



Social, Physical and Cultural Determinants of Health

Their Incorporation into Actuarial Data and
Workstreams

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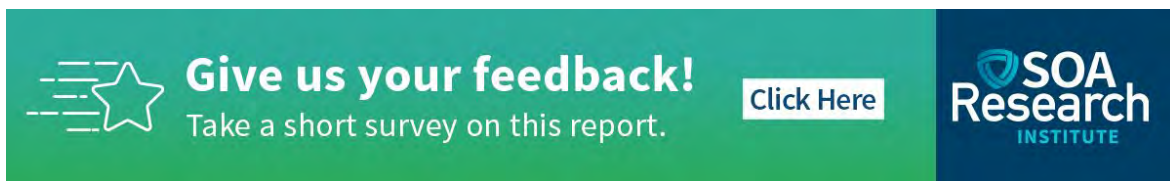
Social, Physical and Cultural Determinants of Health: Their Incorporation into Health Care Data and Actuarial Workstreams

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Social, Physical and Cultural Determinants of Health: Their Incorporation into Health Care Data and Actuarial Workstreams

Executive Summary

This report provides actuaries and other professionals working with risk, data and analytics or program evaluation in the health care space with considerations and frameworks related to the use of determinants of health (DOH), also sometimes more narrowly defined as social determinants of health (SDOH), in data and actuarial work streams. Such frameworks can leverage new data sources to enrich health care data analysis to move beyond traditional data elements, such as age, gender, zip code or health diagnosis.

The report outlines the following key insights:

- Data on DOH are evolving but still fragmented and inconsistent. The user of data must carefully consider which sources to use—including primary and secondary sources—and how to use the data from these sources.
- A companion report, "[How Does Where You Live Impact Your Health?](#)," provides further detail on specific quantitative and other methods that can be used.
- The new DOH ecosystem includes data organizations, social health and resource providers (SHARPs) and community benefit organizations (CBOs) as well as insurers, health systems and other providers of care. The growth of this ecosystem in recent years has been fueled by investment from many new sources such as private equity.
- This growth has spurred the need to evaluate programs and providers that address DOH. However, traditional models for evaluation, including strict requirements for financial return on investment, may not be appropriate in the context of DOH, and new frameworks can assist actuaries and other professionals in adapting traditional evaluation models or creating new models.
- Traditional workstreams such as pricing, reserving, risk adjustment and evaluation may be enhanced by incorporating DOH data. Various population types—including Medicaid, Medicare Advantage, commercially insured, employee health plans and alternative payment models—all have nuances and context that drive how DOH data are incorporated.
- Adding DOH data to already complex data structures and models introduces new ethical and practical considerations. Any user of SDOH data should use fairness tools and tests to understand the downstream impacts of the data in the outcomes for the populations within the data.
- Finally, when DOH are taken into account, it is imperative that the actuary or other professional remember that the data originate from human beings and drive outcomes that affect these same people. Care must be taken to understand how and why the data exist, and the downstream effects of the use of those data.

Section 1: Introduction

Anya, 40 years old, is a single mother of two and lives in an apartment in a small town in a rural part of Anystate, USA. She is a high school graduate, and English is not her primary language. The local community hospital recently shut down, the nearest pharmacy is a 30-minute drive and has reduced pharmacy hours because of a lack of pharmacists, and the sole, short-staffed health clinic in town is only open weekdays from 10 am to 5 pm. The local grocery store has inconsistent and expensive fresh produce, meat and dairy, despite the fact that most community residents work in the farming industry.

Anya usually works about 50 hours per week as a checkout clerk at the nearby big-box hardware store in the next town and has health insurance through her employer. Because she is an hourly employee, she pays about 40% of the premium of her health plan, the cheapest high-deductible plan, which has a narrow preferred provider organization (PPO) network. She was diagnosed with hypertension last year when she went to the emergency room for stitches in her finger. She has not visited a primary care provider in several years, due in part because she does not want to take time off from work, and also because she is not fluent in English. During her last visit, the only words she understood were that she needed to get more exercise. Anya would like to take more walks, but she usually spends her evenings cooking and caring for her aging father. Also, she worries about bringing her children out to play or take walks because their apartment building does not have sidewalks and is next to a highway.

Ann, also 40, also a single mother of two, lives on the other edge of the same county about 40 miles away. She has a college degree and is a native English speaker. Two major hospitals are within 10 miles as well as many clinics with both specialists and primary care physicians, pharmacies and grocery stores in her wealthy outlying collar suburb.

Ann also works about 50 hours per week as a vice president at the corporate headquarters of the same big-box hardware store and is enrolled in her company's low-deductible PPO plan. As a salaried employee, she pays about 20% of the premium. She was diagnosed with hypertension last year during her regular annual visit with her primary care doctor, a woman she has known since they became friends in college. Ann exercises two or three times per week at the gym on-site at her office, and her parents pick up her children at day care on the evenings when she goes to the gym.

Throughout this report short case studies are presented in call-out boxes such as this one, to illustrate how people or organizations have successfully (or unsuccessfully) navigated DOH for better (or worse) health outcomes. All names are fictional.

Many characteristics of these two women look remarkably similar, especially if one considers their health care data points: same age, same gender, similar geography, similar health care diagnoses. But clearly their determinants are not the same, and when their health insurance carrier attempts to project their future needs, outcomes and costs, how will it account for these differences?

