. Census Bureau, 2022b). The Affordable Care Act (ACA) played a role in increasing the percentage of Tennesseans who are covered under health insurance; however, TN has yet to allow Medicaid to be covered under the ACA (Kaiser Family Foundation, 2022). In 2020, the U.S. Census Bureau (2022b) recorded that 9.2% of the HC population did not have health care coverage.

Food Environment

Since 2011, TN has surpassed the national average percentage of food insecurity. As of 2019, 12.5% of the households in TN were food insecure, nationally there were 11.1% (United Health Foundation, 2022). It is difficult to obtain information on food insecurities and how they affect the entire HC community; however, it was detected that in 2017, **13.5% of the HC population suffered from food insecurity, and of that 13.5%, 17.6% were children** (Feeding America, 2022). Statistics show that 33% of the children who suffer from food insecurity are not eligible for food assistance programs (Feeding America, 2022).



Weather

In Tennessee, temperatures, which are directly correlated with the climate of an area, tend to vary due to changes in the topography (TN Department of Environment and Conservation, 2022). The variations in the land as well as its proximity to the Gulf of Mexico also contribute to the rainfall that TN receives (TN Department of Environment and Conservation, 2022).

“

Between 2020 and 2021, Hamilton County saw an 81% spike in the homeless population. By 2021, the homeless population has more than doubled with a 177% increase

”



Housing Insecurity

Those who struggle to afford housing in TN tend to have higher percentages of health issues and are at a greater risk for food insecurities (Melton, 2017). The median pay for a mortgage from 2016 to 2020 in HC is \$1,302 with a median renting rate of \$913 (U.S. Census Bureau, 2022b). According to Chattanooga Regional Homeless Coalition (2022), HC faces a significant increase in the homeless population, between 2020 and 2021, **HC saw an 81% spike in the homeless population. By 2021, the homeless population has more than doubled with a 177% increase** (Massey, 2022). As previously discussed, affordability of housing also pertains to the health of a household.

Safety of the Neighborhood

According to the Tennessee Bureau of Investigation (2020), in 2019, there were 7,753.9 per 100,000 violent crimes in TN. Hamilton County has a violent crime rate of 5.08 per 1,000. Comparatively speaking to other counties throughout the United States, HC is within the 19th percentile for safety, meaning **81% of the U.S. counties are safer than HC** and 19% are less safe (CrimeGrade.org, 2022).

Conclusion

Social Determinants of Health (SDOH) consist of several factors such as education, health care access, economic stability, and built environment. In this report, we provided an overview of the important impact of SDOH on individuals' health and wellbeing in the U.S. We also included literature and data that are specifically related to Tennessee and Hamilton County to provide a picture of the status of health of the resident in these areas.

Our report and the data reveal that the current U.S. (and Tennessee) health status is far from the best when compared with previous years, and many challenges exist. Addressing how SDOH impacts the risk of chronic diseases is critical to improving all individual health in

our community. To reduce poor health outcomes in Tennessee, structural adjustments must be made to lessen the development of chronic diseases and improve health status. Built, home, and food environments that support an active lifestyle and healthy living could be one of the main strategies to overcome health challenges. Several studies had examined the association between built environment and SDOH, health outcomes, and well-being (see Appendix I). A simple action like reducing noise, adding a sidewalk, accessing sunlight, or improving ventilation could add years to our life and may improve health outcomes in our communities.



Appendix I

List of Research on Built Environment and Building Design that Impact Human Health and Well-Being

Title/Location/Year	Purpose of Study	Variables	Main Outcome
1. Neighborhoods and sleep health among adults: A systematic review. U.S. (2022)	How the social and built environment can affect sleep health	-Social capital -Social determinants -Environmental stressors -Sleep health	The study showed cross-sectional evidence that exemplified distinct characteristics between neighborhoods and differences in sleep health. More longitudinal studies to be performed.
2. Climate solutions double as health interventions. U.S. (2021)	Focusing on the relationship between climate change and health risks. How climate focused solutions will contribute to better health.	-Health benefits -Climate change -Education	Climate change reduction will lead to many health benefits. Contributing to the decrease of heatwave mortality, malnutrition from crop yields, water and vector borne diseases and respiratory illness.
3. Feelings of safety during daytime walking: Associations with mental health, physical activity, cardiometabolic health in high vacancy, low-income neighborhoods in Detroit, Michigan. U.S. (2021)	How safety affects mental health, physical activity, Body Mass Index, and other variables in a low-income community.	-Safety of neighborhood -CVD -Diabetes -Obesity	Participants who felt unsafe lived in neighborhoods with higher park area and number of blighted lots. Future research is needed to explain the effects of vacant space and lack of green spaces within a neighborhood on health.

