



How Does Where You Live Impact Your Health?



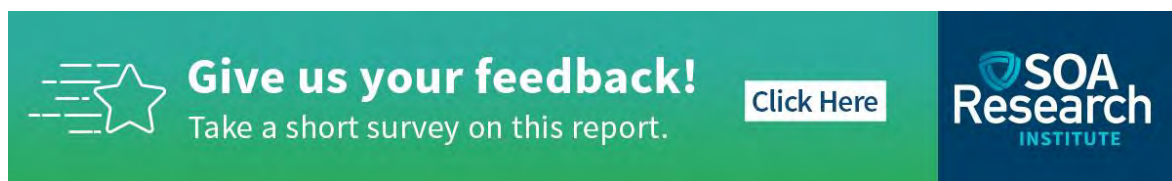


How Does Where You Live Impact Your Health?

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Abstract

How does where you live impact your health? The following research considers this question through the lens of social determinants of health (SDOH), which are factors relating to where you live or work that may impact your health. In the United States, geographical differences in SDOH contribute to wide disparities in health status and outcomes. In particular, individuals who are negatively affected by SDOH may have an increased burden of disease, leading to a relatively high total cost of care and worse quality of life. Given the increased awareness of the pivotal role of SDOH in general health status as well as total cost of care, more actuaries and their counterparts are interested in developing programs to address the SDOH of their members (for health plans) and patients (for providers). This research presents a roadmap for SDOH “solution” development, from data collection to analysis to integration with existing programs. Although SDOH data collection is still in early stages, there is much that can be done with the data that exist. Also, many potential SDOH “solutions” exist that may be implemented by payers and providers. These solutions range from simple initiatives, such as including information about local resources in member communications, to more substantive endeavors, such as setting up rural health clinics.

Executive Summary

Your health depends not only on your genetic make-up and lifestyle but also on where you live. Simple things that many of us take for granted, such as transportation to grocery stores¹ or doctors,² can have a direct and significant impact on your health if they are not available. Conditions that relate to where you live and work that may impact your health are known as social determinants of health (SDOH).³ SDOH contribute to wide disparities in health status and outcomes, and they exacerbate poor outcomes,⁴ especially in rural and low-income areas.

As income inequality has grown over the years and the link between income and good health becomes more apparent,⁵ payers (health plans, employers, Medicare, Medicaid etc.) and providers (hospitals, doctors, pharmacy benefit managers etc.) have begun to show increased interest in addressing SDOH, primarily through their foundations and community outreach programs. An organization may want to address SDOH through their business model for several reasons, including reductions to their total cost of care, market competitiveness, member/patient satisfaction and corporate social responsibility. In a recent employer survey, for example, 67% of the respondents indicated that SDOH are of growing importance to their health strategy.⁶ Similarly, the Centers for Medicare and Medicaid Services (CMS) recently issued guidance to states to drive adoptions to address SDOH in Medicaid.⁷

Given this increased interest in SDOH, the purpose of this report is to address two key questions:

- How does where you live impact your health?
- What can payers and providers do about it?

Countless ways can be identified to answer these questions, and each organization will do so in a way that fits into its business model. This report suggests a roadmap for payers, providers and others to follow as they analyze the landscape and develop solutions to local problems. Although the expectation is that most readers will be actuaries, the report is written for anyone using SDOH data or developing a program intended to address SDOH

The first section, the introduction, is the starting point for the journey. In any organization, the process usually works best as a team effort, with some members focused on the numbers and others focusing on the consumer. Following that principle, Sections 2 and 3 focus on the data and modeling needed to determine which geographic areas and SDOH deserve a closer look. In Section 4, the focus is on the consumer view, with an emphasis on what the consumer needs, what the consumer has now, and how to help the consumer meet their needs. These two viewpoints are tied together in Section 5, where hypothetical case studies describing how an organization may work to meet its objectives are provided.

SECTION 1. INTRODUCTION

The first step in the SDOH solutions development process is to understand how SDOH impacts health based on information available in the literature. SDOH include socioeconomic factors and environmental factors, among others, that can have direct or indirect impacts on health. Deleterious indirect impacts to health can arise when SDOH pose barriers to health care access. Barriers to health care associated with SDOH include affordability, discrimination and transportation, among others. One study has shown up to a 10% reduction in costs for patients who social needs have been met⁸ when compared to those that did not.

SECTION 2. DATA CURATION

The second step in the process was to gather data for use in the modeling and analytics. Since the goal was to compile a replicable dataset with a nationwide scope, the search was limited to publicly available data with a nationwide footprint. This required heavy reliance on federal data sources, although these data were supplemented with public data compiled by private entities. To capture a broad range of SDOH and health data, the data include descriptions for each of the following: health care outcomes, health care costs, health care access, health care quality, risk factors for chronic disease and select SDOH.

SECTION 3. QUANTITATIVE ANALYSIS

The third step in the process was to build and run an SDOH model. The model relied on the data compiled in Section 2, using cluster analysis to group all U.S. counties into one of 10 profiles or “personas” based on their SDOH and other health-related data. The output clusters were then ranked from best to worst based on their average outcomes for 13 health conditions. The regions with the worst health outcomes tended to be areas in the rural Southeast characterized by persistent poverty and low broadband access. The regions with the best outcomes tended to be urban areas on the West and East Coasts with low uninsured rates.

SECTION 4. STRATEGIC APPROACHES

Before an organization can develop a solution to address SDOH, it needs to understand the barriers to better health and the actions other organizations are taking to address the issue. The federal government has several programs in place to address key SDOH such as food insecurity and lack of provider access. These programs alone are not adequate since barriers to better care remain. They are frequently supplemented by nonprofit organizations, payers and providers. For example:

- Nonprofit organizations and managed Medicaid plans often deliver boxes of healthy foods to consumers who are likely to be food insecure.
- Payers, especially employers, may build or staff a clinic to meet the needs of a specific population.⁹

Even if an organization cannot accommodate efforts like these in their business model, they are in a unique position to guide consumers through their health care journey. Those efforts may be as simple as including information about local resources in their communications materials or as sophisticated as including change management and behavioral finance techniques as part of their day-to-day business. Change management techniques involve providing consumers with the knowledge and reinforcement they need to change behavior. Behavioral finance involves framing choices and providing incentives to help consumers make optimal decisions.

SECTION 5. CASE STUDIES

In this section, the principles described above are applied to a specific business situation using hypothetical case studies. In the first case study, a large hospital system has noticed a significant increase in uncompensated care attributed to its emergency department. A study of patient records shows that most of the patients do not have a primary care provider. The hospital system wants not only to not only reduce the level of uncompensated care but also to increase the rate of primary care. Although the problem is spread throughout the service area, it is determined that the problem is centered in two areas, an urban neighborhood and a county on the outskirts of its service area. After an extensive review of both areas, the hospital system decided to build a rural health center. For their entire system, they will consult with a change management expert to find a way to encourage people to seek primary care.

In the second case study, a health plan with a large, self-insured block of business wants to enhance the analytical and consulting services provided to their members. The health plan already has a considerable database it has developed over the years, which includes a proprietary database used to impute SDOH for each member. To expand its capabilities, the health plan is creating a geographic resources database, which will have the capacity to map local services to a member's place of residence. With this information, the health plan will be able to consult with its clients to determine how to supplement existing resources in the most effective way.

In the final case study, a Medicaid managed care organization (MCO) has determined that some areas with poor medical loss ratio performance may benefit from increased attention to SDOH. The MCO increases SDOH data capture efforts in partnership with their providers and expands efforts to partner with community-based organizations in targeted regions.

THE COMPANION REPORT

This report has been written as the first part of a two-part series. The companion report, which is being written by Sara Corrough Teppema, FSA, MAAA, FCA, and Rebecca Owen, FSA, MAAA, FCA, will provide a qualitative discussion of SDOH data and methods that will be a primer for actuaries and data analytics professionals. That report, to be published later, will go into more depth for selected topics as described in this report.

DISCLAIMER

This report is solely the work of the two authors, Joan C. Barrett, FSA, MAAA, and Stephanie D. Entzinger, FSA, MAAA. It does not reflect the opinion of our employer, Axene Health Partners, LLC; the Society of Actuaries; or members of the Project Oversight Group. The use of first-person pronouns, such as "we" and "our," refer to just Ms. Barrett and Ms. Entzinger.

Section 1: Introduction

Social determinants of health (SDOH) are typically very broadly defined, including most factors that affect health outcomes outside of pathogens and individual risk behaviors. This means SDOH can include environmental, socioeconomic, regulatory, cultural and other factors that influence health. Even pathogen exposure and individual risk activity can be impacted by SDOH; for example, working in a factory with unhygienic conditions could increase disease exposure, and tobacco use is strongly associated with socioeconomic status.¹⁰

The factors that make up SDOH can be associated with geography, albeit at different levels. Regulations that affect health, such as restrictions on indoor smoking, may be applicable at local, state or federal levels. Poor air quality can be regional but also wide-ranging (for example, smoke from West Coast wildfires compromising the air quality in New York City).

Given the geographic association of many SDOH, one of the primary goals of this paper is to use social determinants of health data in conjunction with more traditional health data to identify geographies where population health could be improved through a new intervention or program. In the following section of this report, Section 2, we discuss the data used in our analysis and the sources of the data. The discussion below provides support for the selection of the SDOH data used in our analysis, with a focus on the following:

- Section 1.1 discusses *socioeconomic factors*, including income level, education, occupation, poverty etc.
- Section 1.2 discusses *food insecurity*, defined as the inability to meet nutritional needs due to low economic resources as well as low food access.
- Section 1.3 discusses *barriers to health care*, including factors that hinder access to health care services, such as language barriers, affordability or lack of accessible providers.

Each of these factors is explored in more detail below. The subsection that follows, Section 1.4, discusses *the business case*. This section details why health care payers and providers might be interested in SDOH and the related geography. The final subsection, Section 1.5, discusses additional SDOH that are considered *out of scope* for purposes of this project.

1.1 SOCIOECONOMIC FACTORS

Low socioeconomic status is a major contributor to poor health.¹¹ Americans with few economic resources may be unable to afford medical care, such that they must choose between going into debt to receive care or avoiding needed care. And in some cases, this is a false choice. Taking on medical debt is itself associated with delaying or forgoing needed health care.¹² Those with difficulty paying medical bills reported skipping or postponing rehabilitative services, dental care, physician-recommended treatments and tests, and filling prescriptions more often than those who did not report difficulty paying medical bills.¹³

Although delaying or forgoing care may not ultimately result in an adverse health outcome, it certainly can have a deleterious impact. For example, a study of commercially insured women with breast cancer found that the cost of treatment more than doubled for those who received their diagnosis at a late stage compared to those with early-stage diagnoses, implying a higher level of acuity for women diagnosed at later stages.¹⁴ Delays in cancer treatment are associated with mortality increases as well.¹⁵ Perhaps unsurprisingly, people living in poverty are more likely to receive late-stage cancer diagnoses than the affluent.¹⁶ And people living in areas with persistent poverty—at least 20% of the population in poverty for the past three decades—have higher cancer mortality than others, including those in areas with current (but not persistent) high poverty.¹⁷

Poverty is not the only component of socioeconomic status that impacts health; related factors, such as education and occupation, are also associated with health status.^{18,19,20}

One note about terminology: Terms such as “low-income,” “Medicaid recipients” and “Temporary Assistance for Needy Families (TANF) populations” are sometimes used interchangeably in SDOH discussions. Although considerable overlap is seen in these populations, they are not identical. Due diligence is necessary to understand the subtleties in interpreting the results of a study to a specific population. In this report we discuss each of these populations on a stand-alone basis.

1.2 FOOD INSECURITY

Food insecurity occurs when a person or family does not have enough food to meet their nutritional needs. Food insecurity is associated with low socioeconomic status, which itself is associated with poor health outcomes (as discussed above). Having food insecurity in addition to low socioeconomic status, though, can exacerbate poor health outcomes.²¹ For example, among low-income adults (less than 300% of the federal poverty level), “severe” food insecurity was associated with higher prevalence of Type 2 diabetes than “mild” food insecurity.²²

Food insecurity is also associated with obesity, particularly among women.²³ Obesity is a risk factor for many chronic conditions, including diabetes, hypertension and heart disease.²⁴

Other health conditions associated with food insecurity include hypertension, coronary heart disease (CHD), hepatitis, stroke, cancer, asthma, diabetes, arthritis, chronic obstructive pulmonary disease (COPD) and kidney disease.²⁵ Although food insecurity was found to be significantly associated with each of these 10 conditions, income was found to be associated with only three of the 10 (hepatitis, arthritis and COPD).

1.3 BARRIERS TO HEALTH CARE

Many barriers may hinder a person from accessing needed health care. As discussed in more detail above, delayed or forgone care is associated with adverse health outcomes. A few of the potential barriers to health care that a person may encounter include the following:

- *Access*: A person may live in an area with too few primary care or other providers to meet the needs of the community.
- *Affordability*: A person’s anticipated cost of health care may exceed their ability to pay, whether or not they have health insurance coverage.²⁶
- *Child care*: A parent or caregiver may lack affordable child care, hindering their ability to seek care for themselves.
- *Cultural norms*: Needed care may be forgone due to cultural norms, particularly for women.²⁷
- *Discrimination*: A person may avoid health care system because of actual or perceived discrimination based on their gender, race, ethnicity, nationality, ability to pay or insurance coverage (e.g., enrollment in Medicaid).²⁸
- *Health care literacy*: A person may have difficulty navigating the health care system.
- *Language*: For those whose first language is not English, difficulty may arise in finding a provider with whom they can effectively communicate their health issues.
- *Opportunity cost*: Providers outside of urgent and emergency care settings often operate during working hours, such that a prospective patient must take paid or unpaid time off from work to seek care.
- *Transportation*: A person may face long travel times to reach providers, or transportation options are unaffordable.

- *Wait time*: Delays in receiving treatment may be more likely depending on the service needed, the urgency of the service or the patient’s insurance coverage.

One factor associated with many of the above barriers to care (including provider access, affordability, cultural norms, discrimination and transportation) is the rurality of a person’s community.²⁹ Rural areas may lack sufficient providers across the health care spectrum, from primary care physicians to acute care hospital facilities. A lack of accessible providers is associated with adverse health outcomes, including increased preterm delivery, preventable hospitalizations and mortality.^{30,31}

A relatively new social determinant of health that can also pose a barrier to health care access is broadband internet access. Lack of access to broadband (high-speed internet connectivity) hinders access to telehealth services and can exacerbate other social determinants of health, such that broadband access has been called a “super-determinant of health.”³²

1.4 THE BUSINESS CASE

Why should a payer or provider spend resources on initiatives that address the upstream determinants of health as described above rather than focus on the chronic and acute conditions that have traditionally been their purview? Potential reasons include the following:

- *Total cost of care (TCOC)*: Programs that address SDOH may prove more cost-effective in the long run than “treating the symptoms” of SDOH. Payers are already attuned to TCOC, and providers are becoming increasingly aware of TCOC as they take on more risk. One study has shown up to a 10% reduction in costs for patients whose social needs have been met when compared to those that did not.³³
- *Competition*: Payers and providers who ignore SDOH may lose market share to competitors who offer SDOH solutions. For example, if a payer is the only Medicare Advantage plan that does not offer a transportation benefit in a particular rural area, then the organization may lose membership.
- *Member/patient satisfaction*: Some patients appreciate a “whole person” approach to treatment. For payers and providers to treat members and patients holistically, they must incorporate physical, behavioral and social determinants of health into benefit offerings and treatment plans.
- *Corporate social responsibility*: Payers and providers may simply want to give back to their community because they see it as the right thing to do, or it fits within their social responsibility initiative.

The business case for addressing SDOH will likely vary by entity, depending on the unique challenges and opportunities faced by each organization. Some examples of these are provided in the case studies in Section 5.

1.5 OUT-OF-SCOPE SDOH

Many SDOH are not included in this report, including environmental factors and regulatory environment. The discussion focuses on factors for which comprehensive public data are readily available (apart from barriers to care, for which only a subset of factors has at least one associated public dataset). Other SDOH data sources, covering some of the factors not discussed here, are discussed in the following section of this report (Section 2).

Below we have provided a sample of topics that we believe deserve a more in-depth exploration, along with a few resources that may be of use to readers:

- *The COVID-19 pandemic*: The COVID-19 pandemic has exacerbated disparities in health outcomes for persons who have been historically marginalized.³⁴ The CDC and Kaiser Family Foundation have examined some of these disparities, as peer-reviewed studies have as well.³⁵
- *Nonmedical opioid use*: The opioid pandemic disproportionately affects the uninsured and is estimated to have added billions in costs to the U.S. health care system.³⁶
- *Race/ethnicity*: Substantial health disparities exist across race and ethnicity in the U.S. Although peer-reviewed articles examining these disparities can be found in many publications, the *Journal of Racial and Ethnic Health Disparities*³⁷ focuses on this topic specifically.
- *Provider practice patterns*: Primary care providers tend to practice in regions close to their site of training.³⁸ This may contribute to differences in practice patterns by region, which may contribute to regional differences in health outcomes.
- *Regulatory environment*: Federal, state and local laws and regulations may contribute to health care outcomes. Laws that are broader in scope and percent of population impacted are likely to be more thoroughly studied; for example, there is a wealth of information regarding the impact of the passage of the Affordable Care Act on health insurance access and coverage.
- *Environmental factors*: Some populations are disproportionately exposed to environmental hazards, including poor air quality, contaminated water, unsafe living conditions and noise pollution. Available studies of environmental SDOH typically focus on one environmental element at a time and can often be found in public health journals.