An actuary using traditional data sources and models will miss an opportunity to differentiate predictions of outcomes for these two women, as measured, for example, by health care utilization and cost, which drive much of the work of actuaries and other professionals in health care. Such predictions can help allocate resources more appropriately and efficiently, but one must go a step further and understand that neglecting to recognize differences in determinants of health (DOH) can actually *cause* resources to be allocated inappropriately.

Therefore, as additional data sources and new research have emerged to measure determinants other than the traditional variables of age, gender and zip code, actuaries and other data professionals working in health care must consider how to incorporate these novel types of data. In addition, working with programs that address DOH presents an opportunity for actuaries and other professionals to evaluate these programs, measure their effectiveness and understand how they can affect other actuarial workstreams such as pricing and valuation.

Deborah's Story

Throughout this report, the story of Deborah will also be highlighted, a woman who lives in a New England metro area with her partner and daughter. Deborah's challenges and triumphs throughout her life remind us that the data used for modeling and projections come from real human beings doing their best to live their lives.

Deborah's story is shown in boxes of a different color than the other case study examples to make it easier to tie together her story.

The authors use the broad term "determinants of health" (DOH) instead of the more commonly used "social determinants of health" (SDOH) to ensure determinants are captured that might not always be considered social determinants, such as environmental, cultural or geographical determinants. The World Health Organization defines DOH as including "social and work environment, the physical environment and the person's individual characteristics and behaviors."¹ DOH and SDOH have been defined in many other excellent sources as well.^{2,3 4,5}

In this report the authors attempt to provide actuaries and other health care professionals with frameworks in which to consider DOH. These frameworks relate to sources of data, the evolving ecosystem of organizations that help address DOH, measurement and evaluation of DOH programs and incorporation of DOH into actuarial workstreams. We conclude with the extremely important area of ethical considerations that must be taken into account. Underlying everything that is done, especially when actuaries work with the frequently sensitive areas of DOH, one must remember that the work always relates back to human beings, who must be treated, as well as their data, respectfully in all cases.

This report is written for an audience of health actuaries and their principals, analytics professionals, medical economic teams, policymakers, health departments, funders, clinicians and people involved in programs to improve the quality of health systems.

¹ World Health Organization, Determinants of Health, <https://www.who.int/news-room/questions-and-answers/item/determinants-of-health> (accessed Jan. 2023).

² U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, What Are Social Determinants of Health, Healthy People 2030, Social Determinants of Health, <https://health.gov/healthypeople/priority-areas/social-determinants-health> (accessed Jan. 2023).

³ Artiga and Hinton, Kaiser Family Foundation, Racial Equity and Health Policy, Beyond Health Care: The Role of Social Determinants in Promoting Health and Equity, <https://www.kff.org/racial-equity-and-health-policy/issue-brief/beyond-health-care-the-role-of-social-determinants-in-promoting-health-and-health-equity/> (accessed Jan. 2023).

⁴ Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Equitably Addressing Social Determinants of Health and Chronic Diseases, <https://www.cdc.gov/chronicdisease/programs-impact/sdoh.htm> (accessed Jan 2023)

⁵ World Health Organization, Determinants of Health, <https://www.who.int/news-room/questions-and-answers/item/determinants-of-health> (accessed Jan. 2023).

This report was developed based on the authors' own experiences working with DOH data and programs, as well as interviews with 15 people—actuaries and others—in various roles with health insurance payers, data organizations and consulting firms and as people navigating DOH in their daily lives. A list of people interviewed is included in Appendix 3.

A companion report entitled "[How Does Where You Live Impact Your Health?](#)" which was published in early 2022, uses innovative quantitative methods to demonstrate the impact of geography on DOH and provides examples of how payers and providers can use such methods to address DOH.

The authors are grateful for the time and contributions of these individuals, especially to Dr. Natalie Kane and Dr. Sarah Martin of SDOH data provider mySidewalk, who provided additional background in the Data Resources section, as well as several of the case studies that are called out throughout this report.

The authors are also deeply grateful to "Deborah," whose story is woven throughout this report.

Introduction to "Deborah"

Deborah is in her late 40s and has several health conditions, including cerebral palsy, asthma and chronic pain. She entered the foster care system as a child and remained in that system until adulthood. She has one daughter, Jackie, who is nine years old, and they live together with Jackie's father. She participates in the SNAP program in her state and has health coverage through a Medicaid managed care organization (MCO). Although she has been diagnosed in the past with a cognitive disability, Deborah very clearly understands her health care diagnoses and those of her daughter.

Section 2: Discussion of Data Resources

Actuarial work, particularly in health care, relies on data to feed models and to provide relative statistical measures; data that relate to the impacts of issues exogenous to medical treatment, such as DOH, are no different—except that such data are very different. Whereas claims and enrollment information are clearly defined quantities and values that have developed over decades for actuarial work, up to now the data elements used to describe SDOH and other DOH have not been not so easily corralled into clear definitions and usable components. However, DOH characteristics cannot be ignored because it is known that DOH contribute to health outcomes and health care costs, they help identify health care access and quality disparities, and they provide insight into the risk factors for chronic disease and acute care costs. This section discusses primary and secondary data sources that track the characteristics and create a composite picture of populations and assign to them some sort of quantitative value.

WHAT DATA SHOULD BE USED AND WHY BOTHER?