Title/Location/Year	Purpose of Study	Variables	Main Outcome
4. Associations between green building design strategies and community health resilience to extreme heat events. U.S. (2019)	The study examined evidence linking green building design with the potential to enhance community resilience to extreme heat events.	<ul style="list-style-type: none"> -LEED Certified -Heat waves -Climate change 	LEED construction reduced exposure to heat waves, cutting back on the effects of heat islands in urban areas as well as energy burdens. Study exposed the number of green spaces that exist in vulnerable neighborhoods.
5. Energy savings, emission reductions, and health co-benefits of the green building movement. Global. (2018)	How LEED certified buildings impact health, outdoor emissions, and money spent towards energy output.	<ul style="list-style-type: none"> -LEED certified spaces -Emissions -Health benefits -Energy saving 	LEED certified spaces reduced CO2 emissions and air pollution. LEED certified spaces have decreased some chronic disease symptoms.
6. The interplay of climate change and air pollution on health. Global. (2017)	To evaluate evidence on the impacts of climate change on air pollution and health	<ul style="list-style-type: none"> -Mortality -Emissions -Health 	The increase in climate change will result in more of an increase air pollution, which may lead to greater health risks.
7. Indoor air quality in green-renovated vs. non-green low-income homes of children living in a temperate region of US (Ohio). U.S. (2017)	To determine the differences in the indoor air quality (IAQ) between green and non-green homes in low-income housing complexes.	<ul style="list-style-type: none"> -Green renovations -Indoor air quality 	To reduce IAQ problems and potentially improve health, careful selection of indoor building materials and ensuring sufficient ventilation are important for green building designs.
8. Green buildings and health. U.S. (2015)	The review of green building design and how it relates to human health and indoor air environments.	<ul style="list-style-type: none"> -Green building -Health outcomes -Indoor environments 	Initial scientific evidence indicates better indoor environmental quality in green buildings versus non-green buildings.

Title/Location/Year	Purpose of Study	Variables	Main Outcome
9. Climate change, tropospheric ozone and particulate matter, and health impacts. Global. (2008)	How the levels of particulate matter and ozone affect climate change and how these levels can impact morbidity and mortality.	<ul style="list-style-type: none"> -Tropospheric ozone -Climate change -Particulate matter 	Reducing greenhouse gases into the atmosphere will affect health. Additional research is needed to better understand the possible impacts of climate change on health.
10. Effect of insulating existing houses on health inequality: cluster randomized study in the community. New Zealand. (2007)	Determining whether installation in housing will increase indoor temperatures and the effect of this on health and wellbeing.	<ul style="list-style-type: none"> -Installation in housing -Housing temperatures -Health -Energy consumption 	Insulating existing houses resulted in improved health, and fewer hospital admissions due to respiratory conditions.
11. Housing and mental health: a review of the evidence and a methodological and conceptual critique. Global. (2003)	Reviewing current research on housing and mental health and providing a theoretical framework for future research.	<ul style="list-style-type: none"> -Floor level of dwelling -Housing type -Housing quality 	Housing and the impact of mental health were related, specifically in low-income families and high-rise, multiple family dwellings.
12. Health effects of housing improvement: systematic review of intervention studies. U.K. (2001)	Systematic review of housing intervention studies that measured quantitative health outcomes.	<ul style="list-style-type: none"> -Socioeconomic change -Health -Social measures 	Health gains are revealed after housing interventions. Large scale studies that investigate the wider social context of housing interventions are required.