Data sources and descriptions of the variables that were considered in-scope for this report are discussed in the following section of this report.

Section 2: Data Curation

How does where you live impact your health? To address this question, data are required.

In the previous section, we explored the link between SDOH and health status to provide context and support for the quantitative and qualitative SDOH analyses discussed in this report. In this section, we discuss guidelines for curating data, details of specific data sources we found to be applicable, and potential data limitations. Our intent in this section is both to provide the data curation roadmap that we developed for purposes of this study and to provide guidance for the analyst who has a different research objective and must develop an alternate roadmap.

The next three parts of this section relate to our specific research objective, although some of the findings are more broadly applicable:

- Section 2.1 provides our data curation guidelines.
- Section 2.2 includes a discussion of our data sources.
- Section 2.3 describes the variables included in our database.

Finally, Section 2.4 considers data sources that fell outside of our scope but may be useful to another analyst interested in utilizing SDOH data. Although our focus in this section is on publicly available data, we understand most analysts will have access to some additional data sources. As such, we have provided a review of additional potential data sources in that subsection.

We focus here on publicly available data because one of our goals is to generate results that can easily be reproduced, updated and expanded upon over time. We additionally wanted to focus on publicly available data accessible to all analysts.

Our process for data curation is specific to our analysis (see Section 3) but has elements that can be replicated for other analyses. The more generalized processes of selecting, reviewing and compiling data sources for SDOH analyses will be outlined in the companion paper.

In this section, as well as those that follow, we complied with the appropriate actuarial standards of practice (ASOPs) in that we have disclosed any limitations in our data or analysis that may be material. Materiality is defined in the ASOPs as a statement or omission that could impact a decision made by an intended user. In this section and the attached Appendix B, we have identified the primary limitations of the data for the purposes of our study. The ethical use of data will be discussed in more detail in the companion paper.

2.1 DATABASE SPECIFICATIONS

We are endeavoring in this section to compile a broad spectrum of useful, appropriate and publicly available data to answer the question “How does where you live impact your health?” Given this broad mission, one of our first steps was to develop a series of database specifications. These specifications were used as research guidelines. These guidelines narrowed our focus and, importantly, gave meaning to the term “useful, appropriate and publicly available data.”

We considered the following when developing our database specifications:

- Relevance to the research objective
- Study period
- Geography
- Compliance

Each of these specifications is reviewed in more detail below.

RELEVANCE TO THE RESEARCH OBJECTIVE

Our primary interest is how where one lives impacts one's health. As such, our scope was limited to data fields that have been demonstrated to have an impact on health.

We developed the following series of data domains that related to our primary objective:

- Health care outcomes
- Health care costs
- Health care access
- Health care quality
- Risk factors for chronic disease
- Social determinants of health (SDOH)

We accounted for relevance by limiting data selection to variables that fit one of the above domains. Additionally, we maintained a diversity of fields by selecting a few variables for each domain.

The domains and their final variables are discussed in greater depth in Section 2.3.

STUDY PERIOD

Our study period is calendar year 2019. We selected this period to avoid conflating results with the impact of the COVID-19 pandemic and because that was the most recent period available for many of the sources we reviewed.

A few caveats are associated with this study period:

- Some of our sources did not have data available through 2019. These limitations are detailed in Appendix A. We considered the usefulness of these data (particularly the urban/rural classifications) to outweigh the fact that they were not current.
- Some of our data apply to the entire calendar year, such as Medicare claims data, whereas some data are applicable to a specific date range within the year (e.g., some survey data).

Other limitations associated with the study period are discussed in Section 2.2.

GEOGRAPHIC SPECIFICATIONS

Our analysis is restricted to the 50 states and the District of Columbia. The U.S. has more than 89,000 state and local governments,³⁹ so one challenge in developing this report was to determine a focused way to reflect the diversity in the health care system by geographic region.

In this report, the analysis and data collection efforts have been performed at the county level since data are widely available at this level and counties tend to be well-defined geographically from year to year. A total of 3,142 counties or county equivalents are found nationwide. A county equivalent is comparable to a county but may go by another name, such as a parish in Louisiana or a borough in Alaska. In some cases, a

city that is governmentally independent of county organization, such as Carson City, Nevada, is treated as a county. In most states, the county is also a political division, but that is not always the case. In Connecticut, Rhode Island and Massachusetts, geographic counties are listed although they are not governmental entities.

We relied on the Federal Information Processing Standard (FIPS) code, which is unique to each county, to match counties between datasets as a unique identifier.

We did consider basing our analysis on metropolitan statistical areas (MSAs) instead of counties since health care resources are often organized by MSA. The primary reason we did not use them is that some MSAs, such as Cincinnati, cross state borders. Key decisions (such as Affordable Care Act [ACA] premium rates and Medicaid eligibility and benefit rules) are made at the state level. We found it important to perform our analysis at the county level, since each county is associated with only one state.

For some data sources, data are available at a more granular level than by county. This is important to note because as units of study, counties can vary widely. For example, the 2019 population estimate for Kalawao, Hawaii, was 86 residents. During the same period, more than 10 million people resided in Los Angeles, California. Analysts requiring a smaller geographic unit may find data available at the three- or five-digit ZIP code level, at the census tract level, or another geographic basis. As discussed above for MSAs, ZIP codes may cross state borders, which is important to be mindful of if the analysis is dependent on laws or other factors that vary at the state level. When working with data at the census tract level, the user may need to incorporate crosswalks to other geographies. These mappings may not be one-to-one depending on the fields used.⁴⁰

COMPLIANCE

Compliance, which is sometimes referred to as data use, has a two-pronged meaning: the first is compliance with applicable ASOPs, and the second is legal compliance. Legal compliance includes compliance with specific laws, such as HIPAA (the Health Insurance Portability and Accountability Act of 1996), as well as compliance with copyright law, including the terms of use associated with each data source. Depending on the publishing entity, the terms of use may include, among other things, a requirement to cite the data source, an agreement to hold the publishing entity harmless for the data, an agreement not to reproduce and sell the data. It is often advisable to have the organization's legal team review the process.

2.2 DATA REVIEW

The specifications detailed above informed our data review. In accordance with the ASOPs, we conducted a review of the quality control process for each organization providing data and the underlying analytical methods of each of the data sources. We were generally satisfied that the quality control processes were in place and the analytical methods were acceptable, with the exceptions noted.

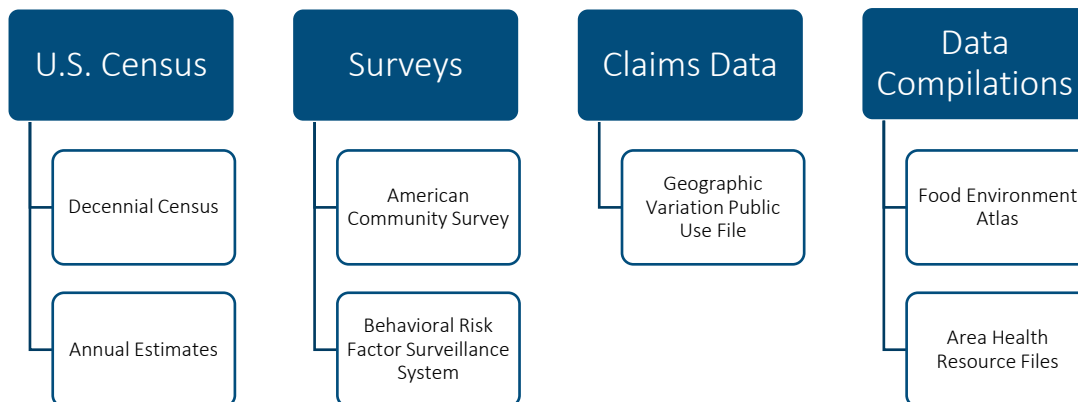
Below we provide the results of the review, including a description of the sources we used for our database and potential limitations of these and other public data.

FEDERAL DATA SOURCES

Most of the data we obtained were sourced from various departments of the federal government. Data collection, processing and dissemination at this level are handled by multiple federal statistical agencies. These functions are governed by a specific set of principles and practices that are intended to ensure credibility and promote trust among stakeholders, among other goals.⁴¹

We relied upon the census, survey results, claims data and data compilations sourced from multiple departments. A summary of the nature of our sources is provided in Figure 2.1.

Figure 2.1
FEDERAL DATA SOURCES



Below we provide a description of federal sources included in the database. More details are provided in Appendix A.

THE CENSUS

The U.S. Census Bureau conducts the decennial census once every 10 years as required by the Constitution. The Constitution states that the purpose of the decennial census is to apportion seats in the House of Representatives, but over time the census has become a premier source of information about the U.S. population.

As the term “census” implies, the intent is to count every person living in the U.S. Each person can participate by answering a short questionnaire by mail, online or over the phone. Although the intent is to include everyone, there is a potential for undercounting, especially for some populations.

The Census Bureau also provides an annual update of the population count using a roll-forward method, which accounts for births, deaths and migration. This method is complicated and may result in some overstatements or understatements, especially in smaller areas.

SURVEYS

To supplement the limited data available through the census, we used surveys and surveillance systems, such as the following:

- The *American Community Survey (ACS)* provides detailed population and housing data based on surveys of about 3 million households annually. It is administered by the U.S. Census Bureau and covers a wide variety of social, housing-related, economic and demographic topics. Once every five years, the Census Bureau releases a five-year estimate that includes data for all 3,142 counties, including the 2,136 counties with populations too small to produce annual estimates. The latest five-year release was for the 2015–2019 timeframe.⁴²
- The *Behavioral Risk Factor Surveillance System (BRFSS)* is a system of health-related surveys regarding risk behaviors, chronic health conditions and use of preventive services. The BRFSS surveys about 400,000 adults (age 18 or greater) each year on an ongoing basis. Like the ACS, the

BRFSS is continuously administered, as opposed to a moment-in-time survey like the decennial census.

Unlike the decennial census, surveys are based on a random sample of the population. The survey may be “oversampled” for specific subgroups to provide a statistically valid conclusion about that population. For other populations, especially smaller areas, little or no data may be collected in any given year, so the values must be imputed.

CLAIMS AND ELIGIBILITY DATA

In addition to survey data, we relied upon federal claims and eligibility data. Claims data for the uninsured, commercially insured and even Medicaid populations are not generally publicly available, with exceptions discussed in Section 2.4. By comparison, data for traditional Medicare beneficiaries are abundantly available, although some data are suppressed for privacy purposes. In this report, we relied on CMS’s Medicare Geographic Variation Public Use Files, which include Medicare beneficiary, cost and utilization data by county. The cost data can be analyzed on a raw or risk-adjusted basis, and CMS additionally provides costs standardized to a national fee schedule (as well as other modifications).⁴³ Concerns with using these data include treatment of missing or suppressed data, as noted above, as well as applicability to the study population. Also, these data do not include any data relating to Medicare Advantage beneficiaries, so the data may not represent the Medicare population as a whole.

DATA COMPILATIONS

We also relied on data compiled by the U.S. Department of Agriculture’s (USDA) Economic Research Service (ERS). These datasets included a wealth of information compiled from other government departments, covering poverty, economic statistics, education and other factors. We cross-checked control totals against tables from the originating department and found no alarming discrepancies, and so we concluded that the ERS compilations may be an acceptable “one-stop shop” for government data. That said, data users must be careful to understand the definition of each variable they are using, particularly when performing reasonability checks against other sources. For example, according to a Society of Actuaries research report, the definition of “uninsured” varies considerably depending on the survey instrument used.⁴⁴

We used two other federally supplied data compilations in our analysis:

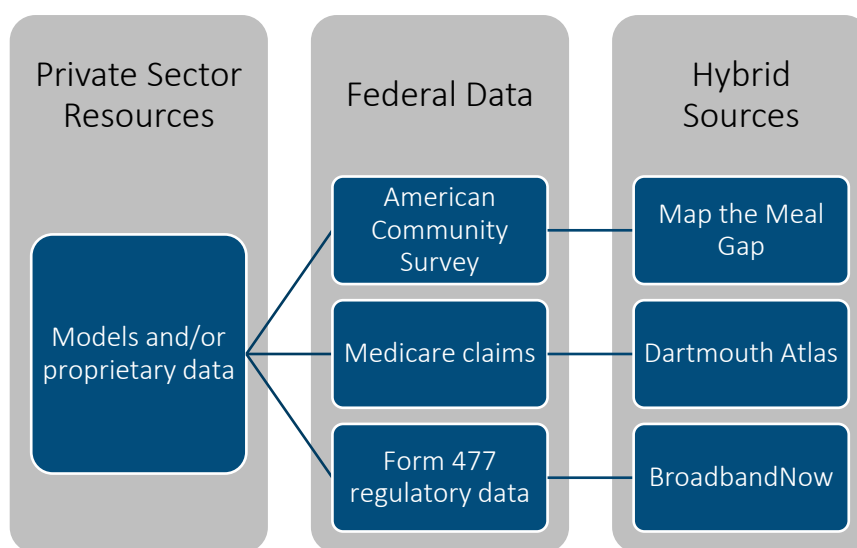
- The *Food Environment Atlas*, which is also available through the USDA’s ERS. The Food Environment Atlas is updated every few years and contains data on food access, grocery store prevalence, health risk factors, and other things. One issue with the data in the Atlas is that the primary data source often has more up-to-date information. For example, the most recent population estimate provided in the latest Atlas release (2020) is for calendar year 2018. An additional limitation is that documentation appears to be available for the 2017 Atlas release but not the 2020 Atlas release. The best use of these data might be to get a quick view of many potential variables, decide which best suit the analysis, and then pull the data from the primary source, whenever possible.
- The *Area Health Resource Files (AHRF)* are available through the Health Resources and Services Administration. The files are quite large, containing more than 6,000 health care–related variables sourced from dozens of public and private entities. Limitations of these data include geography (the most granular level available is county), age (some fields are at least a few years outdated) and validity. Some fields we checked did not pass a reasonableness test, and so they could not be used in our analysis. We recommend checking the desired fields against a secondary source as a reasonableness test before using them.

PUBLIC/PRIVATE HYBRID DATA SOURCES

We prioritized federal data as our default source. This was a natural choice as our data specifications included publicly available, nationwide data. In some instances, however, data from private entities either offered variables that did not appear to be available through federal data or offered data that appeared to be more robust or applicable to our needs than the federal equivalent.

In this report we relied on three such data sources available through private entities: *The Dartmouth Atlas of Health Care* from The Dartmouth Institute for Health Policy and Clinical Practice, the *Map the Meal Gap* dataset from Feeding America, and the *Open Data Challenge* data from BroadbandNow. These datasets all still rely on federal data, though, as shown in Figure 2.2.

Figure 2.2
DEVELOPMENT OF HYBRID DATA



Below we provide a description of public-private hybrid sources included in the database. More details are provided in Appendix A.

The Dartmouth Atlas of Health Care provides a broad array of Medicare data, including expenditures, mortality, hospital discharge rates and quality metrics such as hospital readmission rates. It also integrates other sources, such as data from the American Hospital Association. We preferred some of these data to CMS’s data because adjustments were made to standardize differences in age, sex and race. However, some of the quality measures, such as hospital readmission rates for patients with a congestive heart failure diagnosis, have a prohibitively high rate of missing or suppressed data. Such variables may be useful for some regions but cannot be used in a nationwide analysis. Additionally, the data lag CMS releases by at least a year. Most of the work done by the Dartmouth Atlas of Health Care goes through a rigorous peer review process, so we were satisfied that the quality control processes were in place.

Another advantage to using these data are that resource data are allocated to the residence of the patients using the resource, not to the physical location of the resource. This better reflects the availability or resources for rural areas, which may have a few physicians and no hospitals located in that area.

Feeding America supplies annual data regarding food insecurity at the state, county and congressional district level. As noted above, we did pull food access data from the USDA. However, food insecurity is defined differently than food access. Food access in the USDA dataset was defined as a function of distance

from household to grocery store (with a few additional caveats). Food insecurity includes more dimensions than distance (e.g., the ability to afford enough food for a family). We included these data because they offered a different perspective than the USDA data. Data integrity from this organization is overseen by a Technical Advisory Group.

One note about this dataset is that a downloadable file is not readily available; a data request must be submitted first.

BroadbandNow provides information on broadband access and pricing by ZIP code as well as at the county level. These data are derived from a combination of census data, regulatory data from the Federal Communications Commission (FCC) and proprietary data. The proprietary data include direct submissions from internet service providers. The FCC's broadband access data are available on a semiannual basis and can be used directly instead of the BroadbandNow data. A caveat, however, is that older versions of the FCC data may overstate the level of access in a region.⁴⁵ For this reason, we elected to use the BroadbandNow data rather than the FCC data.