One can give a simple but profound answer to this question. The actuary should use data that suit the task and provide sufficient additional insight and explanatory power to warrant the expense and effort needed to acquire the data. This is not an easy decision nor are the full solutions likely to fuse seamlessly into the actuarial process initially. Often the insight is better known as hindsight, and sometimes the insight is a result of study and some luck. Two examples, common in informal scientific discussions, can help illustrate this decision process. First, those who make decisions based solely on quantitative measures have fallen victim to the McNamara Fallacy, which in this context warns that failure to consider qualitative measures—such as the health effects of where a person lives, works and plays—may lead to poor decision making. Second, those who construct business models using only data that are available—and easy to use—have fallen victim to the Drunkard’s Search fallacy. Just because what one has at hand or is given to use is a tempting place to stop, if gaps in knowledge are known, one should seek to fill them.

When choosing a data source, the actuary or analyst should ensure that it contains strong drivers even though it might be a challenge to apply the results to their work.

PRIMARY SOURCES VS SECONDARY/COMPILED SOURCES VS PURCHASED MODELS

So many sources of data are available on DOH, often in isolated localized format. Currently no certainty exists that any data element will be consistently defined or coded between different entities. Think of a DOH and one will find some entity collecting relevant data. County public health departments, school districts, advocacy groups, visiting nurse logs, law enforcement organizations and the courts, even employers have their own information that is not connected to anything else. DOH are informative, focus on local issues and, as of now, are inaccessible and unconnected. Much of the primary data are self-reported data, which may reflect personal perspectives. Other data sets have more broad geographic coverage and are available for access to anyone who has the capability and the desire to work with them. Examples of these are the American Community Survey or the U.S. Census. Other national databases may focus on just one portion of the DOH, such as the location of pharmacies, eviction rates or food deserts. These are appearing regularly and are often full of informed and interesting data that beg to be considered when thinking about the impact and variability of DOH.

All of these are primary sources of data, and they are the basis for nearly all the work in quantifying the impact of DOH on health expenditures and outcomes. The companion report [“How Does Where You Live Impact Your Health?”](#) has a comprehensive guide to using data sources at a primary level, and the authors encourage the reader interested in creating their own compilation to read the paper.

Although some actuaries will be able to spend the time looking at primary and nearly primary sources of data and composing their own indexes, most practicing actuaries will have neither the resources nor the ability to maintain an ongoing best practice index. Think of how difficult it is to apply a risk adjustment method when the input variables are diagnosis/drug, age, gender, cost and maybe a few other indicators, and the output is expected spend. Actuaries will generally need to use secondary sources rather than primary ones.

A secondary or compiled source takes a subset of these primary sources and compiles them into a global measure of the relative intensity of the DOH for a given subset. In general, secondary sources will assign a score or a grade to subsets of the studied areas, and the actuary would simply join the characteristic as recorded in their population of interest with the characteristic in the index and retrieve a value. Most of the DOH secondary sources use zip codes or other geography to which they assign a numerical value. Many of the DOH secondary source methods have not been constructed to follow health expenditure exactly but to return a measure of resource constraint that the actuary will use as a proxy for a status that is likely to experience less than optimal outcomes, either in the health of the person or in the cost of the care.

WHAT KINDS OF DATA ARE INCLUDED IN THESE MODELS?

The amount and variety of DOH measures are astounding, and therefore actuaries may want and need to use the results compiled in a secondary or proprietary data source. Seldom does one find a comfortable overlap of periods or definitions, and although most studies have a fairly regular update schedule, the discontinuities created by the COVID-19 pandemic have caused some updates to be skipped, and some measures will have discontinuities that will need to be dealt with.

Typical data elements come from the National Center for Health Statistics, which would be a source for premature mortality statistics or teen births. The Behavioral Risk Factor Surveillance System would be a source for self-reported data such as smoking prevalence or the average number of days of poor mental health. From the U.S. Diabetes Surveillance System, the measure might be of physical inactivity. From the USDA Food Environment Atlas one obtains a measure of the availability of healthy food. Access to primary physicians comes from the Area Health Resource File or from the National Provider Identification File. Income information comes from the American Community Survey. Violent crime statistics might come from the Federal Bureau of Investigation. There is a Safe Water Drinking Information system. The list grows and deepens.

Health Happens to People, Not Data: The Story of DJ

“DJ” was a 12-year-old Black child with a history of asthma who lived in a rental home on the east side of Kansas City, Missouri, with his father “Darren.” DJ was home sick from school and was in his room playing video games, while Darren cleaned out the basement of the house. The basement contained mold, and cleaning it released spores and dust into the air. This triggered an asthma attack, leading to DJ’s cardiac arrest and ultimately his death.

Asthma is a manageable disease, and housing is a modifiable risk factor. However, although housing may be modifiable in theory, and although housing is sometimes considered a “choice,” because of historical structural inequalities such as redlining and disinvestment in neighborhoods, for many people of color, healthy, affordable and stable housing options are severely limited. This is to say nothing of the toxic stress, inadequate access to health care, political inequality and economic challenges, all of which are driven by systemic racism and rooted in place.

In addition, identifying and responding to the needs of children and families at risk of housing injustice is complicated by a lack of high-quality data. Environmental risk factors at the household level are rarely, if ever, available in health care data sets or otherwise. And health systems do not consistently record deaths in electronic health records (EHRs). Furthermore, the event itself was likely buried in the EHR; asthma may have been listed as a diagnosis code, but the primary diagnosis and cause of death at the hospital would have been recorded as cardiac arrest, obscuring the incidence of death due to asthma.