References

- Alakaam, A., Lett, M., Puckett, H., & Kite, K. (2022). Associations among Eating Habits, Health Conditions, and Education Level in North Dakota Adults. *Health Behavior and Policy Review*, 9(1), 636-644.
- American Diabetes Association. (2022). Statistics About Diabetes. Retrieved May 23, 2022 from <https://www.diabetes.org/about-us/statistics/about-diabetes>
- American Heart Association. (2022). 2022 Heart Disease and Stroke Statistics Update Fact Sheet. Retrieved May 23, 2022 from <https://professional.heart.org/en/science-news/-/media/8D840F1AA88D423888ED3BA96DD61010.ashx>
- American Lung Association. (2020). Cockroaches. Retrieved June 7, 2022 from <https://www.lung.org/clean-air/at-home/indoor-air-pollutants/cockroaches>
- American Lung Association. (2022). What Causes Asthma? Retrieved May 20, 2022 from <https://www.lung.org/lung-health-diseases/lung-disease-lookup/asthma/asthma-symptoms-causes-risk-factors/what-causes-asthma>
- Braveman, P., Dekker, M., Egerter, S., Sadegh-Nobari, T., & Pollack, C. (2011). How Does Housing Affect Health? Robert Wood Foundation. Retrieved June 7, 2022 from <https://www.rwjf.org/en/library/research/2011/05/housing-and-health.html>
- Centers for Disease Control and Prevention. (2009). Healthy Housing Reference Manual. Retrieved June 7, 2022 from <https://www.cdc.gov/nceh/publications/books/housing/cha04.htm>
- Centers for Disease Control and Prevention. (2020). Hypertension Prevalence Among Adults Aged 18 and Over: United States, 2017-2018. Retrieved May 23, 2022 from <https://www.cdc.gov/nchs/products/databriefs/db364.htm>
- Centers for Disease Control and Prevention. (2021a). Coronary Artery Disease. Retrieved May 4, 2022 from https://www.cdc.gov/heartdisease/coronary_ad.htm
- Centers for Disease Control and Prevention. (2021b). High Blood Pressure Symptoms and Causes. Retrieved May 4, 2022 from <https://www.cdc.gov/bloodpressure/about.htm#problems>
- Centers for Disease Control and Prevention. (2021c). Health Topics- Asthma. Retrieved May 20, 2022 from <https://www.cdc.gov/policy/polaris/healthtopics/asthma/index.html>
- Centers for Disease Control and Prevention. (2022a). About Chronic Diseases. Retrieved April 25, 2022 from <https://www.cdc.gov/chronicdisease/about/index.htm>
- Centers for Disease Control and Prevention. (2022c). What is Diabetes? Retrieved May 4, 2022 from <https://www.cdc.gov/diabetes/basics/diabetes.html>
- Centers for Disease Control and Prevention. (2022d). Adult Obesity Facts. Retrieved May 23, 2022 from <https://www.cdc.gov/obesity/data/adult.html>

Centers for Disease Control and Prevention. (2022e). Defining Adult Overweight and Obesity. Retrieved May 4, 2022 from <https://www.cdc.gov/obesity/basics/adult-defining.html>

Centers for Disease Control and Prevention. (2022f). Most Recent National Asthma Data. Retrieved May 20, 2022 from https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm

Centers for Disease Control and Prevention. (2022g). National Center for Health Statistics. Retrieved May 20, 2022 from <https://www.cdc.gov/nchs/pressroom/states/tennessee/tn.htm>

Centers for Disease Control and Prevention. (2022h). PLACES: Local Data for Better Health. Retrieved May 20, 2022 from <https://www.cdc.gov/places/>

Chattanooga- Hamilton County Health Department. (2019). 2019 Hamilton County Community Health Profile. Retrieved June 27, 2022 from <https://health.hamiltontn.org/Portals/14/DataPublications/Docs/2019%20Report%20Final%202019-02-28.docx.pdf>

Chattanooga Regional Homeless Coalition. (2022). Metrics. Retrieved July 10, 2022 from <https://www.homelesscoalition.org/metrics/>

City-Data. (2022). Chattanooga, Tennessee. Retrieved July 10, 2022 from <https://www.city-data.com/city/Chattanooga-Tennessee.html>

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. A., & Singh, A. (2021). Households Food Security in the United States in 2020. <https://www.ers.usda.gov/webdocs/publications/102076/err-298.pdf?v=798>

Creamer, J. (2020). Inequalities persist despite decline in poverty for all major race and Hispanic origin groups. United States Census Bureau. Retrieved May 23, 2022 from <https://www.census.gov/library/stories/2020/09/poverty-rates-for-blacks-and-hispanics-reached-historic-lows-in-2019.html>