DATA LIMITATIONS

We discovered a few limitations and potential pitfalls during our review. We have included limitations associated with specific data sources in Appendix A. Here we will discuss a few more general concerns that analysts should be familiar with:

- *Aggregate data:* We are using aggregate data for our analysis. We do not consider that to be a major limitation for our purposes since our focus is on identifying resources to meet the needs of a community, the payers and other stakeholders. On the other hand, we know that in some counties, especially large, diverse counties, there may be neighborhoods with specific needs that will not be identified by analyzing data at the county level. We address that concern in Section 5.
- *Data collection timing:* Some data, such as the census, are applicable to a very specific moment in time, whereas other data reflect a period of multiple years. For example, the ACS is typically shown as a multiyear average due to the data collection methodology. This may skew the results in counties undergoing a major population shift during this timeframe.
- *Data collection methodology:* Different concerns apply depending on how the data were collected or generated:
 - For surveys, the analyst must determine whether the surveyed population is of a credible size and is representative of the study population. Numerous other potential pitfalls are found with surveys, such as recall bias, poor question design leading to framing effects, and the impact of population weighting methods on the results.
 - For data generated through models, the analyst must consider the appropriateness of the input data and the modeling methodology. For example, some counties are quite small and may not have credible input data. How were such counties treated in the model?
 - For claims data, the analyst must consider the applicability of the population to the research question at hand. For example, Medicare claims data are unlikely to reflect costs and utilization in a commercial population.
- *Changes in methodologies between years:* If the analyst is using time series data, he or she must review the source documentation for each year for which data are pulled. For example, models may have parameters updated or added or removed, potentially to the extent that the same variable from the same source for year N is not comparable to year N + 1.
- *File size:* Some sources, particularly compilations of multiple data sources, have very large file sizes. The analyst may need to exercise additional caution when uploading and working with such

data. An additional note is that, particularly for large files, the file type may not be in the analyst’s preferred format.

- *Migration:* Most data available are linked to place of residence. However, people can move between counties and states as well as internationally. To the extent that a survey respondent was raised in one county but resided in another at the time the data was collected, the individual characteristics might not have been shaped by that county to the same extent as another individual who spent their whole life in the same neighborhood. This issue will likely affect urban areas more than rural areas. One way in which an analyst may account for this issue is to ensure any study results are ascribed generally to populations and not ascribed specifically to individuals.

As noted earlier, the process we used to review the data applicable to our research may serve as a roadmap for other analysts. Of course, it is incumbent upon the analysts to determine which techniques are appropriate for the question at hand and if any additional tests should be performed.

2.3 DATABASE COMPOSITION

As discussed above, we organized our variables by six domains: health care outcomes, health care costs, health care access, health care quality, risk factors for chronic disease and SDOH. Some of the variables included in each domain are demonstrated in Figure 2.3, with the complete list provided in Appendix B.

Figure 2.3

SELECT VARIABLES BY DOMAIN

Health Care Outcomes	Health Care Costs	Health Care Access	Health Care Quality	Risk Factors for Chronic Disease	Social Determinants of Health
<ul style="list-style-type: none"> • Cancer • Diabetes • High blood pressure 	<ul style="list-style-type: none"> • FFS Medicare medical costs 	<ul style="list-style-type: none"> • Uninsured rate • PCP shortage area • Mental health provider shortage area 	<ul style="list-style-type: none"> • PCP visits for adults • FFS Medicare hospital readmissions 	<ul style="list-style-type: none"> • Obesity • Binge drinking • Smoking 	<ul style="list-style-type: none"> • Poverty • Rural/urban status • Food access

Below we provide additional detail about the domains and why they were selected.

HEALTH CARE OUTCOMES

The term “health care outcomes” is defined here to mean chronic and acute health conditions. These are the conditions that may come first to mind when one considers “health”: cancer prevalence, diabetes prevalence and heart disease, for example. We also included two self-assessed measures of health: poor physical health or poor mental health experienced over an extended timeframe.

HEALTH CARE COSTS

Health care costs may be defined in terms of billed, allowed or paid costs and may include pharmacy, dental, vision or other costs in addition to the cost of medical services. These data may exist at the claim line level or aggregated by service category or another dimension. The only free, publicly available claims data we were able to obtain was fee-for-service (FFS) Medicare medical claims data (including Parts A and B) from CMS. This is the only variable we have that represents the cost domain. Other potential sources of health care cost data are described in Section 2.4.

HEALTH CARE ACCESS

The health care access domain reflects access to health insurance as well as access to health care providers. We have included four fields that capture both dimensions, including the uninsured rate as well as three variables describing provider shortages. Our provider shortage data covers dental, primary care practitioners (PCP) and mental health providers, but not health care facilities. The shortage data are based in part on provider-to-population ratios and are not specific to any one population within a county.

HEALTH CARE QUALITY

Health care quality can be defined in terms of patient satisfaction, timeliness, equity and other factors. Although many of these are important in the larger sense, we focused on evidence-based medicine (EBM) measures such as readmissions and preventive care compliance. We were able to find a total of 10 such measures. Some of these just applied to FFS Medicare beneficiaries, and others applied to adults (age 18 and older) more broadly.

RISK FACTORS FOR CHRONIC DISEASE

Risk factors generally refer to behaviors that are associated with increased risk of chronic disease or increased health care costs. The risk factors included in our database have all been found to add billions of dollars to U.S. health care costs. The risk factors included are obesity,⁴⁶ smoking (not including individuals who have quit)⁴⁷ and binge drinking.⁴⁸

SOCIAL DETERMINANTS OF HEALTH

This domain captures almost half of our variables, 10 of 24. These are variables that describe “where you live”: urban/rural status, poverty level, food insecurity, unemployment rate etc. The impact that these factors, particularly poverty, have had on health has been demonstrated in research spanning decades.⁴⁹ We focused heavily on these variables because they affect so many different facets of a population, such as economics, demographics and access to resources. Our intent with data collection in this domain was to be as comprehensive as possible in describing “where you live.”

2.4 ALTERNATIVE DATA SOURCES

The data used in this report are limited to what is described above and in Appendices A and B. Many other types and sources of SDOH data might facilitate an analysis, depending on the analyst’s purpose and the resources available. Generally speaking, no one source provides all the information a researcher needs.

PAYER DATA

Several sources of information provide detailed eligibility and claims data on an individual level, including the following:

- *Health plan data:* Health plan employees have access to considerable information available at the individual level, including eligibility, claims, risk scores, EBM compliance and provider location data (which can be used for network adequacy calculations). Health plans generally have data for Commercial, Medicare Advantage and Managed Medicaid lines of business. This information is restricted to employees only.
- *Data aggregators:* Several organizations, such as the Health Care Cost Institute (HCCI)⁵⁰ and Truven,⁵¹ aggregate data from several health plans. In both cases, the data include eligibility and

- claims data. Both organizations charge a fee for access to the data, and HCCI limits access to researchers.
- *All-payer claims databases (APCDs)*: Several states offer claims and eligibility data submitted from payers voluntarily or (as in most cases) by mandate. APCDs may include medical, pharmacy or ancillary (e.g., dental or vision) claims and may be sourced from commercial payers, Medicaid Managed Care Organizations and Medicare Advantage plans. Self-funded plans can opt out of an all-payer database under the ERISA exemption.⁵² The data are typically available for a fee, which may vary depending on the scale of the data request. Some APCDs are limited to nonprofit researchers only. The State All Payer Claims Databases Advisory Committee was established in 2021 to advise the Secretary of Labor on standardized reporting formats and guidance on data collection methods.
 - *Medicare limited data set*: The Centers for Medicare and Medicaid Services (CMS) provide detailed beneficiary and claims data for 5% and 100% of the Medicare Fee-for-Service population on an annual basis. There is a cost for the data. In addition, under the Qualified Entity Program, CMS designated organizations to receive data for use in evaluating provider performance.⁵³ In addition, the CMS Virtual Research Data Center provides researchers to direct access to approved data files within the CMS secure environment.⁵⁴

Although payer databases provide valuable information, three primary limitations can be identified:

- *Electronic health records*: Electronic health records contain valuable information about a patient, such as lab results and which medications were prescribed. This information may or may not be passed on to the payer.
- *Demographic indicators*: Payer data almost always include the age and gender of every member, but other important demographic information such as ethnicity, income and education are not routinely collected. Some payers have access to a commercial database with this information for a fee. In most cases, the values are imputed using information such as ZIP code and surname. This information may or may not be accurate, so a review of the methodology and a validation from another source is recommended.
- *Z-codes*: Historically, claims data have included CPT-4 codes, which describes the procedure performed, and ICD-9 codes, which describe the diagnosis associated with an encounter. The latest release of diagnostic codes, ICD-10, includes the concept of Z-codes. Z-codes are used to document a patient's SDOH such as housing, food insecurity and transportation. Although CMS is actively developing techniques for ensure completeness and consistency, the process is a work in progress. As a result, very few records include associated Z-codes. In fact, in 2019 only 1.59% of all Medicare beneficiaries had claims with Z-codes, as compared to 1.31% in 2016.⁵⁵

PROVIDER ORGANIZATION DATA

Provider organizations often conduct surveys of their members, which can be quite detailed. For example, the American Hospital Association conducts a detailed survey of its members each year. The details are available for a fee.

OTHER SOURCES

SDOH indices typically endeavor to capture multiple facets of a geographic region within one number. Many data sources are combined into an algorithm that produces a final score or ranking. Examples include the University of Wisconsin–Madison's Area Deprivation Index,⁵⁶ the CDC/Agency for Toxic Substances and Disease Registry's Social Vulnerability Index,⁵⁷ the Unite Us Community Needs Map Composite Index,⁵⁸ the

County Health Rankings from the University of Wisconsin Population Health Institute,⁵⁹ Kaiser Family Foundation's State Health Facts,⁶⁰ and the America's Health Rankings 2021 Report.⁶¹

These additional sources may be invaluable in completing a SDOH-influenced analysis. Our emphasis here on publicly available data is simply to bring focus to datasets that are equally available to all actuaries and other researchers.

For similar reasons, we limited our search to datasets available on a national basis. Other sources of excellent public data may be applicable to certain regions only. This was certainly true of many COVID-19-related data published by local public health departments. For example, Los Angeles County continues to publish rates of COVID-19 cases, hospitalizations deaths and vaccinations by race/ethnicity,⁶² but this level of data is not accessible in many other regions.

Secondary sources of SDOH information, which aggregate data from multiple sources, will be covered in more detail in the companion paper.

In the following section, we will apply the data compiled in this section to a SDOH model and examine the results.

Section 3: Quantitative Analysis

This section details the methods and results of our quantitative analysis. Our intent in this section is to group all U.S. counties into clusters, or personas, using the data described in Section 2. We believe this approach facilitates identification of high-need counties as well as the development of an understanding of their characteristics. Identifying high-need counties allows us to focus on areas with the largest opportunity for improvement. Understanding the unifying characteristics of the high-need counties allows us to choose interventions that will have the broadest impact. The clusters, then, provide a guide to the “who,” “where” and “why” of SDOH-related interventions.

We believe that by grouping counties with poor health outcomes, we can begin to develop solutions that are broadly applicable to the needs of similarly situated counties that can then be further tailored as needed. In other words, we can develop a small set of general programs, each specific to a given cluster, and then refine those programs as needed given the specific needs of a given community.

In using machine learning to identify and group counties by their SDOH and other health care-related statistics, we can find connections that might otherwise not have been apparent. For example, below we will discuss how our highest-needs cluster comprises Western tribal reservations as well as rural Southeastern communities. These connections can allow organizations with limited resources to narrow their focus to areas with the largest opportunity for impact. Additionally, developing an intervention for multiple counties at one time optimizes the balance between developing a one-size-fits-all health care intervention and an unwieldy encyclopedia of hyper-targeted interventions.

Our focus in this section, then, will be the clustering methodology and exploring the characteristics of the resulting clusters. Specifically:

- Section 3.1 describes the clustering methodology.
- Section 3.2 discusses the clustering results, including more granular detail on the attributes of a few specific clusters.

Our findings in this section will be leveraged in Section 5 using a case study methodology. The case studies in Section 5 will focus specifically on stakeholders with an interest in the regions described in Section 3.2.

3.1 METHODS

We grouped our data into 10 clusters using a k-means analysis performed in SAS. Ten clusters were chosen based on an elbow plot.⁶³ We input 24 variables across five domains, including the following:

- *Health care access (4)*: Uninsured adult rate, PCP shortage, dental care provider shortage, and mental health care provider shortage
- *Health care cost (1)*: Medicare fee-for-service per-member-per-month (FFS PMPM)
- *Health care quality (6)*: Core preventive services for seniors (separate for male and female), routine checkups for adults, mammograms, dental services, and blood pressure medication adherence
- *Risk factors (3)*: Binge drinking, smoking and obesity
- *Social determinants of health (10)*: food insecurity, low food access and no vehicle, broadband access, unemployment rate, non-English-speaking, rural-urban continuum code (a numeric indicator of the level of rurality of a county), highest level of education, poverty rate, persistent poverty, and economic typology (a numeric indicator of the dominant type of industry in a county)

The 24 variables chosen are a subset of those discussed in Section 2 and presented in Appendix B. The other variables were considered for use in our analysis but ultimately excluded because they had a high volume of missing data (Dartmouth Atlas data, for example) or were duplicative of other variables (overall poverty rate versus child poverty rate, for example).

We tested the algorithm on every integer between 3 and 30 for the maximum number of clusters. We ultimately selected 10 clusters based on a combination of criteria, including the pseudo-F statistic and SAS's cubic clustering criterion.⁶⁴

We ultimately excluded some of the variables considered in Section 2 from the clustering algorithm. Reasons for excluding variables included the following:

- Duplicative variables (e.g., uninsured rate for age less than 65 versus uninsured rate for age 18–65)
- High volume of missing data (e.g., Medicare readmission data)

We also excluded variables in our Outcomes domain from the clustering algorithm.⁶⁵ These variables (13 total) were used to rank the clusters. Each cluster was ordered from best to worst for each outcome, receiving higher scores for better outcomes. These scores were summed for each outcome variable, resulting in our final cluster rankings as demonstrated in Section 3.3.

Counties with missing data were not included in our algorithm and were not sorted into clusters. There were six such counties, making up 0.2% of the counties and 0.1% of the U.S. population missing from our analysis.

An additional limitation of the methodology was the use of survey data and modeled data, as discussed in Section 2. This particularly applies to the small area estimates of health outcomes and other data from the CDC's PLACES project.⁶⁶ However, the small area estimates from the PLACES project have generally been supported by external validation.^{67,68,69}

We considered supplementing the cluster analysis with some type of regression analysis using the SDOH factors as the independent variables and cost as the dependent variable. We decided against it for several reasons:

- We were not trying to predict cost, but rather our goal was to group counties based on similarities.
- Although cost is a major consideration in our analysis, other variables, such as outcomes, were equally important.
- Considerable covariance is found between the SDOH variables, which could materially skew the results.
- Similarly, we used aggregate data, not data based on individual results, which could also materially skew the results.

3.2 RESULTS

In this section, we examine in greater detail some of the clusters obtained using the methodology described in Section 2. We will first provide a general overview of the cluster landscape, and then narrow our focus to just those clusters that have been selected as targets for intervention. These specific clusters will be the setting of the case studies in Section 5.

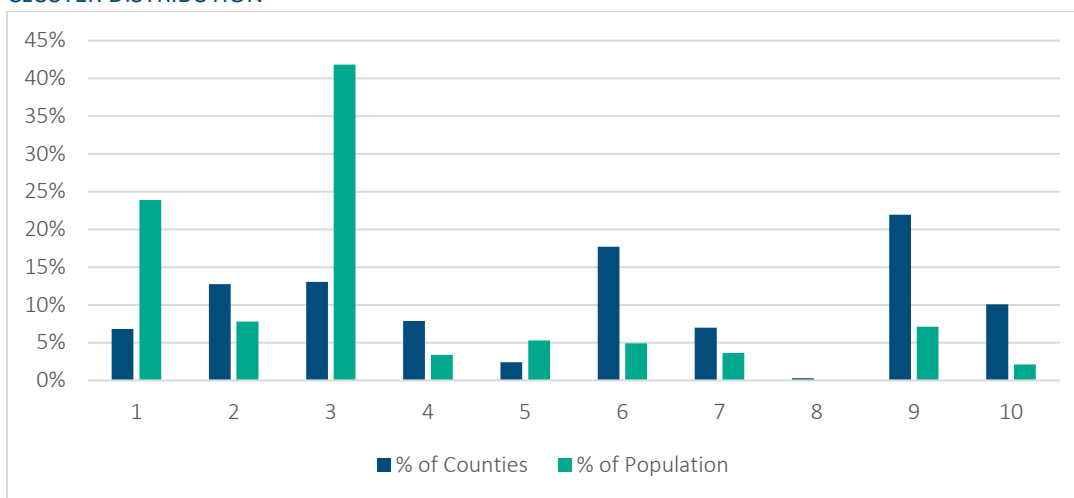
THE OVERALL CLUSTER LANDSCAPE

The clusters below are described in their ranking order, with Cluster 1 having the best health outcomes, and Cluster 10 having the worst. As discussed in more detail below, we created an aggregate health outcomes measure to rank the clusters from best to worst

Our algorithm resulted in a disparate distribution of both the number of counties and the total 2019 U.S. population between the final 10 clusters, as demonstrated in Figure 3.1.