SPATIAL DATA

Spatial data include any data resources with location information. Three main types of spatial data can be identified—point, line and polygon:

- Point data are based on latitude and longitude and could include things such as the location of a patient’s residential address or the physical location of a CBO.
- Line data may represent things such as transportation routes.
- Polygon data are the most common for DOH research and analysis and can include any area-based measure, such as Census tract demographics or county-level estimates for infant mortality. Although the individual level (e.g., address-level patient data) might be the ideal, the most readily available and reliable data on health outcomes and related risk factors are typically published at the community level.

The spatial scale of the data is important for identifying inequities, designing appropriate statistical analyses, and understanding the context and efficacy of DOH programs. The distribution of DOH, related health risks and access to relevant resources often exhibits substantial variation at the local level, within and between different communities.

Two key factors should be considered when using spatial data. The first is the Modifiable Areal Unit Problem, which describes how aggregating, or grouping, spatial data to an inappropriate geography can obscure important patterns in the local distribution of outcomes and risk factors. We see this clearly in the case of Flint, Michigan, where state analysts originally mapped the incidence of lead poisoning at the zip code geography. Zip codes for Flint include parts of both the city and the surrounding suburbs. Analysts could see rates were increasing generally, but it wasn’t until researchers mapped the data at the parcel (or residential) level that they could see the new lead poisoning was occurring only among children who lived within Flint city limits. This helped the researchers to identify the change in water supply as the cause of the lead exposure, because Flint has a different water supply than the surrounding suburbs.

Similarly, the second key factor when using spatial data is the Ecological Fallacy, which means that one assumes something about an individual based on group-level estimates, and this can introduce bias into statistical models and negatively impact intervention strategies. For example, a community may have a relatively high median household income, but that does not mean that a patient living in that area is not burdened by income inequality and related DOH. Similarly, someone may live near several grocers with healthy food options and not in a food desert but may not personally be able to afford to shop there. Exploring community indicator data is an important part of understanding inequities among patients and in the general population and can help guide DOH interventions and programs. Care should be taken when using those measures in statistical modeling and to inform decision making.

HOW CAN AND SHOULD THE DATA BE USED?

A quick refresher on some concepts in data might be in order as this report starts to examine the available data sources; even for those whose data expertise is strong it will serve as a reminder of what is needed when relative measures are established. First, this report considers the nature of the values of the variables in the data. Some measure values are continuous or nearly continuous, such as age or income. Continuous variables behave nicely in regression situations, and it is not hard to see how a model assigns values. Other variables have a list of values, such as race or gender. These do well in descriptive comparisons based on values, but for any individual or group of individuals, the values assigned may be inaccurate. This problem

can cause havoc with assigning DOH composite values as it does with any collection of heterogeneous components.

Consider the problem of a gentrifying neighborhood. The average income or house value for the neighborhood may be much higher than the median because the average disproportionately weights the highest values. If the average value is used as a basis for relative wealth of the location, an index using the average will miss the prevalence of low-income residents. Another example is a variable that is not consistent with a systemic difference within the resident population, such as access to dentists. Many dentists may practice within a region, but if they are not in preferred networks or do not accept Medicaid, a disconnect will exist between measured access and actual access for portions of the population. The score assigned here is “correct” for the neighborhood, but the underlying characteristics are masked.

Another issue is that the larger or broader the data collection, in terms of geography or demographic information, the more likely it is that a “score” will be systemically wrong for a subset. This is different from the issue with averages in which any individual in the average might not be well described (low R -squared on the predictive value of a prospective risk adjustment score for a male diabetic aged 44), in that an entire locale may not fit into the determinant scoring method because of a characteristic that is not included in the model. An example of this might be a small town in a rural area being apparently walkable because it is identified as rural with open space, but the town may not be walkable at all because the town has no sidewalks, is hemmed in by private property and is on a main two-lane rural highway, all things not captured by a model that asks only about rurality. The score assigned to this neighborhood is not correct.

An example of the problem of trying to find a balance between thousands of zip codes and the need to consolidate information to make workable models is the zip code series 97001 through 97089 in the state of Oregon. Zip code 97001 is for the town of Antelope (population 47), and zip code 97003 is for Beaverton (population 100,000). Antelope, a small ranching community in eastern Oregon, is a 3-1/2-hour drive from Beaverton, a part of the Portland metropolitan area. Using three-digit zip codes (or even two) to simplify modeling would lump these together.

DOH variables have problems with using self-reported survey responses too, although most good surveys are designed to overcome this challenge. If the relative score is based on a relative perception, this introduces instability into values based on responses. An example of this might be a question that asks about food insecurity. Here is an example question from a USDA food survey:

“(I/we) couldn’t afford to eat balanced meals.”

Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- Don’t know or Refused

The concern here is that this question is asking for the respondent to say what they felt like they could or could not afford and relies on the respondent's definition of a balanced meal, which may or may not coincide with the researcher's definition. Also, people with the same economic resources might answer this question very differently depending on other facts in their lives.

Focusing on SDOH and not including some physical or environmental DOH could lead to the exclusion of key contributors to health expense and health outcomes in the scores. For example, the impact of heat events, flood or forest fire on both direct health costs and SDOH such as housing uncertainty, provider access or food deserts means that the periods impacted by a climate event will not be adequately assessed. Water quality and pollutant levels also may or may not be captured in the social data collections, yet they are DOH.