CrimeGrade.org. (2022). Hamilton County, TN Violent Crime Rates and Maps. Retrieved July 10, 2022 from <https://crimegrade.org/violent-crime-hamilton-county-tn/>

Cubit. (2022). Tennessee Counties by Population. Retrieved July 10, 2022 from https://www.tennessee-demographics.com/counties_by_population

Feeding America. (2022). Child Food Insecurity in Hamilton County. Retrieved June 27, 2022 from <https://map.feedingamerica.org/county/2017/child/tennessee/county/hamilton>

Gonzales, T., & Whalen, E. (2022). Easy breathing: A review of the impact of air quality on pediatric health outcomes. *Journal of Pediatric Health Care*, 36(1), 57-63.

Institute of Medicine. (1993). Committee on Monitoring Access to Personal Health Care Services. *Access to health care in America* (M. Millman, Ed.). National Academies Press.

Kaiser Family Foundation. (2022). State Health Facts. Retrieved July 10, 2022 from <https://www.kff.org/other/state-indicator/adults-who-report-having-asthma-by-race-ethnicity/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Lo>

- Kim, B., Branas, C. C., Rudolph, K. E., Morrison, C. N., Chaix, B., Troxel, W. M., & Duncan, D. T. (2022). Neighborhoods and sleep health among adults: A systematic review. *Sleep Health*, 701.
- Krueger, P. M., Tran, M. K., Hummer, R. A., & Chang, V. W. (2015). Mortality attributable to low levels of education in the United States. *PloS One*, 10(7), e0131809.
- Levy, B. L., Vachuska, K., Subramanian, S. V., & Sampson, R. J. (2022). Neighborhood socioeconomic inequality based on everyday mobility predicts COVID-19 infection in San Francisco, Seattle, and Wisconsin. *Science Advances*, 8(7), eabl3825.
- Massey, W. (2022). Homelessness increased by 177% in Hamilton County, 153% in the region since 2021, according to new data. *Chattanooga Times Free Press*.
<https://www.timesfreepress.com/news/local/story/2022/apr/22/homelessness-increased-177-hamiltcounty-153-r/567580/#/questions>
- Mayo Clinic. (2022). Asthma. Retrieved May 20, 2022 from
<https://www.mayoclinic.org/diseases-conditions/asthma/symptoms-causes/syc-20369653>
- Melton, C. (2017). The Housing and Health Connection. The Sycamore Institute. Retrieved May 2, 2022 from <https://www.sycamoreinstitute.org/housing-and-health/>
- Melvin, J. (2018). The split incentives energy efficiency problem: Evidence of underinvestment by landlords. *Energy Policy*, 115, 342-352.
- Pantell, M. S., Prather, A. A., Downing, J. M., Gordon, N. P., & Adler, N. E. (2019). Association of social and behavioral risk factors with earlier onset of adult hypertension and diabetes. *JAMA Network Open*, 2(5), e193933-e193933.
- Pearson, A. L., Clevenger, K. A., Horton, T. H., Gardiner, J. C., Asana, V., Dougherty, B. V., & Pfeiffer, K. A. (2021). Feelings of safety during daytime walking: associations with mental health, physical activity and cardiometabolic health in high vacancy, low-income neighborhoods in Detroit, Michigan. *International Journal of Health Geographics*, 20(1), 1-13.
- Robbins, R., Jean-Louis, G., Gallagher, R. A., Hale, L., Branas, C. C., Gooneratne, N., ... & Grandner, M. A. (2019). Examining social capital in relation to sleep duration, insomnia, and daytime sleepiness. *Sleep Medicine*, 60, 165-172.
- Statistical Atlas. (2018). Overview of Chattanooga, Tennessee. Retrieved July 10, 2022 from <https://statisticalatlas.com/place/Tennessee/Chattanooga/Overview>
- Taber, J. M., Leyva, B., & Persoskie, A. (2015). Why do people avoid medical care? A qualitative study using national data. *Journal of General Internal Medicine*, 30(3), 290-297.
- Tan, J. (2014). Social Infrastructure and Climate Change. Retrieved July 26, 2022 from https://www.researchgate.net/publication/275488140_SOCIAL_INFRASTRUCTURE_AND_CLIMATE_CHANGE_Promoting_a_lifestyle_of_altruism_and_resilience_through_social_connections_in_the_built_environment