Figure 3.1

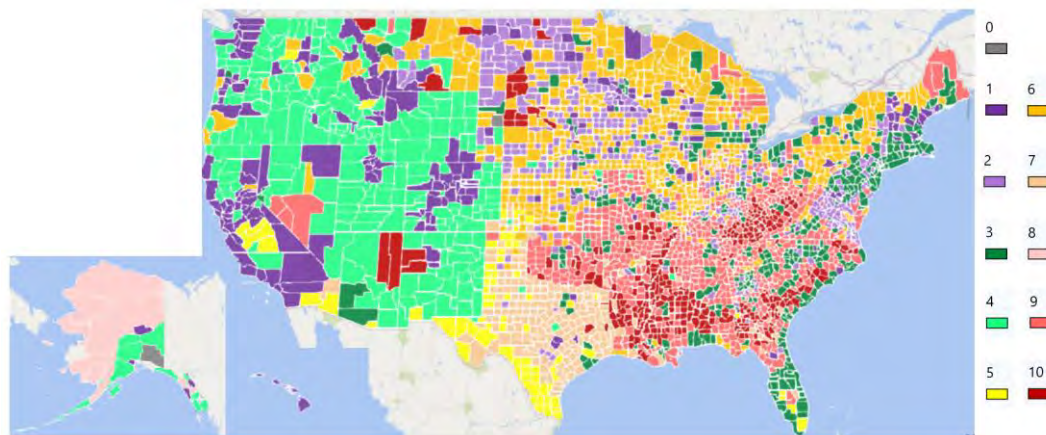
CLUSTER DISTRIBUTION



As shown in Figure 3.1, the higher-ranking clusters (Clusters 1 and 3) tend to be more urban than the lower-ranking clusters. Specifically, the top ranking cluster represents 7% of the U.S. population but only 33% of the counties. Meanwhile, the bottom three clusters make up 9% of the population but 32% of the counties.

The geographic distribution of the clusters is demonstrated in Figure 3.2. As in all the maps that follow in this section, Alaska and Hawaii are shown at the bottom left of the continental U.S., and the legend for the cluster colors is provided on the right. Cluster 0 represents the six counties that were not grouped because of missing data.

Figure 3.2
GEOGRAPHIC DISTRIBUTION OF CLUSTERS



As shown in Figure 3.2, a few clusters have clear geographic patterns, such as Cluster 9 in the Southeast and Cluster 4 in more rural regions of the West. The vast majority of counties in clusters 7 and 8 are associated with just one state each (Texas and Alaska, respectively).

Figures 3.1 and 3.2 illustrate some general characteristics of the clusters. Our goal in this section of the report, however, is to use these clusters to identify areas for potential intervention. The following section addresses the identification step.

IDENTIFYING CLUSTERS TO TARGET FOR INTERVENTION

Our ranking algorithm guarantees that low-numbered clusters such as Cluster 1 and Cluster 2 will have the best overall health outcomes, whereas high-numbered clusters like Cluster 10 will have the worst overall health outcomes. This is illustrated in Figure 3.3, which demonstrates the ranking of each cluster for each of our 13 health outcomes. Clusters are ranked according to their average score for each condition (i.e., the straight average of the survey result for each condition across each county included in the cluster). The two top-scoring clusters are shown in green, the two bottom-scoring clusters are shown in red, and a middle-scoring cluster, Cluster 5, is shown in orange. Cluster 5 is discussed in more detail below.

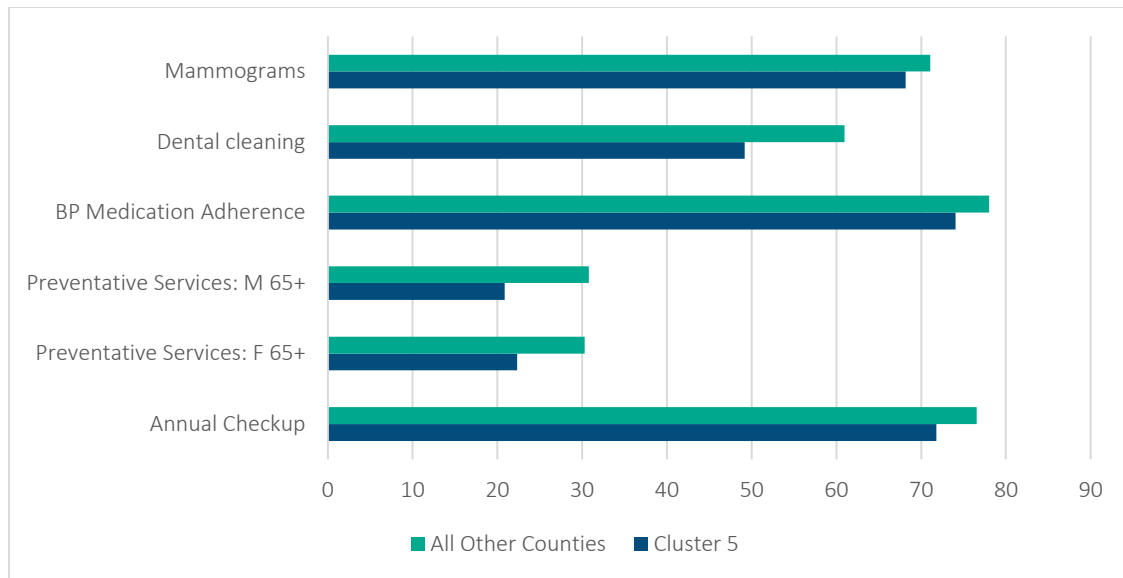
Figure 3.3
RANKED CLUSTERS FOR EACH CONDITION IN HEALTH OUTCOMES DOMAIN

Ranking	Cluster Ranking												
	Mental Health	Physical Health	Diabetes	Cancer	High BP	Arthritis	Asthma	COPD	CHD	High Chol	Kidney	Stroke	Teeth Lost
1	2	1	1	5	1	1	2	1	1	1	1	1	1
2	1	2	2	8	4	5	5	2	3	8	2	2	2
3	6	3	3	1	2	8	1	5	2	3	3	3	3
4	4	6	6	3	3	3	7	3	4	2	6	6	6
5	3	4	4	7	8	7	6	4	5	4	4	4	4
6	7	7	7	10	5	2	3	6	6	5	7	5	7
7	5	5	8	4	6	4	4	7	8	6	8	7	5
8	9	9	9	2	7	6	9	8	7	7	9	9	9
9	10	8	5	9	9	9	10	9	9	10	5	8	10
10	8	10	10	6	10	10	8	10	10	9	10	10	8

Apart from cancer, Cluster 9 and Cluster 10 are consistently among the bottom three clusters. This demonstrates that Cluster 9 and Cluster 10 have opportunity for improvement across a broad spectrum of conditions and thus are clear targets for intervention.

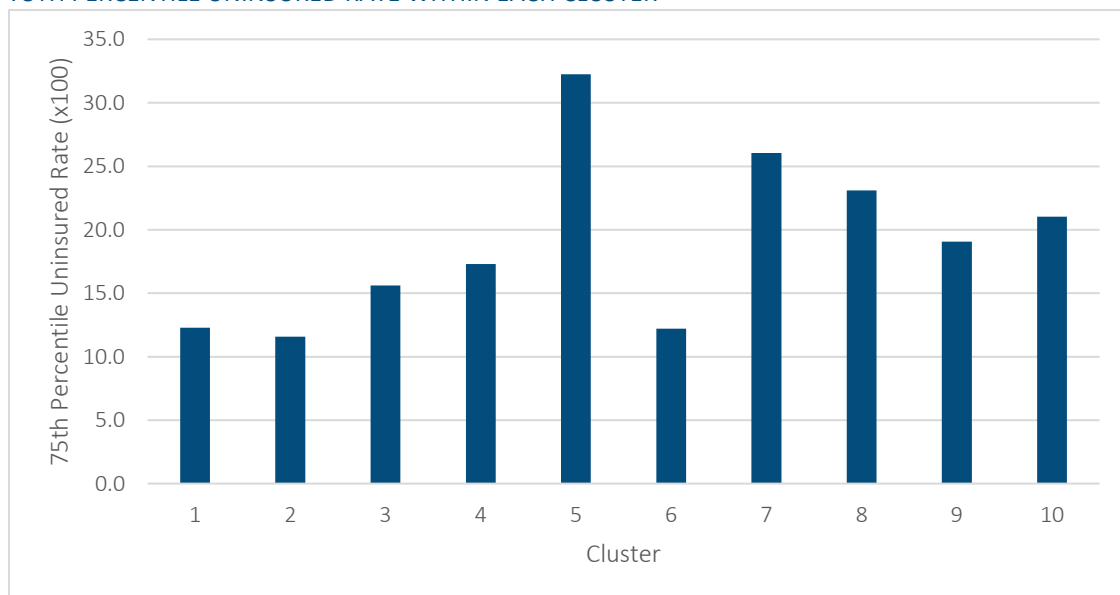
Cluster 5 is also of interest, ranking low for diabetes and kidney disease but high for cancer, arthritis and asthma. Some of the low-ranking metrics may be explained in part by a lack of preventive services, as demonstrated in Figure 3.4.

Figure 3.4
CLUSTER 5 HEALTH CARE QUALITY SCORES VS. ALL OTHER COUNTIES



Cluster 5 also has the highest uninsured rate of all clusters, as demonstrated in Figure 3.5.

Figure 3.5
75TH PERCENTILE UNINSURED RATE WITHIN EACH CLUSTER



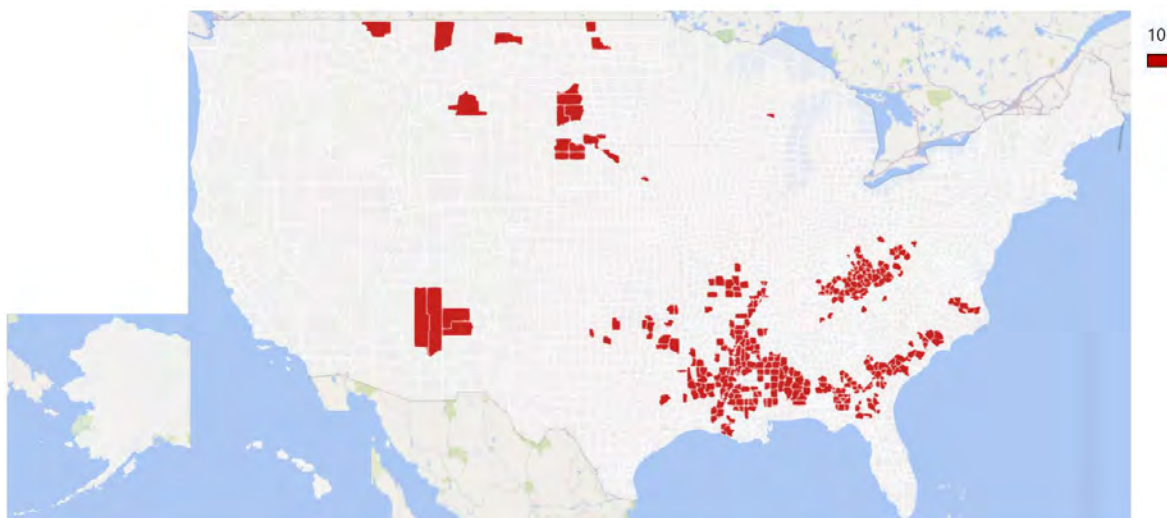
Together, Figures 3.4 and 3.5 demonstrate that residents of Cluster 5 may be facing some barriers to health care access, contributing to lower rates of preventive care. These barriers to care may contribute to poor health outcomes for chronic conditions that require ongoing management, such as diabetes.

Based on the above, we believe Clusters 9 and 10 are clear targets for intervention based on the poor health outcomes exhibited. We believe Cluster 5 should also be a target cluster based on the evidence of potential barriers to care. Other clusters may also be of interest, but because of the high opportunity potential in Clusters 5, 9 and 10, we will focus our discussion there. We will explore these three clusters in the next section to better understand their unifying characteristics. We can then discuss potential interventions for these areas in Section 5.

ANALYSIS: CLUSTER 10

The cluster with the worst overall health outcomes score is Cluster 10. Cluster 10 is dominated by rural Southeastern counties and tribal reservations, as shown in Figure 3.6.

Figure 3.6
CLUSTER 10 GEOGRAPHY



The counties included in Cluster 10 are some of the most rural areas in the U.S. This distribution is demonstrated in Table 3.1, which shows the distribution of each cluster across the ERS’s Rural-Urban Continuum Codes. The values in the table represent the percentage of total counties in each cluster that correspond to each of the nine Rural-Urban Continuum Codes. These are organized so that the top row is the most urban and the bottom row is the most rural. Starting in the upper left corner, for example, we find that 1% of the counties in Cluster 10 are “Counties in metro areas of 1 million population or more.”

Table 3.1
DISTRIBUTION WITHIN EACH CLUSTER BY RURAL-URBAN CONTINUUM CODE

	1	2	3	4	5	6	7	8	9	10
Counties in metro areas of 1 million population or more	26%	28%	40%	1%	5%	3%	11%	0%	8%	1%
Counties in metro areas of 250,000 to 1 million population	19%	10%	35%	6%	12%	5%	8%	0%	10%	5%

Counties in metro areas of fewer than 250,000 population	21%	12%	15%	13%	4%	6%	13%	0%	12%	6%
Urban population of 20,000 or more, adjacent to a metro area	8%	5%	7%	6%	5%	8%	7%	0%	9%	3%
Urban population of 20,000 or more, not adjacent to a metro area	7%	1%	1%	6%	7%	3%	3%	0%	3%	3%
Urban population of 2,500 to 19,999, adjacent to a metro area	4%	11%	2%	15%	31%	25%	25%	0%	27%	28%
Urban population of 2,500 to 19,999, not adjacent to a metro area	10%	11%	0%	26%	24%	18%	12%	56%	12%	21%
Completely rural or less than 2,500 urban population, adjacent to a metro area	1%	6%	0%	6%	4%	10%	7%	0%	10%	12%
Completely rural or less than 2,500 urban population, not adjacent to a metro area	4%	16%	0%	20%	8%	23%	14%	44%	9%	21%

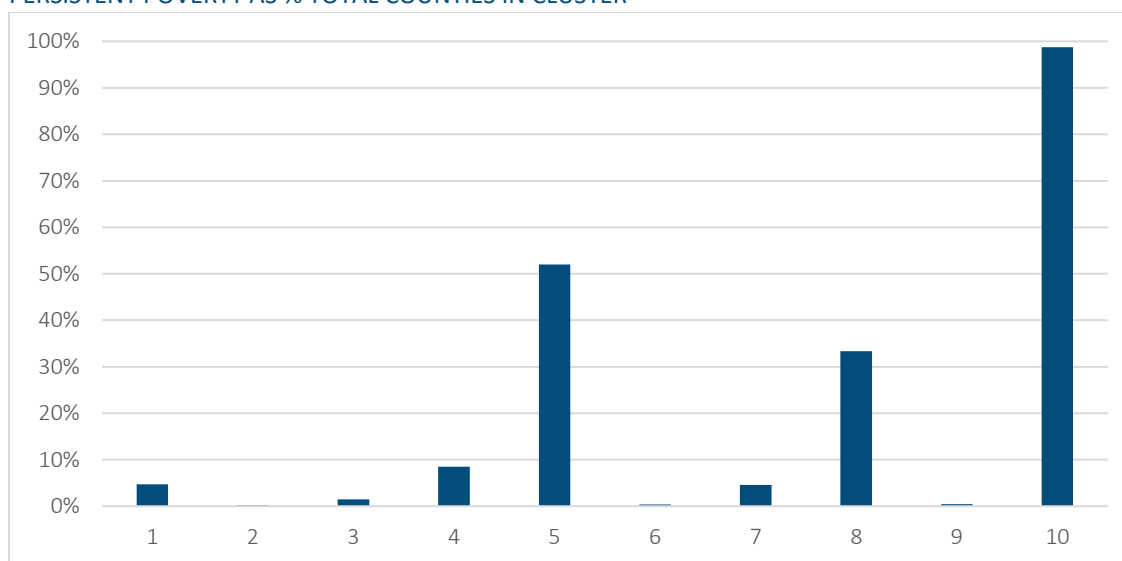
Table 3.1 shows a general pattern from left to right (high- to low-scoring clusters) of the clusters becoming less urban and more rural. Only clusters 1 and 3 have at least half of their constituent counties in metropolitan areas. The remaining clusters are predominantly micropolitan or rural. This finding, that rural counties appear to be associated with worse health outcomes, is consistent with well-documented health disparities between urban and rural areas.⁷⁰

Cluster 10 in particular skews rural. It has the largest percentage of “completely rural” counties outside of Cluster 8 (which contains only nine counties). Interventions targeted to Cluster 10 must account for the predominantly rural nature of the cluster.

Furthermore, 99% of the counties in Cluster 10 were flagged as persistent poverty counties in the 2020 census. Persistent poverty counties have at least 20% of their population living in poverty for the three most recent censuses (in other words, over a 30-year timeframe). As demonstrated in Figure 3.7, persistent poverty counties are generally associated with the clusters with the poorest health outcomes, but Cluster 10 more so than any other cluster. We also see a high percentage of persistent poverty counties in Cluster 5, another cluster we have targeted for intervention.