Keep It Simple: Refrigerators as Medicine

One community leader has used data in simple, yet powerful, ways. She created profiles for each neighborhood, including a series of actionable data points related to needs and resources. When she walked through her report, other neighborhood leaders were shocked to find out how many homes in their neighborhood were estimated to have incomplete kitchen facilities, most notably a lack of working refrigerators. She was able to use her data to advocate for funding to deliver new refrigerators for those homes in need, thus enabling food security with a simple and relatively inexpensive solution.

A final caveat to using these models is to acknowledge that underneath all the DOH— which can often be nearly impossible to disentangle in terms of cause and effect—is the issue of racial disparities in overall well-being and in the effectiveness of the health delivery system.

SECONDARY SOURCES OF DATA

CHARACTERISTICS OF SECONDARY DATA SOURCES

A good and useful secondary data source should have several characteristics:

Consistency. A good secondary source should not have significant differences in data values for a population characteristic from period to period. For example, if in one period the safety measure scores are calculated using crime statistics generated by a national database and in a subsequent time period by compiling state data sources, it is possible that variations are introduced in the resulting scores that are not related to the actual hazard. Nor should the source have differences by major determinant measures across population groups. An example is a measure of housing uncertainty in a model that has results only from major urban centers or is missing some states. The conflicting issue with consistency is that this is emerging science, and it would be a pity to stay with an old measure when a much-improved method or index appears.

Family Stress Is Also an Important Determinant of Health

Deborah's daughter Jackie has been diagnosed with attention deficit hyperactive disorder (ADHD), oppositional defiant disorder (ODD) and a sensory disorder. Jackie struggles socially, at school and outside of school, especially since the COVID-19 pandemic. She has outbursts that can cause significant stress to Deborah, causing her pain to increase and her mental health to erode. Although she has read many brochures about managing a child with ADHD and ODD, she wishes she could find a support group of other parents.

Persistence. A persistent model is a must for actuaries who want to use scores to measure relative costs over a period or to measure the impact of interventions or to identify emerging issues. Right now, many organizations are developing their own deprivation indexes. Some may not last, especially if the champion who is developing the index currently leaves the organization. The best way to make sure that this is not a factor is to choose an index developed and maintained by an organization with a long-standing reputation of consistent work. This sort of indexing and

data source is an example of a public good and may well be most likely to be maintained by public health organizations or the federal government.

Comprehensiveness. The dataset should not leave out large portions of the population, nor should it overlook DOH that have been shown to be highly predictive of disparate health events and outcomes. An example of this is currently evident in the focus of the most popular indexes that focus only on the SDOH but do not include more geographic variations. As climate change creates regions with higher risk of events with health impacts, such as heat waves or loss of residence, models that do not reflect this issue will not be as comprehensive as they should be.

Robustness. When developing the models, the granularity of the data resource should be enough to stand up to the level of analysis the actuary will be using. Although it might be tempting to have an analysis at the zip code level, this will open the model up to instability and unexpected results, whereas being at a total county level may mean little real added value is to be gained from broad statistics concerning the county. An example of this is a fairly large county with dispersed population clusters, each too small to be stable, but with significant variations so that an average result describes none of the constituent parts.

Applicability. Most actuaries know that a unified risk model is not going to be a good match for any one population. Actuaries should understand if the scores or weights developed in the model are too general to be used to measure the status of their own particular population. It may be that the model was developed using characteristics of the entire population of the region, but the actuary is concerned with only the commercial employed population. Actuaries need to evaluate if the index they have chosen does a good job for their own needs.

Neutrality. At some point in any model construction, one will find a human deciding something. The best secondary sources will do their best to make sure that no bias is built into their models, but it may be difficult for the end user to identify if bias has been introduced by choice of variables or by clustering method or by data censoring or other means.

Version control. The best models will acknowledge that the newest model has changes and be very explicit about the changes, how they operate within the model and how the output of the models, the values, might have changed. If they are aware of user needs, they will retain access to prior models so that the user might be able to judge which best suits their needs—a measure consistent over time or a measure with more timely input.

Open and clear methodology. All of these factors suggest the importance of the user's having access to a clear and transparent documentation of the source materials, including the dates, the modeling methodology and any shortfalls or issues encountered in the construction of the index/models. Although the actuary may find that they do not want to spend a lot of time examining the development of the model, not being aware of the methods can lead to missing an issue—that may or may not be rectifiable. It is very important that the actuary knows when and how data values are imputed rather than measured. Imputation can stray from the mark. Also understanding how it was constructed may reassure an actuary that the model is sufficiently descriptive and the values are as appropriate as they can be. This may be an issue with proprietary models whose developers depend on the confidentiality of their methods to protect their product.