- Tennessee Bureau of Investigation. (2020). Crime in Tennessee 2019. Retrieved July 10, 2022 from <https://www.tn.gov/content/dam/tn/tbi/documents/CrimeInTennessee2019.pdf>
- Thomson, H., Petticrew, M., & Morrison, D. (2001). Health effects of housing improvement: systematic review of intervention studies. *BMJ*, 323(7306), 187-190. <https://doi.org/10.1136/bmj.323.7306.187>
- TN Department of Environment and Conservation. (2022). Tennessee Geology. Retrieved July 10, 2022 from <https://www.tn.gov/environment/program-areas/tennessee-geological-survey.html>
- TN Department of Health. (2017). Heart Disease Still Tennessee's Top Cause of Death. Retrieved July 10, 2022 from <https://www.tn.gov/health/news/2017/2/8/heart-disease-still-tennessees-top-cause-of-death.html>
- U.S. Census Bureau. (2021). QuickFacts Hamilton County, Tennessee. Retrieved June 27, 2022 from <https://www.census.gov/quickfacts/fact/table/hamiltoncountytennessee#>
- U.S. Census Bureau. (2022a). National Poverty in America Awareness Month: January 2022. Retrieved May 24, 2022 from <https://www.census.gov/newsroom/stories/poverty-awareness-month.html>
- U.S. Census Bureau. (2020). Total Population in Tennessee. Retrieved June 27, 2022 from <https://data.census.gov/cedsci/all?q=tennessee>
- U.S. Census Bureau. (2022b). Hamilton County, Tennessee. Retrieved June 27, 2022 from <https://data.census.gov/cedsci/profile?g=0500000US47065>
- U.S. Department of Health and Human Services. (2022a). Social Determinants of Health. Retrieved April 25, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health>
- U.S. Department of Health and Human Services. (2022b). Employment. Retrieved April 26, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/employment>
- U.S. Department of Health and Human Services. (2022c). High School Graduation. Retrieved April 26, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/high-school-graduation#cit25>
- U.S. Department of Health and Human Services. (2022d). Health Care Access and Quality. Retrieved July 13, 2022 from <https://health.gov/healthypeople/objectives-and-data/browse-objectives/health-care-access-and-quality>
- U.S. Department of Health and Human Services. (2022e). Environmental Conditions. Retrieved May 2, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/environmental-conditions>
- U.S. Department of Health and Human Services. (2022f). Housing Instability. Retrieved May 2, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/housing-instability>

- U.S. Department of Health and Human Services. (2022g). Neighborhood and built Environment. Retrieved April 27, 2022 from <https://health.gov/healthypeople/objectives-and-data/browse-objectives/neighborhood-and-built-environment>
- U.S. Department of Health and Human Services. (2022h). Social Cohesion. Retrieved May 2, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/social-cohesion>
- U.S. Department of Health and Human Services. (2022i). Civic Participation. Retrieved May 4, 2022 from <https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/civic-participation>
- U.S. Environmental Protection Agency. (2021). Indoor Air Quality. Retrieved May 2, 2022 from <https://www.epa.gov/report-environment/indoor-air-quality>
- U.S. Environmental Protection Agency. (2022a). Basic Information about the Built Environment. Retrieved July 26, 2022 from <https://www.epa.gov/smm/basic-information-about-built-environment>
- U.S. Environmental Protection Agency. (2022b). Asthma Triggers: Gain Control. Retrieved July 26, 2022 from <https://www.epa.gov/asthma/asthma-triggers-gain-control#molds>
- U.S. Environmental Protection Agency. (2022c). Research on Healthy Effects from Air Pollution. Retrieved June 7, 2022 from <https://www.epa.gov/air-research/research-health-effects-air-pollution>
- United Health Foundation. (2022). America's Health Rankings. Retrieved July 10, 2022 from <https://www.americashealthrankings.org/explore/annual/measure/CVD/state/TN>
- USA Facts. (2022). Our Changing Population: Hamilton County, Tennessee. Retrieved July 10, 2022 from <https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/tennessee/county/hamilton-county>