Figure 3.7

PERSISTENT POVERTY AS % TOTAL COUNTIES IN CLUSTER



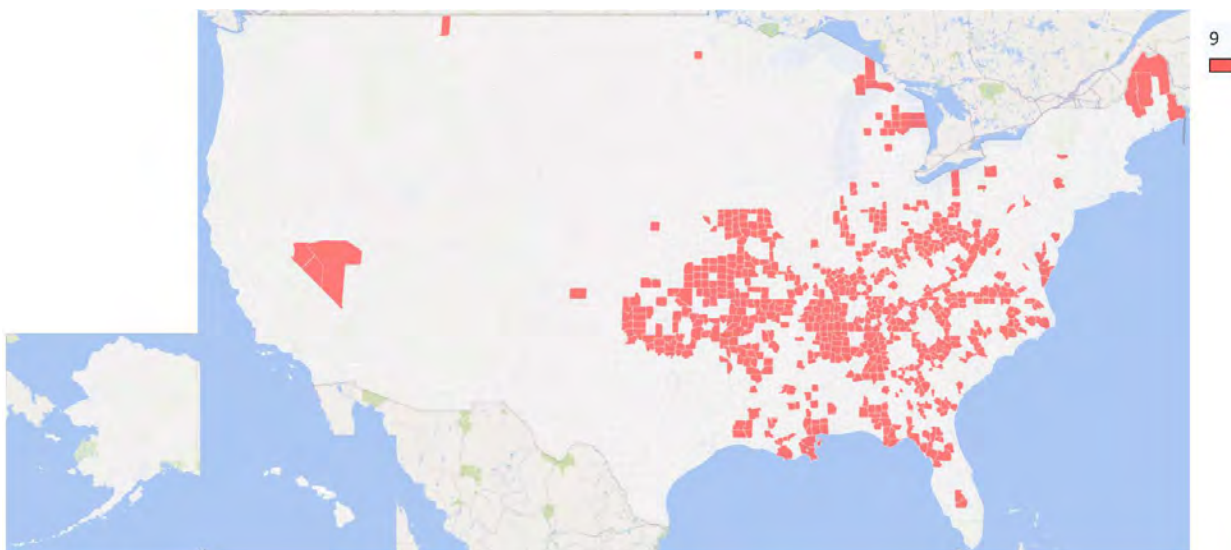
Of the 316 counties included in Cluster 10, 312 are persistent poverty counties. If an intervention for a persistent poverty county does not directly address poverty itself, it must address reducing some of the barriers to care faced by impoverished residents.

ANALYSIS: CLUSTER 9

The second-lowest scoring cluster, Cluster 9, is similarly situated as Cluster 10 geographically. This is demonstrated in Figure 3.8.

Figure 3.8

CLUSTER 9 GEOGRAPHY



As shown in Figure 3.8, Cluster 9 is predominantly located in the Southeastern U.S., like Cluster 10 (shown in Figure 3.6). However, Cluster 9 is less rural than Cluster 10 and has dramatically less incidence of persistent poverty.

Cluster 9 is differentiated from the remaining clusters in its economic typology distribution, as demonstrated in Table 3.2, which shows the distribution of each cluster across the ERS’s County Typology Codes. The values in the figure represent the percentage of total counties in each cluster that correspond to each of the six typology codes, including “Nonspecialized,” which are counties that do not meet the criteria for inclusion in one of the other categories listed (farming, mining etc.). A higher prevalence of manufacturing-dependent counties (26%) is seen in Cluster 9 than in any other cluster.

Table 3.2

DISTRIBUTION WITHIN EACH CLUSTER BY ECONOMIC TYPOLOGY

	1	2	3	4	5	6	7	8	9	10
Nonspecialized	35%	42%	63%	29%	25%	26%	29%	33%	41%	47%
Farming	1%	25%	1%	17%	21%	25%	21%	0%	9%	12%
Mining	3%	3%	1%	15%	24%	4%	23%	22%	6%	9%
Manufacturing	4%	17%	9%	4%	9%	22%	11%	22%	26%	15%

Federal/State government	28%	6%	14%	21%	19%	9%	10%	11%	11%	16%
Recreation	30%	8%	12%	14%	1%	15%	6%	11%	7%	1%

The Economic Typology factors were developed in 2013 based on the 2010 census. Counties that were manufacturing-dependent in 2010 may not have as strong a manufacturing industry in 2020. Factory closures have been linked to opioid overdose deaths⁷¹ and may be associated with some of the poor health outcomes exhibited for Cluster 9. This finding could indicate that areas with recent disruptions to the local economy (due to, for example, the loss of a large employer) could be good targets for intervention.

Cluster 9 additionally has a lower median household income than all clusters other than Cluster 10, as demonstrated in Figure 3.9.

Figure 3.9
75TH PERCENTILE MEDIAN HOUSEHOLD INCOME WITHIN EACH CLUSTER

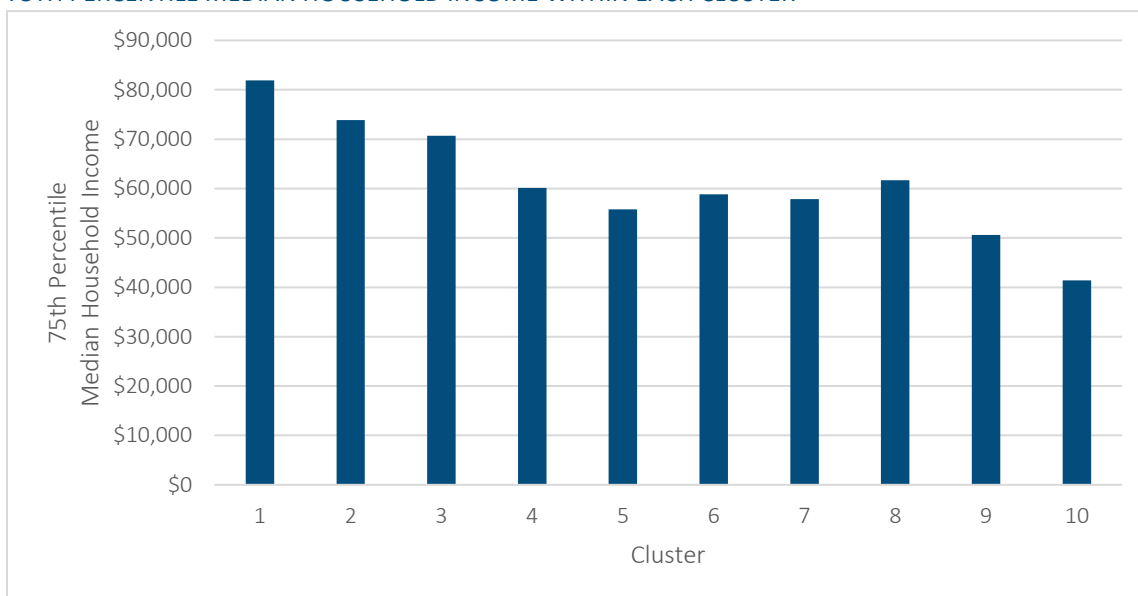
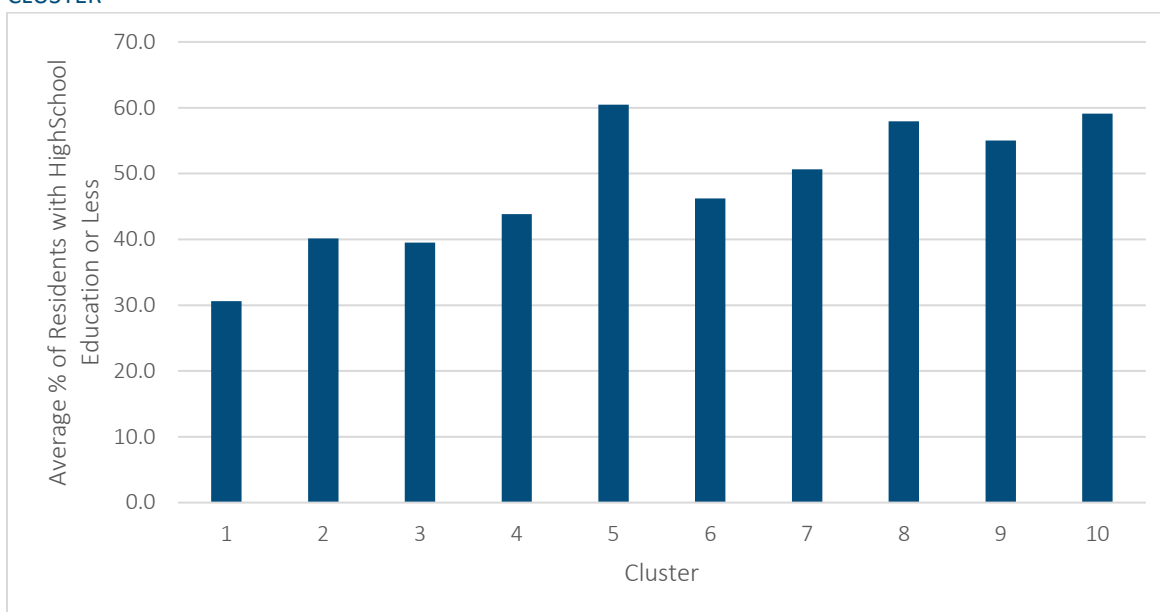


Figure 3.9 demonstrates that income may be a barrier to health care access for those in Cluster 10, even though Figure 3.7 indicates that Cluster 9 does not currently have a problem with persistent poverty.

Another potential barrier to positive health outcomes is low education.⁷² As shown in Figure 3.10, Cluster 9 has one of the highest average rates of residents with a high school degree (or equivalent) or less education.

Figure 3.10
AVERAGE PERCENT OF RESIDENTS WITH HIGH SCHOOL DEGREE OR LESS EDUCATION WITHIN EACH CLUSTER

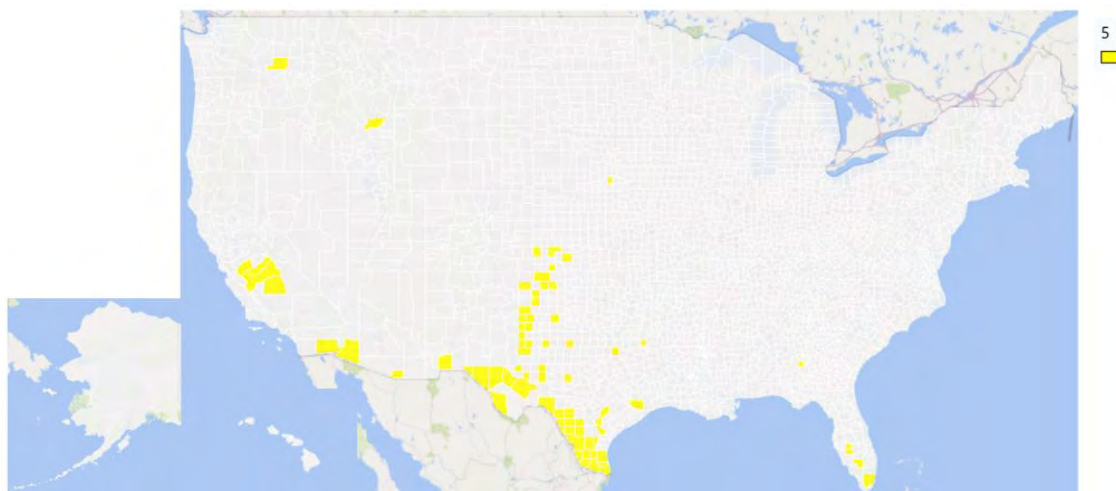


Clusters 9 and 10 have similar geographic distributions and some similar attributes, as shown in Figures 3.9 and 3.10. However, an intervention targeting individuals in Cluster 9 may not have to overcome deeply entrenched issues such as persistent poverty.

ANALYSIS: CLUSTER 5

The final cluster targeted for intervention is Cluster 5. This cluster includes counties that lie mostly on the southern border of the U.S. and in central California, as demonstrated in Figure 3.11.

Figure 3.11
CLUSTER 5 GEOGRAPHY



This cluster has a very high percentage of residents who report speaking English “not well” or “not well at all” (13.2% on average for this cluster compared to 1.3% for all other clusters) and a very high uninsured rate as demonstrated in Figure 3.5. This cluster also scores poorly on health care quality measures, as shown in Figure 3.4. Persistent poverty is also quite high for Cluster 5, as demonstrated in Figure 3.7.

Another potential barrier to health care for residents of Cluster 5 could be access to providers. Table 3.3 shows that Cluster 5 has very high rates of HPSAs relative to other clusters.

Table 3.3
DISTRIBUTION OF COUNTIES BY HPSA STATUS WITHIN EACH CLUSTER

Cluster	Mental Health			Primary Care Provider			Dental Care		
	Not a HPSA 0	HPSA 1	Some HPSA 2	Not a HPSA 0	HPSA 1	Some HPSA 2	Not a HPSA 0	HPSA 1	Some HPSA 2
1	2%	37%	61%	4%	7%	89%	8%	5%	86%
2	35%	61%	4%	58%	27%	15%	79%	12%	9%
3	0%	9%	91%	1%	4%	94%	5%	2%	93%
4	0%	85%	14%	1%	32%	67%	4%	20%	76%
5	1%	87%	12%	3%	45%	52%	19%	40%	41%
6	4%	87%	9%	3%	21%	77%	9%	7%	84%
7	11%	78%	11%	10%	46%	44%	47%	24%	28%
8	0%	100%	0%	11%	67%	22%	0%	78%	22%
9	1%	58%	41%	5%	28%	68%	5%	12%	82%
10	2%	77%	22%	3%	54%	43%	5%	45%	50%

Table 3.3 demonstrates that, for example, 87% of the counties included in Cluster 5 are HPSAs for mental health care providers, indicating a dearth of mental health care in most regions in the cluster. Cluster 5 also has high HPSA rates for primary care and dental care providers, which indicates potential difficulty accessing preventative and basic care.

In Figure 3.3, we determined that Cluster 5 exhibited relatively positive health outcomes for a few conditions, and average or low outcomes for others. Given the barriers to care (poverty, language, access to providers and access to insurance) evident in Cluster 5, however, the positive outcomes may be associated with a lack of access to health care rather than truly average health outcomes. The survey questions supporting the health outcome results that we used to rank the clusters are generally framed as “Has a doctor or other health care provider ever told you that you have [condition x]?” A “no” response to such a question could indicate an undiagnosed condition as well as an absence of the condition. The barriers to health care discussed above may be preventing accurate capture of diagnoses for this group. Interventions targeted to Cluster 5 should take these barriers into account.

NEXT STEPS

The associations we discuss above are not intended to be full explanations of the good or poor health outcomes exhibited by the clusters. Rather, as discussed above, we will use these characteristics as starting points for solution development in Section 5.

First, we will complete the final step in our solution development roadmap by discussing the current landscape of products and programs that have been developed to ameliorate the negative effects of some SDOH.

Section 4: Strategic Considerations

In the previous sections, we provided a general overview of how SDOH impacts health care in general as well as data and analytical techniques for understanding the impact for specific populations. The next question is “What can payers and providers do about it?” Some payers and providers are currently addressing SDOH through their foundations and community outreach programs. For example, the American Hospital Association has developed a roadmap for improving housing conditions in a neighborhood through a partnership with hospitals and health care systems, nonprofit organizations and businesses.⁷³ One such effort in Lancaster, Pennsylvania, was able to address the needs of the homeless population during COVID, by adding portable bathrooms and handwashing stations and establishing a quarantine site for COVID-positive people living in an emergency shelter or on the streets.⁷⁴ There are several approaches a payer or provider may want to consider in developing a business strategy to address SDOH:

- *Optimizing resources:* A payer or provider can optimize available resources either by expanding their current offerings to broadly reflect SDOH or by targeting specific populations to remove barriers to better health.
- *Guiding consumers:* A payer or provider can reimagine how they guide consumers through their health care journey.

Regardless of how the organization approaches the issue, successful implementation requires an understanding of the barriers to better health and how the existing infrastructure supports efforts to remove those barriers. In this section, we discuss three major barriers to better health: food insecurity, provider access and system navigation. With that foundation in place, we then describe how payers and providers can implement a solution.

4.1 FOOD INSECURITY

Food insecurity is defined as a “disruption in food intake or eating patterns due to a lack of money or other resources” in terms of households that are uncertain of having, or unable to acquire, enough food to meet the needs of all their members because they had insufficient money or other resources for food.⁷⁵ Over the last 22 years, between 10% and 15% of all Americans have been food insecure at least part of each year as shown in Figure 4.1.

Figure 4.1
PERCENT OF POPULATION WITH FOOD INSECURITY



Source: Alisha Coleman-Jensen, Mathew P. Rabbitt, Christian A. Gregory, and Anita Singh. Sept. 2021. [USDA ERS—Household Food Security in the United States in 2020](#). U.S. Department of Agriculture, Economic Research Service, Economic Research Report 298. Last accessed November 2, 2021.

Not surprisingly, food insecurity is associated with low-incomes: 28.6% of people living below 185% of income are food insecure, compared to 4.9% for those over 185% of the income-to-poverty ratio.⁷⁶

BARRIERS TO FOOD SECURITY

Arguably, affordability is the most common barrier to food security. In a 2020 survey 95% of the food insecure participants reported that they “could not afford to eat balanced meals.”⁷⁷ Even if a household can afford healthy food, they still need to be able to physically get the food home, either by going to a store to purchase the food or by having food delivered. About 23 million people live in a food desert, which means they do not live close to a store or supermarket offering healthy foods at a reasonable price. Food deserts tend to be in rural areas where there are few grocery stores or in urban areas dominated by convenience stores that do not offer healthy foods or charge a high fee for them. Home-cooked meals are not an option for many populations, including disabled people living at home, the homeless or people living in congregate settings such as a shelter. These consumers need to have cooked food delivered or prepared at a convenient place.

Finally, everyone, regardless of whether they are food insecure, needs to understand why healthy eating is important and what constitutes healthy meals and snacks.