EXAMPLES OF SECONDARY SOURCES

The following is a small sampling of the types of resources available. This listing does not pretend to be exhaustive, nor does inclusion in this list constitute a gold star approval of the methods used to create them. All these indexes have flaws and imperfections, nor should an actuary use them in a misplaced belief

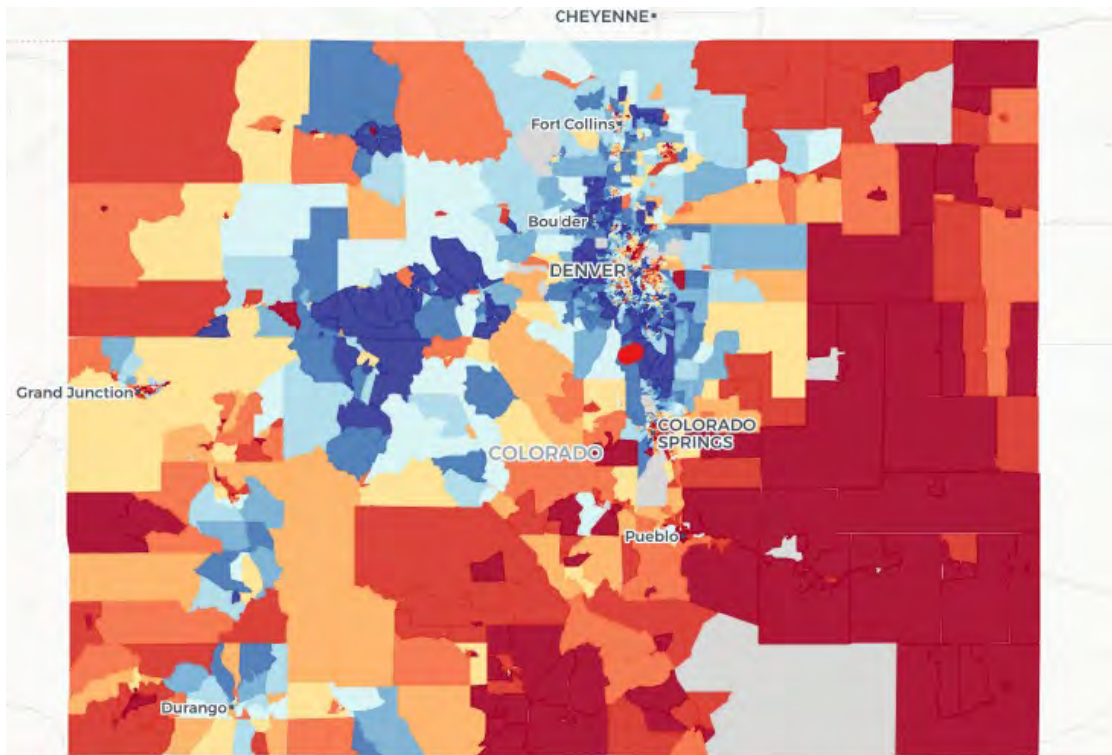
that they are going to solve all their problems with incorporating DOH measures into their workflow. They are popular and available and have been around for a long time, or the organizations that generate them appear to have committed resources for long-term support and improvement of their data. In most cases they support questions and are willing to show the methods and the values used to create their measures. An actuary using these indexes can be assured that they will be able to judge and assess the value of the measure they have chosen to use and will be part of a larger community of users who will be in active discussions about the usefulness and pitfalls inherent in these models.

The Neighborhood Atlas™ was created by and is maintained by the Center for Health Disparities Research at the University of Wisconsin School of Medicine and Public Health. It was launched in 2018 and has been available for public use since its inception. There is a 2015 and a 2020 version, with the American Community Survey data as a basis for the index.

The Area Deprivation Index (ADI) score is available by the Federal Information Processing Standard (FIPS) codes or zip code. The layout includes the zip code/FIPS and a national decile ranking and a state decile ranking. In this context the term “neighborhood” refers to a Census block group. Information about the methodology is best accessed through the change log on the site, but specifics on the methodology are difficult to access. The original idea came from a model developed by G. K. Singh published in 1990 that used 17 different markers of socioeconomic status as a means of understanding inequities in mortality.

An example of a state map of Colorado with decile information is shown in Figure 2-1.

Figure 2-1 ADI scores for Colorado (Source The Neighborhood Atlas™)



The dark red areas in Figure 2-1 correspond to areas with a state decile of 10, Most Deprived. Dark blue areas are those with a decile of 1, Least Deprived. Immediately the question about rurality emerges from the maps produced using ADI data.

County Health Rankings from the University of Wisconsin Population Health Institute use seven variables including state, county, FIPS and year. The rankings include measures about the following:

- Health outcomes such as length of life and quality of life,
- Health factors such as smoking, food environment and teen births,
- Clinical care such as access to care,
- Social and economic factors such as education or community safety,
- Physical environment such as transport housing or air quality and
- Demographics including populations, percent over 65.

Counties are ranked within each state by health outcomes and health factors; quartiles are also reported, as are each measure. The data are easy to read and to look at, but perhaps not as easy to implement in an actuarial setting.

The Social Vulnerability Index is created and maintained by the Agency for Toxic Substances and Disease Registry. Social vulnerability refers to the potential negative effects on communities caused by exogenous stresses on human health, such as natural or human-caused disasters or epidemics. It uses Census variables to measure communities that are not resilient in the face of disasters. These measures often align with those that predict poorer health outcomes. The data downloads are very detailed with both state and national rankings for all variables in the 15 “themes” of the modeling. This allows the user to choose which components they would choose to use without needing to construct their own index. The data are as of 2018, so they are dated, but the good thing about this site is the discussion and the documentation of methodology and issues.

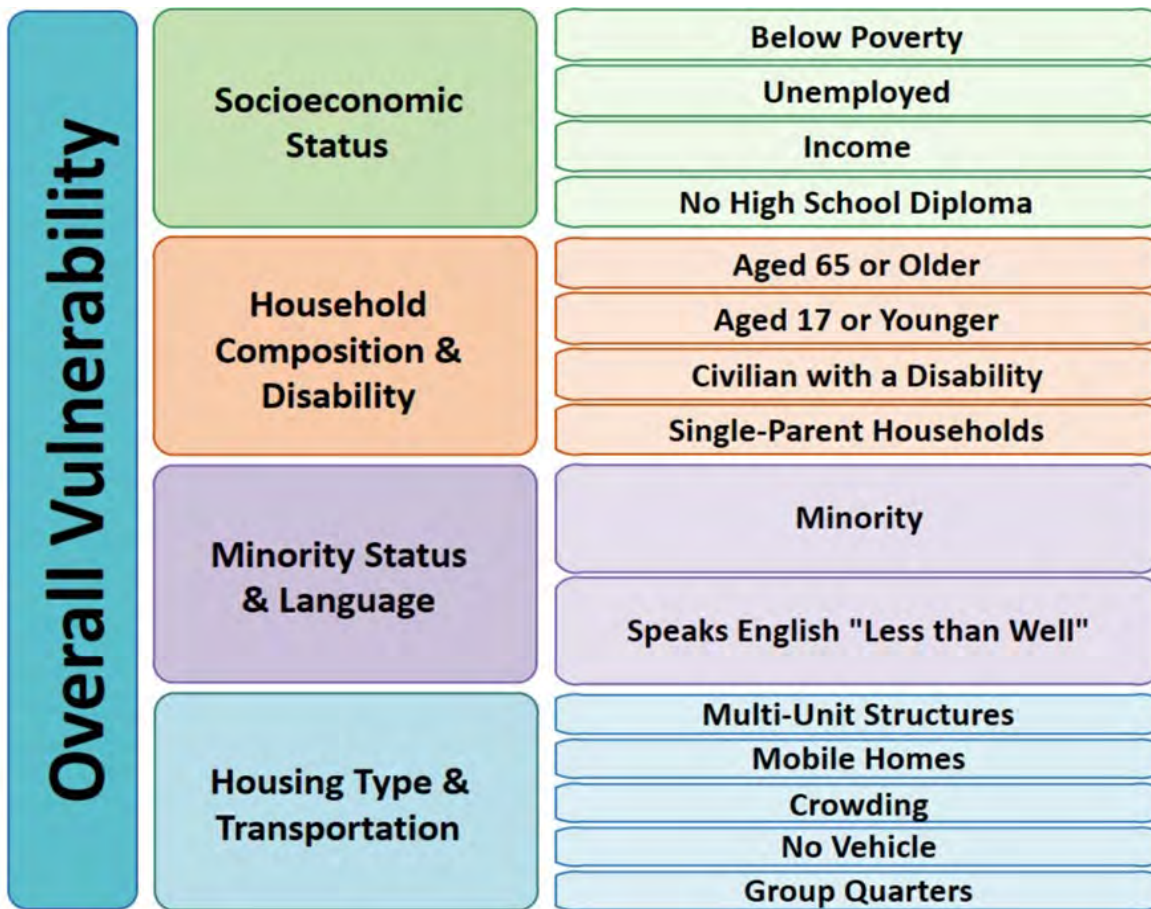
Geography Can Be Deceiving

A study on the spatial distribution of acute care visits for pediatric asthma found substantial local variation in outcomes that related to structural inequalities and segregation. One Census tract had a very high rate of asthma visits per capita compared to the norm but did not exhibit expected patterns in DOH and other community indicators often related to health disparities. This Census tract consisted mostly of high-priced urban housing developments, commercial centers and a relatively young, single and socially advantaged population. However, at the edge of this downtown corridor, within the same Census tract, were a number of homeless shelters and high-rise, low-income subsidized housing units.

Although not many children were in the Census tract, those that lived there were often facing significant social disadvantage and subject to severe disparities in pediatric asthma. The community-level data did not indicate that an at-risk pediatric population resided in this Census tract. The patient records, however, clearly indicated within the Census tract a concentration of underserved children burdened by social needs and severe asthma.