AFFORDABILITY SOLUTIONS

Low-income households are constantly balancing various needs. Should we buy food or pay the rent? Can the electric bill wait so we can afford food tonight? The federal government has many programs to assist low-income families with their living expenses. For example, the Temporary Assistance to Needy Families (TANF) provides energy, housing, child care and job training for eligible low-income families.⁷⁸

From a food insecurity perspective, the USDA’s Food Nutrition Service administers several nutrition assistance programs, including the school lunch program and its signature program, the Supplemental Nutrition Assistance Program (SNAP). SNAP provides a benefit to 42 million participants⁷⁹ who meet the

qualifications, including an income of less than 130% of the poverty level.⁸⁰ The average benefit is \$213.95 per person per month.⁸¹ The benefit can be used to purchase healthy food to be prepared at home, including snack foods and nonalcoholic beverages. The benefit cannot be used to purchase food served hot at the point of sale, alcoholic beverages, pet food, cleaning supplies or personal hygiene products.⁸²

SNAP, like many federal programs, is administered by the states, which have considerable discretion on setting the specific rules for the program. This adds to the complexity of the situation. For example, under the SNAP programs states determine such things as the following:⁸³

- Work requirements for able-bodied adults
- Administrative procedures, such as coordinating with other programs such as Medicaid
- Income requirements, including the treatment of child support payments.

OTHER SOLUTIONS

Many local governments and nonprofit organizations, including provider and payer foundations, have stepped up to address the issue of physical access to food as shown in Table 4.1.

Table 4.1
COMMON FOOD INSECURITY SOLUTIONS

Solution	Barriers	Comment
Food pantry	Affordability, food desert	Fixed location, can include perishable food
Food truck	Affordability, food desert	Mobile delivery, can include perishable foods
Food boxes	Affordability, food desert	Nonperishable foods delivered to the home
Healthy food discounts	Affordability	Payers partner with retailers to do this
Home grocery delivery	Food desert	Requires ability to cook meals at home
Soup kitchens	No home option	Primarily for homeless and low-income populations in urban area
Home meal delivery	No home option	Example: Meals on Wheels for the elderly and homebound

Most of the programs described above have some type of nutritional counseling included. In some cases, the counseling is as simple as a piece of paper with a list of healthy and unhealthy foods. In other cases, it may be as sophisticated as an in-person program.

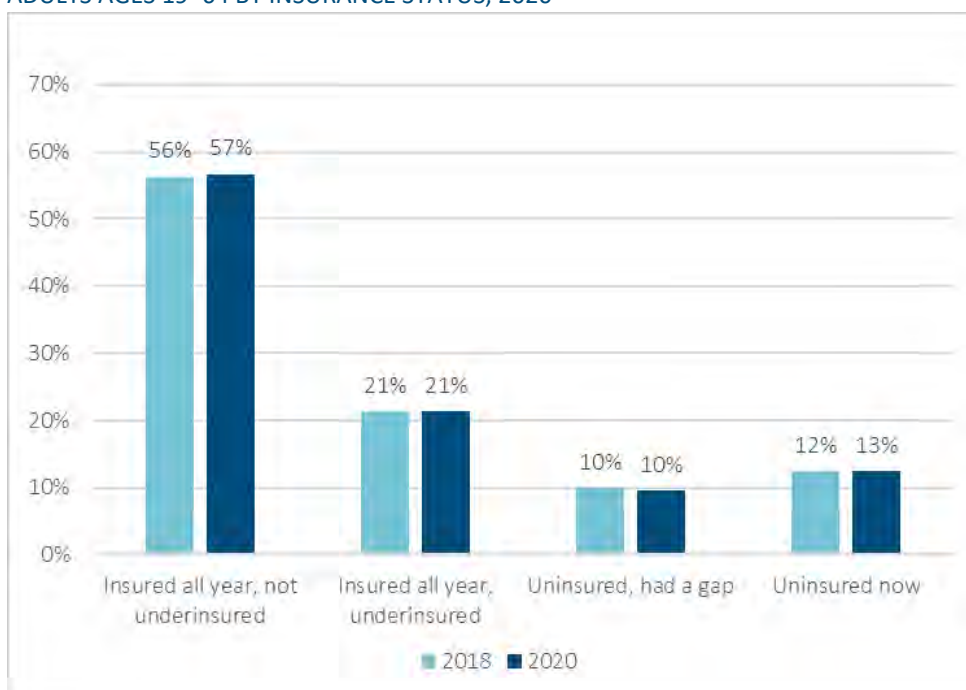
4.2 ACCESS TO PROVIDERS

Patients need access to providers to maintain their health, to treat diseases, and to care for them in an emergency. In this context, providers are not limited to doctors and hospitals. In fact, other types of providers, such as mental health providers⁸⁴ and dentists,⁸⁵ have been shown to provide great value in maintaining health.

BARRIERS TO BETTER HEALTH

Like food insecurity, barriers to better health related to provider access include affordability and physical or virtual access to the needed services. Affordability includes not only insurance coverage, but also the ability to afford cost-share, time away from work, transportation, and, in some cases, child care. As Figure 4.2 shows, in 2020 only 57% of adults ages 19–64 were insured the full year and not underinsured at any time during the year. In this context, the term “underinsured” means that the members’ out-of-pocket expenses, excluding premiums, exceeded a specified percent of their income. The specified percent varies by income level.

Figure 4.2
ADULTS AGES 19–64 BY INSURANCE STATUS, 2020



Source: Sara R. Collins, Munira Z. Gunja, and Gabriella N. Aboulafia. Aug. 19, 2020. [U.S. Health Insurance Coverage in 2020: A Looming Crisis in Affordability Findings from the Commonwealth Fund Biennial Health Insurance Survey \(Supplemental Tables\)](#), Commonwealth Fund Issue Briefs.

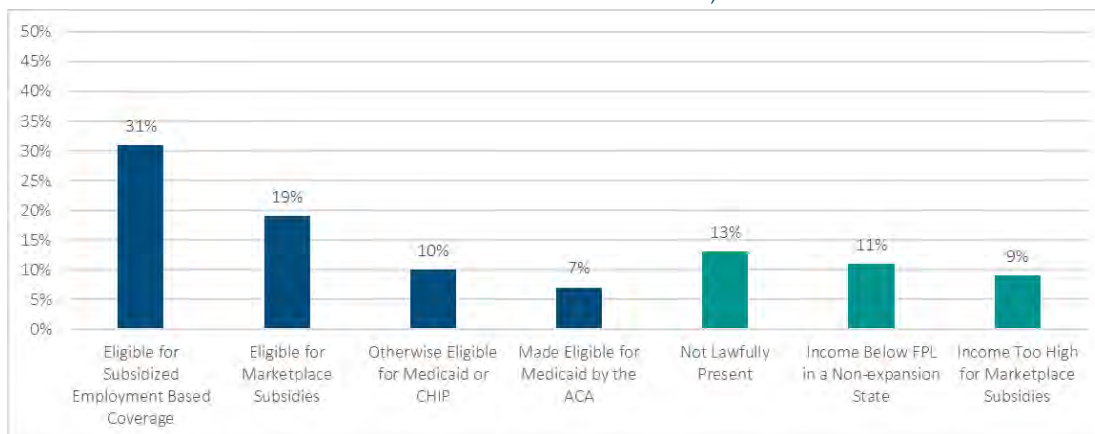
There may be several reasons that a patient may not have physical access to a provider. First, the consumer may live in an underserved area, such as a rural area, or may be part of an underserved population, such as the homeless. Approximately 86 million people live in a designated health provider shortage area (HPSA).⁸⁶ Similarly, an individual may be homebound, so it may be physically difficult for them to go to a doctor’s office or other place of service. Finally, a consumer may simply want a more convenient way to receive care.

AFFORDABILITY SOLUTIONS

In the U.S. the health care system consists of several programs, many of which include subsidies to help the consumer affordability. As Figure 4.3 shows, 67% of the uninsured are eligible for some type of subsidy but remained uninsured anyway. Possible reasons for this hesitancy include they are not aware of the subsidy, the coverage may be too costly even with the subsidy, or they do not feel the need for insurance.

Figure 4.3

ELIGIBILITY FOR SUBSIDIZED COVERAGE AMONG THE UNINSURED, 2019



Source: Who Went Without Health Insurance and Why? Congressional Budget Office Report, September 20, 2020, [Who Went Without Health Insurance in 2019, and Why? | Congressional Budget Office \(cbo.gov\)](https://www.cbo.gov/publications/2020/09/who-went-without-health-insurance-in-2019-and-why). Last accessed December 23, 2021.

Some formal efforts have been made to reduce the number of uninsured who are eligible for some type of coverage. For example, if a Medicaid-eligible patient receives hospital treatment, they are automatically signed up for Medicaid, retroactively.⁸⁷

In addition to TANF and other resources discussed above, some nonprofit organizations are available to help with affordability. One such construct is called health care-sharing ministries (HCSMs), which pool money to cover the cost of health care. In some states, HCSM enrollment accounts for up to 35% of total ACA marketplace enrollment. These organizations are currently under scrutiny because of a lack of consumer protection regulation.⁸⁸

Some primary care safety net programs also exist for consumers who are uninsured or underinsured or who live in rural areas as described below. This safety net, however, does not meet all the needs of the uninsured and underinsured populations, especially needs associated with major emergencies and complicated diseases. Hospitals are required to treat patients in emergency situations.⁸⁹ In many situations, the patient must rely on nonprofit organizations, pro-bono provider services and fundraisers, such as a GoFundMe campaign. As a last resort, the patient may be forced to forgo care, pay out of pocket or receive uncompensated care.

OTHER SOLUTIONS

The federal primary safety net system for the underserved population mentioned above includes the following:

- *Primary care services:* Several alternative health centers provide primary care, including rural health clinics, federally qualified health centers and health centers run by the Indian Health Service. Each type of center has its own regulations, including required services, staffing and business requirements.⁹⁰
- *Professional services:* The National Health Service Corps provides financial incentives, such as student loan forgiveness, to encourage providers to practice in a designated HPSA.⁹¹

- *Critical access hospitals:* Hospitals meeting certain requirements, such as a distance greater than 35 miles from another hospital, may be reimbursed on a cost-plus basis that may or may not be financially advantageous when compared to the Medicare prospective payment system.⁹²

The private sector also addresses safety net concerns through a combination of mobile medical vans, in-store clinics and on-site employer clinics.

Adequate health care is a challenge for those who are homebound either because they are recuperating from a hospital stay or because of an underlying medical condition. Medicare, Medicaid and most health plans will cover medical services, such as physical therapy or wound management, under these circumstances, but not housekeeping and similar services. Several hospitals are reimagining their delivery system using the hospital-at-home model, which is designed to keep people out of the hospital by offering advanced home care.⁹³

Physical access to a provider is not as necessary as it once was. During the pandemic, we saw a rise in the use of telemedicine⁹⁴ out of fear of contagion. There is reason to expect this to continue even after the pandemic ends because it reduces barriers to care due to issues like child care and time away from work. Today, some care can be provided virtually through teleconferencing and email. Even some routine tests and monitoring can be done remotely using home testing kits and remote monitoring techniques. Virtual care is not limited to primary care. For example, some pilot programs have provided specialists in a teaching hospital who use teleradiology to consult with surgeons in a rural area for traumatic brain injuries.⁹⁵

Although the movement toward telemedicine holds great promise, some major limitations exist:

- The technology is still limited. Many services require in-person care.
- The technology is changing rapidly, so payers and providers are struggling to keep up with what services are covered and what the cost-share levels should be.
- Not everyone has access to a computer and smart phone, either because they cannot afford the device and/or because there is no broadband access in their area. Although subsidy programs can be found to help with the costs, alternatives need to be provided for those that do not have access.
- In-visit privacy may be an issue in some cases.

4.3 NAVIGATING THE SYSTEM

For many of us, navigating the health system is relatively easy. If you have a question about your insurance coverage, you call the payer's customer service line. If you have a question about your health, you can research it online or call your doctor. But the situation is not that easy for consumers who must look beyond payers and providers to meet their health care needs.

BARRIERS TO BETTER HEALTH

As described above, many public and private programs are in place to address SDOH-related barriers to better health, such as SNAP and rural health clinics. These programs, however, are of little or no value if the consumer does not know about the program and how to access the program. Common barriers to making the best use of existing programs include the following:

- *Program complexity:* Each of the federal programs described above has its own rules for eligibility at a national level, and the application of the rules varies by state. To determine if one is eligible

for a specific program often requires going online and entering information about where you live and your income level. At the end of that process the consumer may find that they are not eligible for that program. Some states automatically qualify consumers for all eligible programs, but that is not true across the board.

- *Language*: Although translation services are often available, especially for written communications, language for non-English speakers can be a major barrier for consumers whose language is not part of the translation services, if the translation is poorly done, or if the consumer has questions and no oral translation is available.
- *Technology*: Although some information about existing programs is available nonelectronically, the process is much easier if the consumer has access to the internet or a cell phone. According to a 2018 study, about 25 million Americans do not have access to the internet, and about 163 million do not use it.⁹⁶

SOLUTIONS

One place to start the navigation process is by calling 211 or going online to 211.org. The 211 system is a nationwide information and referral network consisting of 200 local organizations. Under the auspices of the United Way, consumers can obtain information about resources for insurance, food assistance programs and financial assistance to pay rent and utilities specific to a consumer's locality.⁹⁷ One state, North Carolina, has built a robust resource directory, NCCARE360. NCCARE360 is powered by the 211 system in the state. It includes not only a call center and website but also dedicated navigators. A data team verifies resources.⁹⁸

Other resources include the following:

- Some state and federal programs assign social workers to ensure that clients make the best use of the available benefits and to certify needs.
- Many organizations promote their services using billboards, mailers, advertisements etc.
- A good deal of cross-pollination is found between resources. For example, a table at a food pantry may have brochures for other organizations such as the 211 system.
- Friends and family are often the best resource.

Of course, the 211 system is not helpful if cell phone and/or internet service⁹⁹ is not available or not affordable. Several assistance programs are available for low-income households, including the following:

- Lifeline and other subsidy programs managed by the Federal Communications Commission¹⁰⁰
- State-managed programs¹⁰¹
- Special rates provided by the carrier¹⁰²

4.4 WHAT CAN PAYERS AND PROVIDERS DO ABOUT IT?

As discussed above, an infrastructure is in place to address SDOH. The key players include the federal and local governments and nonprofit organizations. Even with this infrastructure, many barriers remain. Payers and providers cannot remove all the remaining barriers, but they can play a key role by optimizing resources and guiding the consumer through their health care journey in a meaningful way. To do this, appropriate financial incentives must be in place for all parties.

Many organizations provide solutions that can help payers, providers and consumers navigate these barriers, with different financial structures. These will be explored in more detail in the companion paper.

OPTIMIZING RESOURCES

To help alleviate food insecurity problems, payers can adapt the solutions described above into their business models to the extent that they fit into their business model. This is relatively easy for Medicare Advantage and Managed Medicaid products since they can be treated like dental, vision and other supplemental benefits. Employers can also adopt nutrition assistance programs if they can afford the cost. The cost may be offset for employers by partnering with other organizations, such as food banks.

Similarly, providers can build additional facilities to the extent their business model permits. They can also adapt how they provide services to accommodate the needs of a population. The obvious examples are telemedicine and mobile vans.

Payers can support these efforts by way of their reimbursement strategies. This can be done by including SDOH-related activities in scorecards used in determining year-end bonuses and penalties or including a per capita fee to compensate providers for coordinating care. Of course, there is an inherent incentive to address potential cost-saving activities for any reimbursement arrangement involving the total cost of care.

GUIDING CONSUMERS

Consumers receive their health care information from a myriad of sources, such as the internet, friends and family, health plans, and their doctors. In many cases, this information is very generic. For example, a doctor may tell a patient that they need to diet and exercise to lose weight. As part of that advice, the doctor may provide the patient with a list of healthy foods and suggested exercises, such as walking. That is good advice, but it may not be enough for a patient who is food insecure and does not live near a safe place to walk.

The simplest way for a payer or provider to address these issues is to simply include some information about local resources as part of their overall communications strategy. That could be as simple as referencing 211 in their communications material or taking a more comprehensive approach such as including a list of food pantries in their material or engaging referral platform organizations (which will be discussed in more detail in the companion paper).

To change consumer behavior, however, the organization may need to apply change management and/or behavioral finance techniques. Change management techniques rely on motivating consumers to change, providing information on how to achieve the desired results and reinforcement to make sure change happens. For example, a payer's interactive weight loss counseling program may include the following:

- Taking time to understand the member's specific situation through a screening process. Is the member food insecure? Can the member prepare food at home? What does their current diet look like?
- Explaining to the member the importance of weight loss as it applies to the member's circumstances. How does obesity impact the day-to-day life of the member?
- Providing the member with general information applicable to their situation. What are some low-cost alternatives to their current diet? Where can they obtain those foods in their area?
- Establishing a weight loss plan with the member to keep them on track.
- Providing the member with the opportunity to communicate with a nutritionist or other counselor about specific questions, either live or by text/email.
- Establishing check points with the member to make sure they are on track.
- Reevaluating the plan as needed.

Behavioral finance techniques complement change management techniques by framing alternatives, setting achievable goals and offering financial incentives in a way that encourages the consumer to make optimal choices. In the nutritional counseling example, the goals were included in the plan. Many such plans include financial incentives such as a one-time reduction in premium or participation in a raffle.

CREATING A KNOWLEDGE BASE

Once an organization has decided which, if any, approaches it wants to take to address SDOH, then it needs to determine what information is needed for the initial launch and for ongoing administration and analysis. At a minimum, this includes some measure of SDOH needs of the consumers served by the organization. This may be accomplished by using publicly available information such as that described in Section 2 or by capturing consumer-specific information through some type of screening process. Of course, due diligence must be applied in using data obtained through a screening process to avoid privacy violations and to avoid confirmation bias in applying the data.

To measure return on investment or some other effectiveness measure, the organization also needs to capture and analyze information such as the following:

- *Activity description:* The organization needs some qualitative information about the type of activity, including the initial goal and the applicable parameters. In the nutritional counseling example, as the name implies, the goal is weight loss. Parameters include whether there was an in-person consultation, outreach techniques etc.
- *Participation:* To analyze the effectiveness of a program, the organization needs to understand how many and the type of people who participated. In the nutritional counseling example, key questions include the following: How many people participated in total? Were there enough food insecure people participating to warrant the additional effort in providing that information?
- *Outcomes:* Outcome data may or may not be available. If the desired outcome is a reduction in the total cost of care, then those data will be available for those that remain in the plan but not for those that leave. Similarly, weight loss data may not be available for those who dropped out of the program.

Measurement and cost effectiveness of programs that address SDOH will be discussed in more detail in the companion paper.

In the next section, Section 5, we provide examples of how these strategic considerations can be applied in practice.

Section 5: Case Studies

In the previous sections, we used cluster analysis informed by SDOH and health outcomes data to determine which U.S. counties were likeliest to benefit from SDOH interventions. In this section, we provide case studies describing approaches to potential issues that could arise in these regions. In each case, the case study is hypothetical.

Two of the case studies below, “Emergency Department Uncompensated Care” and “Medicaid MCO Data Capture and Community Partnerships,” take place in specific regions highlighted in the analysis described in Section 3. “Emergency Department Uncompensated Care” examines a problem faced by a metropolitan hospital adjacent to a rural area with few providers, such as the counties included in Cluster 5. “Medicaid MCO Data Capture and Community Partnerships” illustrates a payer’s approach to incorporating SDOH in their strategy for a rural Southeastern region, such as the counties included in Cluster 10.

The final case study, “Health Plan Self-Insured Strategy,” takes a nationwide view, in line with the starting point of our data collection and analysis. As the health plan builds its approach, it is expected that cluster analysis or similar analysis will need to be performed to select test markets for the plan’s chosen strategy.

5.1 EMERGENCY DEPARTMENT UNCOMPENSATED CARE

The principal in this case study is a large hospital system in a medium-sized metropolitan area. The hospital’s main campus is in a neighborhood about three miles from the downtown area. In addition, the system includes several smaller hospitals in the suburbs, urgent care centers and a large professional group with offices scattered throughout the greater metropolitan area. The system has one major competitor, a hospital system organized in a similar manner, but slightly smaller than the principal system. The competitor’s main campus is located about 10 miles west of the principal’s main campus.

The CFO for the system has noted that there has been a steady increase in uncompensated care from services performed in the emergency department (ED) on the main campus. Based on an analysis of patient records over the last three years, it has become clear that the primary source of the uncompensated care comes from nonemergent services in two locations. The first location is a blue-collar neighborhood near the main campus. Most of the patients from this neighborhood are children with colds, ear infections, asthma attacks etc. Although some of the families qualify for Medicaid, most of them fall into the coverage gap between Medicaid and subsidized marketplace coverage. The second location is a rural county adjacent to the main campus. Most of the patients from that location are elderly Medicare fee-for-service patients suffering from complications of chronic diseases.

Based on these findings, the hospital has decided to take actions that not only reduce uncompensated care, but also remove the barriers to better health for the two target populations. They will take a two-prong approach to address these issues: conduct a change management campaign to encourage patients to take more responsibility for their health and find an alternative delivery system to enable the change management. The alternatives considered included the following:

- *Health clinics:* The hospital examined the possibility of establishing a rural health clinic in the county. Private ownership is permitted for rural health clinics. Similarly, they considered establishing a federally qualified health center for the neighborhood.
- *Extended office hours:* Under this option, urgent care centers and, possibly, doctor’s offices would extend their office hours to allow greater flexibility for workers.
- *Alternative delivery methods:* The hospital considered expanding their offerings related to telemedicine and home-based care.

There was one option that the hospital quickly ruled out. Under that option, the hospital would have directed patients to resources outside their system, such as in-store clinics and the competitor’s ED. That option may have been considered unethical “dumping” of patients.

THE ANALYTICS

To gauge the feasibility of each alternative, the hospital needs to look at each alternative delivery mechanism from the perspective of the patient and their caregiver. Examples of the analytics needed include the following:

- *Transportation*: One way to measure physical access to providers is driving distance or time. That statistic is usually framed as “What percent of the target population lives within a 10-minute drive to a provider?” Although this statistic is meaningful in many situations, it is not meaningful for patients and caregivers who do not own a car. Other alternatives that need to be considered include public transportation, ride shares and walkability.
- *Services provided*: Although the hospital identified specific diagnoses for each target population, it is important to include other services, especially primary services. In this context, primary care services could include dental services, mental health care, pharmacy services etc.
- *Affordability*: Affordability is an issue for everyone, especially for the uninsured and underinsured. Sliding scales are often an attractive alternative.

THE FINAL DECISION

For the urban neighborhood, the hospital decided to extend hours within their existing infrastructure services. They already have sufficient geographic coverage, but the expanded hours would help working parents. They are also looking into the clinical and legal ramifications of using an ED hotline to help patients determine if the situation is emergent. This approach will not eliminate uncompensated care, but it will reduce the cost of the services provided and it will give them an opportunity to provide at least some additional services. To make sure the process works as smoothly as possible, the hospital will provide ED patients with information upon discharge that includes alternative sites within their system and suggested actions to take before utilizing the ED.

For the rural county, the hospital has negotiated a per capita fee with a Medicare Advantage health plan that is looking to expand their service area. To manage the cost, the hospital would establish a rural health clinic for most patients and rely on a hospital-at-home approach for high-risk chronic patients.

5.2 MEDICAID MCO DATA CAPTURE AND COMMUNITY PARTNERSHIPS

A Medicaid Managed Care Organization (MCO) has an average of one million members across five states in the Midwestern and Eastern regions of the U.S. A small but costly cohort of members resides in one state in the rural Appalachian region, consistent with some of the Southeastern counties identified as “Cluster 10” in Section 3. The MCO has identified the following characteristics of their members in this region relative to others in the same state:

- A relatively large proportion of the membership is high-risk because of dual eligibility for Medicaid and Medicare
- NICU utilization is high, in part due to neonatal abstinence syndrome (NAS).
- Primary care utilization is lower than average across all rating groups.

The health plan understands that, in accordance with the findings of Section 3, these target counties have a high rate of persistent poverty, a high probability of designation as a Health Provider Shortage Area, and very high rates of obesity and smoking relative to other counties. The MCO is concerned these factors may be contributing to poor outcomes for their members in these counties. There is also a concern that the MCO is being underpaid through the state’s risk-adjustment process; the MCO believes they would potentially receive more accurate payment if its members’ SDOH were considered in the risk adjustment formula.

The MCO already takes the following actions on SDOH for their members, although support activities in this state lag the MCO’s programs in other states where there is a broader network of community-based organizations (CBOs) to partner with and recommend to members:

- *Makes a SDOH screening tool available to providers.* Different screening tools are used in different markets. Some providers have high rates of tool completion, but many do not.
- *Maintains a database of community resources* for members who need support with housing, food security and or interpersonal violence. The MCO also provides application assistance for programs that require an application, and in some markets, it provides guided referrals to other social services that the member may need. Members often encounter waiting lists for desired services.
- *Provides care coordination, nonemergent medical transportation, home modifications and caregiver support* for children with special health care needs. Some families have complained that they receive different or conflicting information from different members of the child’s care team.

The MCO decides to implement the following to further address the SDOH of members residing in Cluster 10 counties:

- *Train providers on SDOH screening tools.* The plan will continue to use the existing tools in each market rather than implement a standardized tool. This is because some providers in each market are already quite familiar with their assessment, and the plan has determined that each assessment covers at least the following categories:
 - Living situation (including utilities access)
 - Food security
 - Transportation access
 - Safety

The plan will focus training efforts on providers with the largest attributed membership. The goal is to train enough provider groups to cover at least 70% of the attributed membership in the targeted regions:

- *Expand CBO resources and partnerships* by working with the local social services department to identify new resources. The plan recognized that the CBO database and referral program in more urban areas was much more expansive than in the more rural target areas, in part because of wider availability of resources in urban areas. Finding partner CBOs in rural areas will be more difficult than in more populated areas but could alleviate members’ waiting list burden.
- *Implement strategy to identify pregnant members with substance use disorder (SUD).* Prioritizing early identification of these members and targeting them for intervention may help reduce costs attributable to neonatal abstinence syndrome. SUD services are covered through managed care in this state, so claims data may be leveraged for this purpose. When members are identified, they will be assigned a care coordinator to manage their care through delivery and postpartum.

After the SDOH screening tool training initiative has been completed, the MCO will contact members to recommend an annual primary care checkup. Once the screening data are received, the MCO can leverage

their expanded CBO referral network to provide support to their at-risk membership, prioritizing members with the worst scores per the tool results.

Given its increased efforts to capture SDOH data through screening tools, the MCO also intends to lobby the state for inclusion of SDOH in the risk adjustment process. The MCO will continue to focus on its provider training efforts and increasing the SDOH screening tool completion rates. This will ensure a robust data capture process before any payment changes are implemented.

5.3 HEALTH PLAN SELF-INSURED STRATEGY

A large health plan has been working with its self-insured employers to develop a more member-focused approach to health care. Most of this effort has focused on member decision making. Do members comply with evidence-based guidelines? If not, why not and what can the employer or health plan do about it? It has become increasingly clear that the answer to these questions is dependent on the member's SDOH to some degree. With this in mind, the health plan is expanding its current strategy to include what is known and not known about SDOH. The current strategy includes consultative services, which promote good will between the client and the health plan, and buy-up programs, which add to the health plan's bottom line.

GOALS

Based on prior experience, the health plan expects that the questions employers will want answers to include the following:

- Why should I care about SDOH?
- What barriers to better health are my members experiencing?
- Are the barriers uniform across the board, or do we need to target certain locations and targets?
- How does my employee base compare to my peers'?
- What can I do about it?
- How do I know what works and what does not?
- What will my employees value as a benefit?
- Will I see a return on my investment, and, if so, how long will it take given the turnover in my population?

To answer those questions, the health plan will expand its current database and create a knowledge base with results of studies performed by the health plan or published by other organizations. The health plan will also create a standard set of exhibits for presenting the results to the employers.

DATA

The health plan has been accumulating data for many years now, including the following:

- *Claims and eligibility data:* Actuaries have access to detailed information about each member's age, gender, ZIP code and claims. The health plan has a grouper system that classifies the claims by episode.
- *Provider:* The data warehouse includes detailed information about each provider, including the type of provider and location. The data warehouse also has a geo-access program that calculates the distance from a member to a provider. This is commonly summarized using statistics such as "70% of the members live within five miles of a primary care doctor." It does not include other access information, such as the availability of public transportation.
- *Risk scores:* Prospective, concurrent and retrospective risk scores are available by member.

- *Evidence-based medicine (EBM) rules:* The health plan can determine whether a member has complied with each of the EBM rules applicable to their situation.
- *SDOH indicators:* The health plan has purchased a proprietary database that imputes certain socioeconomic SDOH to members, including income, ethnicity and education. The algorithm for the imputation is based primarily on factors such as geographic characteristics and last name. Over the years, the health plan has been able to compare these data to self-reported data from their clients. The accuracy rate is in the 80% to 90% range.
- *Activities and outcomes:* The health plan tracks activities and outcome related to the outreach efforts they perform. For example, if a member completes an online course on nutritional counseling, then the health plan records that information for analysis later. Sometimes a client is willing to share information with the health plan. For example, if the employer sponsors a health fair, then the client may be willing to share the biometric results with the health plan, on a de-identified basis, of course. The health plan also has procedures in place to make sure that the data are not used for any purpose other than analytics.

The SDOH database does not include information about barriers to better health such as distance to a grocery store. The health plan will create a new geographic dataset with this type of information.

KNOWLEDGE BASE

To answer an employer’s questions, the health plan needs an understanding of what’s happening in general and what’s happening with respect to the employer. In this context, a knowledge base represents what the health plan knows about SDOH in general based on peer-reviewed, published articles and internal studies.

Cost and quality comparisons such as the one shown in Figure 5.1 are relatively easy to perform, and they provide great value, particularly in the beginning stages of developing the knowledge base. Of course, to be a valid comparison, the results must be normalized to account for differences in age, gender and other key variables.

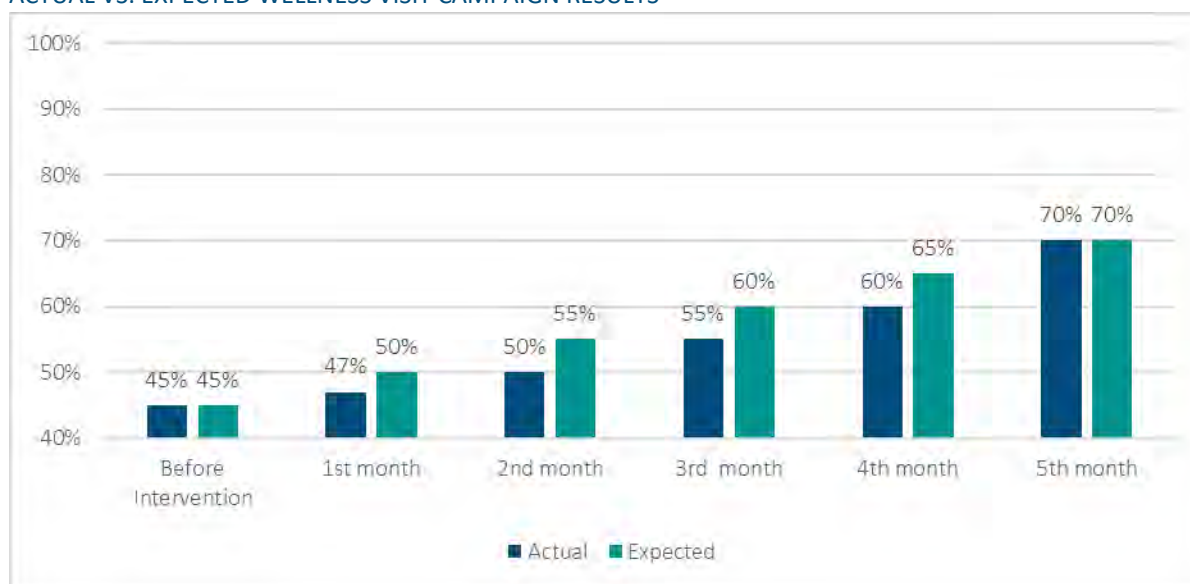
Figure 5.1
COST COMPARISON EXAMPLE



As experience emerges, more emphasis will be placed on how well any proposed interventions worked. Although standard methods of effectiveness, such as return on investment and statistical differences, are important to employers, they will also want some early indicators. The first available measure of effectiveness is some gauge of activity such as the one shown in Figure 5.2. In this example, the health plan expanded the number of ways that an adult member could get a wellness visit. The intervention included reduced copays for telemedicine visits and an expansion of its network. The results show that at the end of the second month after the change, actual compliance was below expected. At that point, they increased their communication efforts, which resulted in actual results catching up to what was expected.

Figure 5.2

ACTUAL VS. EXPECTED WELLNESS VISIT CAMPAIGN RESULTS



The health plan is planning on using common testing techniques, such as comparing key statistics for participants versus nonparticipants to determine the overall success of each intervention. The overall results will have to be adjusted to the circumstances relevant to each employer. For example, results will likely be very different for employers with high turnover compared to those with low turnover. This means that the results should be differentiated by members who are continuously enrolled in a study period, new entrants during the study period, and terminations during the study period.

Section 6: Acknowledgments

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Appendix A: Data Sources

The tables below include supporting detail as well as links to the data dictionaries and methodology summaries for the data sources used to create our database. The “Additional Notes” section of the tables includes detail regarding specific data limitations, where applicable. For example, some data sources did not have data available as recently as calendar year 2019, so older data were used. Other sources of data, both specialized and composite, will be noted in the companion paper.

TABLE A-1: CENSUS DATA FROM THE U.S. CENSUS BUREAU

Attribute	Value
Data Category	Census Data
Source	https://www.census.gov/data/tables/time-series/demo/popest/2010s-counties-detail.html
Source Ownership	U.S. Census Bureau, Population Division
Table Name	CC-EST2019-ALLDATA
Methodology Reference	https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2010-2019/natstcopr-methv2.pdf
Data Dictionary	https://www2.census.gov/programs-surveys/popest/technical-documentation/file-layouts/2010-2019/cc-est2019-alldata.pdf
Last Updated	Apr. 20, 2021
Last Accessed	Aug. 27, 2021
Additional Notes	N/A

TABLE A-2: FEE-FOR-SERVICE MEDICARE DATA FROM THE CENTERS FOR MEDICARE AND MEDICAID SERVICES

Attribute	Value
Data Category	Medicare Costs
Source	https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/GV_PUF
Source Ownership	Centers for Medicare and Medicaid Services
Table Name	State County All Table 2019
Methodology Reference	https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/Downloads/Geo_Var_PUF_Methods_Paper.pdf
Data Dictionary	Included with Methodology
Last Updated	Mar. 24, 2021
Last Accessed	Aug. 27, 2021
Additional Notes	Does not exclude data for beneficiaries who died during the study year.

TABLE A-3: FOOD ACCESS DATA FROM THE U.S. DEPARTMENT OF AGRICULTURE

Attribute	Value
Data Category	Access to Food
Source	https://www.ers.usda.gov/data-products/food-environment-atlas/data-access-and-documentation-downloads/
Source Ownership	U.S. Department of Agriculture, Economic Research Service
Table Name	FoodEnvironmentAtlas
Methodology Reference	https://www.ers.usda.gov/webdocs/publications/82101/eib-165.pdf?v=5676.4
Data Dictionary	Included in separate file on the Source page
Last Updated	Sept. 10, 2020
Last Accessed	Aug. 27, 2021
Additional Notes	Data are applicable to calendar year 2015. Data are missing or suppressed for about 1% of counties.

TABLE A-4: FOOD INSECURITY DATA FROM FEEDING AMERICA

Attribute	Value
Data Category	Food Insecurity
Source	https://www.feedingamerica.org/research/map-the-meal-gap/by-county
Source Ownership	Feeding America
Table Name	MMG20XX_20YYData_ToShare (20XX is publication year, 20YY is as-of year)
Methodology Reference	https://www.feedingamerica.org/sites/default/files/2020-06/Map%20the%20Meal%20Gap%202020%20Technical%20Brief.pdf
Data Dictionary	Included in Excel file with the data
Last Updated	May 19, 2021
Last Accessed	Aug. 27, 2021
Additional Notes	Data must be requested, cannot just be downloaded.

TABLE A-5: BROADBAND ACCESS DATA FROM BROADBANDNOW.COM

Attribute	Value
Data Category	Broadband Access
Source	https://raw.githubusercontent.com/BroadbandNow/Open-Data/master/broadband_data_opendatachallenge.csv
Source Ownership	BroadbandNow.com
Table Name	Broadband_data_opendatachallenge
Methodology Reference	https://broadbandnow.com/research/data
Data Dictionary	https://github.com/BroadbandNow/Open-Data/blob/master/README.md
Last Updated	Jan. 8, 2021
Last Accessed	Aug. 27, 2021
Additional Notes	Data available at the ZIP code level and so were aggregated to county level. FIPS code is not available and must use a combination of county name and state name for county mapping purposes. Data are as of June 2019.

TABLE A-6: HEALTH OUTCOMES AND RISK FACTORS FROM THE CDC'S PLACES PROJECT

Attribute	Value
Data Category	Health Outcomes and Risk Factors
Source	https://chronicdata.cdc.gov/browse?category=500+Cities+%26+Places
Source Ownership	Centers for Disease Control and Prevention (CDC), the Robert Wood Johnson Foundation, the CDC Foundation
Table Name	PLACES: Local Data for Better Health, County Data 2020 release
Methodology Reference	https://www.cdc.gov/places/methodology/index.html
Data Dictionary	https://www.cdc.gov/places/measure-definitions/index.html
Last Updated	Mar. 17, 2021
Last Accessed	Aug. 27, 2021
Additional Notes	Data sources include Behavioral Risk Factor Surveillance System (BRFSS) 2018 or 2017 data, Census Bureau 2018 or 2017 county population data, and American Community Survey (ACS) 2014–2018 or 2013–2017 estimates. Data for calendar year 2019 are not yet available.

TABLE A-7: ECONOMIC STATISTICS FROM VARIOUS SOURCES, COMPILED BY THE U.S. DEPARTMENT OF AGRICULTURE

Attribute	Value
Data Category	Economic Statistics
Source	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/
Source Ownership	U.S. Department of Agriculture, Economic Research Service
Table Name	Unemployment and median household income for the U.S., States, and counties, 2000-20
Methodology Reference	https://www.ers.usda.gov/data-products/county-level-data-sets/documentation/
Data Dictionary	Included in Excel file with data
Last Updated	June 2, 2021
Last Accessed	Aug. 31, 2021
Additional Notes	Data are compiled from multiple sources as discussed in the above link provided for the Methodology Reference.

TABLE A-8: EDUCATION STATISTICS FROM THE U.S. DEPARTMENT OF AGRICULTURE

Attribute	Value
Data Category	Education
Source	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/
Source Ownership	U.S. Department of Agriculture, Economic Research Service
Table Name	Educational attainment for the U.S., States, and counties, 1970-2019
Methodology Reference	https://www.ers.usda.gov/data-products/county-level-data-sets/documentation/
Data Dictionary	Does not appear to be available from USDA; one needs to refer to American Community Survey (ACS) documentation
Last Updated	Feb. 24, 2021
Last Accessed	Aug. 31, 2021
Additional Notes	Estimates are five-year averages from 2015–2019 from the American Community Survey.

TABLE A-9: POVERTY STATISTICS FROM THE U.S. DEPARTMENT OF AGRICULTURE

Attribute	Value
Data Category	Poverty
Source	https://www.ers.usda.gov/data-products/county-level-data-sets/download-data/
Source Ownership	U.S. Department of Agriculture, Economic Research Service
Table Name	Poverty estimates for the U.S., States, and counties, 2019
Methodology Reference	https://www.ers.usda.gov/data-products/county-level-data-sets/documentation/
Data Dictionary	Included in Excel file with data
Last Updated	Jan. 5, 2021
Last Accessed	Aug. 31, 2021
Additional Notes	Data are compiled from the U.S. Department of Commerce, Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program .

TABLE A-10: MEDICARE HEALTH CARE QUALITY FROM THE DARTMOUTH ATLAS OF HEALTH CARE

Attribute	Value
Data Category	Health Care Quality
Source	https://data.dartmouthatlas.org/post-discharge/
Source Ownership	Dartmouth Atlas
Table Name	county_postdis_6599ffs_2017
Methodology Reference	https://data.dartmouthatlas.org/downloads/reports/Post discharge events 09281 1.pdf
Data Dictionary	Included in separate file on the Source page
Last Updated	June 2, 2020
Last Accessed	Aug. 31, 2021
Additional Notes	High percentage of missing/suppressed data for many quality indicators in the Atlas. Most recent data are for calendar year 2017.

TABLE A-11: ECONOMIC STATISTICS FROM THE U.S. DEPARTMENT OF AGRICULTURE

Attribute	Value
Data Category	Economic Statistics
Source	https://www.ers.usda.gov/data-products/county-typology-codes/
Source Ownership	U.S. Department of Agriculture, Economic Research Service
Table Name	ERSCountyTypology2015Edition
Methodology Reference	https://www.ers.usda.gov/data-products/county-typology-codes/documentation/
Data Dictionary	Included in Excel file with data
Last Updated	May 31, 2017
Last Accessed	Aug. 31, 2021
Additional Notes	Typologies intended for nonmetro analysis and may not be as useful for metro. Data source was the 2008–2012 ACS survey.

TABLE A-12: HEALTH CARE ACCESS AND DEMOGRAPHICS STATISTICS FROM THE HEALTH RESOURCES AND SERVICES ADMINISTRATION'S AREA HEALTH RESOURCES FILES

Attribute	Value
Data Category	Health Care Access, Demographics
Source	https://data.hrsa.gov/data/download?data=AHRF#AHRF
Source Ownership	Health Resources and Services Administration
Table Name	ahrf2019
Methodology Reference	Included in separate file on the Source page, under "Technical documentation"
Data Dictionary	Included in separate file on the Source page, under "Technical documentation"
Last Updated	July 21, 2020
Last Accessed	Aug. 31, 2021
Additional Notes	The data are available in SAS and ASCII format only (very large file). Data are typically released each summer. 2018–2019 dataset was used rather than the 2019–2020 dataset to avoid any COVID-19-related issues in the data. The data in these files are compiled from many disparate sources.

TABLE A-13: UNINSURED RATE FROM THE SMALL AREA HEALTH INSURANCE ESTIMATES

Attribute	Value
Data Category	Health Care Access
Source	https://www.census.gov/data/datasets/time-series/demo/sahie/estimates-acs.html
Source Ownership	U.S. Census Bureau
Table Name	Sahie_2019
Methodology Reference	https://www.census.gov/programs-surveys/sahie/technical-documentation/methodology/methodology-2008-2019.html
Data Dictionary	Included in file with data
Last Updated	Mar. 1, 2021
Last Accessed	Sept. 13, 2021
Additional Notes	Modeled estimates are derived from the ACS for 2008 and later. Some results have been adjusted so that in aggregate the estimates tie back to expected state or national totals.

Appendix B: Variables

Table B-1 includes a data dictionary for the variables included in the database compiled for Section 2. The variable names shown are not the actual names used in our database, but rather the plain-English description of the data represented by the variable. Longer descriptions are also provided for each variable in the “Definition” column. Variables marked with an asterisk were used in the cluster analysis. Variables marked with two asterisks were used to rank the clusters.

More detail regarding the sources of each of these variables can be found in Appendix A. A mapping to the corresponding Appendix A table for each variable is provided in the “Appendix A Detail” column in Table B-1. All data apply to calendar year 2019 and are supplied at the county level (in addition to more granular detail, in some cases) unless otherwise noted in the corresponding table in Appendix A.

As in the main body of the report, the term “ACS” refers to the American Community Survey.

TABLE B-1: SECTION 2 DATA DICTIONARY

Data Domain	Variable	Definition	Appendix A Detail
ID	County Name	Full U.S. county name (includes LA parishes etc.)	Table A-1
ID	FIPS Code	Five-digit FIPS code. Unique ID for U.S. counties.	Table A-1
ID	State Name	Full U.S. state name (includes District of Columbia)	Table A-1
Health Care Access	Dental Care Shortage*	County flagged for full or partial dental practitioner shortage based on provider-to-population ratio and other criteria	Table A-12
Health Care Access	Mental Health Care Shortage*	County flagged for full or partial mental health practitioner shortage based on provider-to-population ratio and other criteria	Table A-12
Health Care Access	PCP Shortage*	County flagged for full or partial primary care provider shortage based on provider-to-population ratio and other criteria	Table A-12
Health Care Access	Uninsured Rate	Percent of population (age < 65) who report having no current health insurance at time of interview	Table A-13
Health Care Access	Adult Uninsured Rate*	Percent of adults (age 18–64) who report having no current health insurance at time of interview	Table A-13
Health Care Access	Child Uninsured Rate	Percent of children (age < 19) reported to have no current health insurance at time of interview	Table A-13
Health Care Costs	Medicare FFS PMPM*	Risk-adjusted, standardized per-capita fee-for-service (FFS) Medicare per-member-per-month (PMPM) costs	Table A-2

Health Care Outcomes	Cancer Prevalence**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have cancer (excludes skin cancer)	Table A-6
Health Care Outcomes	Diabetes Prevalence**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have diabetes (excludes gestational diabetes)	Table A-6
Health Care Outcomes	High Blood Pressure Prevalence**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have high blood pressure (excludes borderline hypertension and women with high blood pressure during pregnancy)	Table A-6
Health Care Outcomes	Mental Health**	Percent of adults (age ≥ 18) who report 14 or more days during the past 30 days during which their mental health was not good	Table A-6
Health Care Outcomes	Physical Health**	Percent of adults (age ≥ 18) who report 14 or more days during the past 30 days during which their physical health was not good	Table A-6
Health Care Outcomes	Arthritis**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have arthritis	Table A-6
Health Care Outcomes	Current Asthma**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have asthma and report that they still have asthma	Table A-6
Health Care Outcomes	High Cholesterol**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have high cholesterol	Table A-6
Health Care Outcomes	Chronic Kidney Disease**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have kidney disease	Table A-6
Health Care Outcomes	Chronic Obstructive Pulmonary Disease**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have COPD, emphysema or chronic bronchitis	Table A-6
Health Care Outcomes	Coronary Heart Disease**	Percent of adults (age ≥ 18) who report having been told by a health professional that they have angina or coronary heart disease	Table A-6
Health Care Outcomes	Teeth Lost**	Percent of seniors (age (age ≥ 65) who report having lost all their teeth due to tooth decay or gum disease	Table A-6
Health Care Outcomes	Stroke**	Percent of adults (age ≥ 18) who report having been told by a health professional that they had a stroke	Table A-6

Health Care Quality	Ambulatory Visits	Percent of FFS Medicare patients having an ambulatory visit within 14 days of discharge following medical admission	Table A-10
Health Care Quality	ED Visits	Percent of FFS Medicare patients having an emergency department (ED) visit within 30 days of discharge following medical admission	Table A-10
Health Care Quality	PCP Visits	Percent of FFS Medicare patients visiting a primary care clinician within 14 days of discharge following medical admission	Table A-10
Health Care Quality	Readmissions	Percent of FFS Medicare patients readmitted within 30 days of discharge following medical admission	Table A-10
Health Care Quality	Prevention: Female*	Percent of females (age ≥ 65) reporting having received the services described in "Prevention: Male" plus a mammogram in past two years	Table A-6
Health Care Quality	Prevention: Male*	Percent of males (age ≥ 65) reporting having received all the following: an influenza vaccination in the past year; a pneumococcal vaccination ever; and either a fecal occult blood test (FOBT) within the past year, a sigmoidoscopy within the past five years and a FOBT within the past three years, or a colonoscopy within the past 10 years	Table A-6
Health Care Quality	BP Medication Adherence*	Percent of adults (age ≥ 18) with high blood pressure who report taking blood pressure medication	Table A-6
Health Care Quality	Routine Checkup*	Percent of adults (age ≥ 18) who report having received a routine checkup in the past year	Table A-6
Health Care Quality	Dental Visit*	Percent of adults (age ≥ 18) who report having been to the dentist in the past year	Table A-6
Health Care Quality	Mammogram*	Percent of females aged 50–74 who report having had a mammogram in the prior two years	Table A-6
Risk Factors	Binge drinking*	Percent of adults (age ≥ 18) who report having ≥ 5 drinks (men) or ≥ 4 drinks (women) on an occasion in the past 30 days	Table A-6
Risk Factors	Obesity*	Percent of adults (age ≥ 18) with a body mass index ≥ 30 kg/m ²	Table A-6
Risk Factors	Smoking*	Percent of adults (age ≥ 18) who smoked at least 100 cigarettes in their lifetime and currently smoke every day or some days	Table A-6
SDOH	Broadband Access*	Percent of the population that has access to terrestrial (wired + fixed wireless) broadband (minimum 25 mbps download/3 mbps upload)	Table A-5

SDOH	Population	Census Bureau estimate of total population (inclusive of all ages)	Table A-1
SDOH	Non-English Speaking*	The percent of people (age ≥ 5) who speak English “not well” or “not at all,” per the 2013–2017 ACS	Table A-12
SDOH	Population Loss	Binary indicator of whether county lost population between 2000 and 2010 census	Table A-11
SDOH	Rural-Urban Continuum Code (2013)*	Classification scheme , which identifies metro areas by population size and nonmetro areas by degree of urbanization and adjacency to metro area. Consists of nine classifications.	Table A-7
SDOH	Urban Influence Code (2013)	Classification scheme , which identifies metro areas by population size and nonmetro areas by size of largest city/town and proximity to metro/micropolitan area. Consists of 12 classifications.	Table A-7
SDOH	Economic Typology Code*	Nonoverlapping economic-dependence county indicator. 0 = Nonspecialized, 1 = Farm, 2 = Mining, 3 = Manufacturing, 4 =Federal/State government, 5 = Recreation	Table A-11
SDOH	Median Income	Median household income per the U.S. Census Bureau’s Small Area Income and Poverty Estimate program	Table A-7
SDOH	Unemployment Rate*	Percent of civilian labor force, which is unemployed, per the Bureau of Labor Statistics Local Area Unemployment Statistics	Table A-7
SDOH	Education Index*	Weighted average index denoting highest level of education achieved, 1 = Less than high school, 2 = High school or GED, 3 = Some college, 4 = Bachelor’s degree or higher	Table A-8
SDOH	Low Food Access: All	Percentage of people in a county living more than one mile from a supermarket or large grocery store if in an urban area, or more than 10 miles from a supermarket or large grocery store if in a rural area	Table A-3
SDOH	Low Food Access: Child	Percentage of children (age < 18) in a county with low food access (using the criteria specified in “Low Food Access: All”)	Table A-3
SDOH	Low Food Access: Senior	Percentage of seniors (age > 64) in a county with low food access (using the criteria specified in “Low Food Access: All”)	Table A-3
SDOH	Low Food Access: SNAP	Percentage of housing units in a county receiving SNAP benefits and more than one mile from a supermarket or large grocery store	Table A-3

SDOH	Low Food Access and Low Income	Percentage of people in a county with low income and low food access (using the criteria specified in “Low Food Access: All”)	Table A-3
SDOH	Low Food Access and No Vehicle*	Percentage of housing units in a county without a car and more than one mile from a supermarket or large grocery store	Table A-3
SDOH	Food Insecurity*	Percentage of county inhabitants who are food insecure	Table A-4
SDOH	Food Insecurity: Child	Percentage of children (age < 18) who are food insecure	Table A-4
SDOH	Persistent Child Poverty	County flagged as persistent poverty if ≥ 20% residents (age < 18) were poor in the 1980, 1990 and 2000 censuses and the 2007–2011 ACS	Table A-11
SDOH	Persistent Poverty*	County flagged as persistent poverty if ≥ 20% residents were poor in the 1980, 1990 and 2000 censuses and the 2007–2011 ACS	Table A-11
SDOH	Child Poverty Rate	Estimated percent of people aged 0–17 in poverty	Table A-9
SDOH	Poverty Rate*	Estimated percent of people of all ages in poverty	Table A-9

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