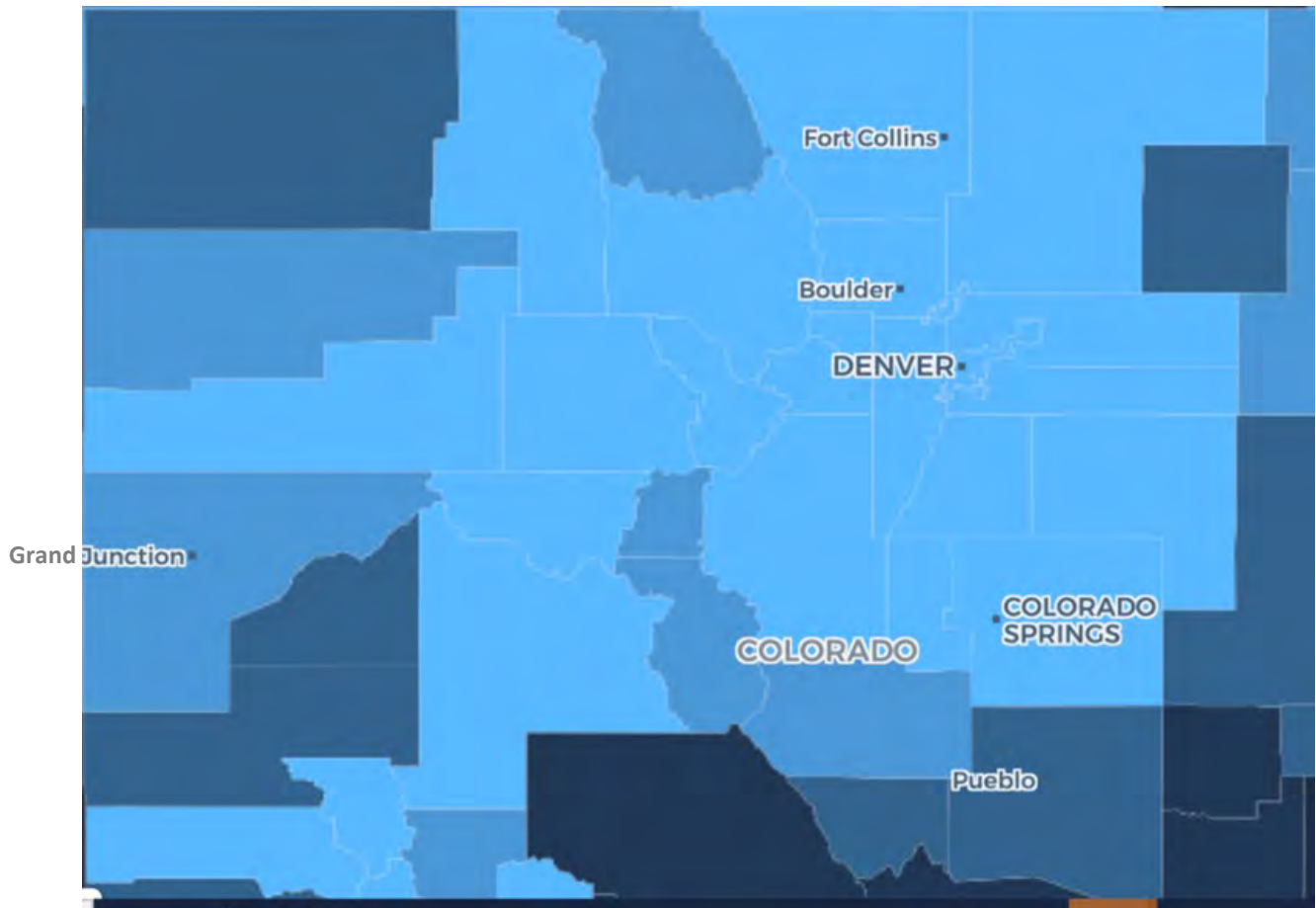
The Social Vulnerability Index includes 15 themes summarized in Figure 2-2.

FIGURE 2-2



UniteUs has created a repository of community needs measures focusing on social, structural and environmental risk factors. The scores range from low need (0.0) to high need (1.0), as illustrated in Figure 2-3.

FIGURE 2-3



Note that although the areas of low need (light blue) correspond somewhat, but not exactly, with the ADI dark blue regions, some significant differences are found between the two indexes.

REPURPOSING OTHER SOURCES

Another source for the actuary for SDOH data may reside within their medical management areas or from clinicians. Models used to stratify the population as an aid to identify members who might need more assistance or interventions than their claims data would suggest can be a useful tool for actuaries to refine their risk measurement methods. These methods have been developed as clinicians and social workers made clear connections between risk as measured by the scores sent to them and the actual needs of their patients. These might include outputs from proprietary programs purchased to aid in identifying members as being at risk for suboptimal care or health outcomes, but the ranking system can be used as a measure of population risk for actuarial work as well.

INCORPORATING EMERGING SCIENCE

One thing that is certain is that the compilation of data to reflect DOH and then assigning weights and values to measures of those determinants is a vibrant and changing area of study and development. Although the ADI does incorporate health costs, attaching values through claims experience is so far from being mature that one can expect a continued refinement and growth of these indexes. The actuary who uses primary sources will need to be deeply aware of the progress made to adjust locally developed models to reflect the current science. Those that use secondary sources will need to be sure that they understand if, and when, new methods and measures have been implemented and how they impact the scoring—and whether restatements of old work are necessary. Those who purchase their indexing and population measures will need to rely on their partners to guide them on when, if and how the newest science is included in their indexes.

POTENTIAL NEW SOURCES AND HOW TO FIND THEM

Many passionate and committed groups are actively seeking to broadcast the newest and best sources of indexes and measures. The Centers for Disease Control (CDC) is very active in this area and would be a first stop for most researchers. Most of the major health policy sites, including the Urban Institute, the National Rural Health Resource, Community Commons, Dartmouth, the RAND Corporation and the Kaiser Family Foundation (KFF) report regularly on advances and discoveries in this area. People who construct these indexes are frequently profiled in *Health Affairs*, the *Journal of the American Medical Association (JAMA)*, the *New England Journal of Medicine (NEJM)* and even the popular press.

It should come as no surprise that even using and maintaining modeling using secondary source material is still a heavy lift and requires considerable insight into how to use these indexes in different applications. For those actuaries who want a third option, plug-and-play models are available for purchase that can be implemented for the appropriate population. The next section includes examples of these types of models. Comparing and contrasting the application of these three types of data sources, developing a model from primary sources, using an open-source secondary model or accessing a proprietary model all using the same population claims and enrollment data set might be a good future research project. It would be analogous to the comparisons of risk adjustment software methods.

Section 3: The Changing DOH Ecosystem

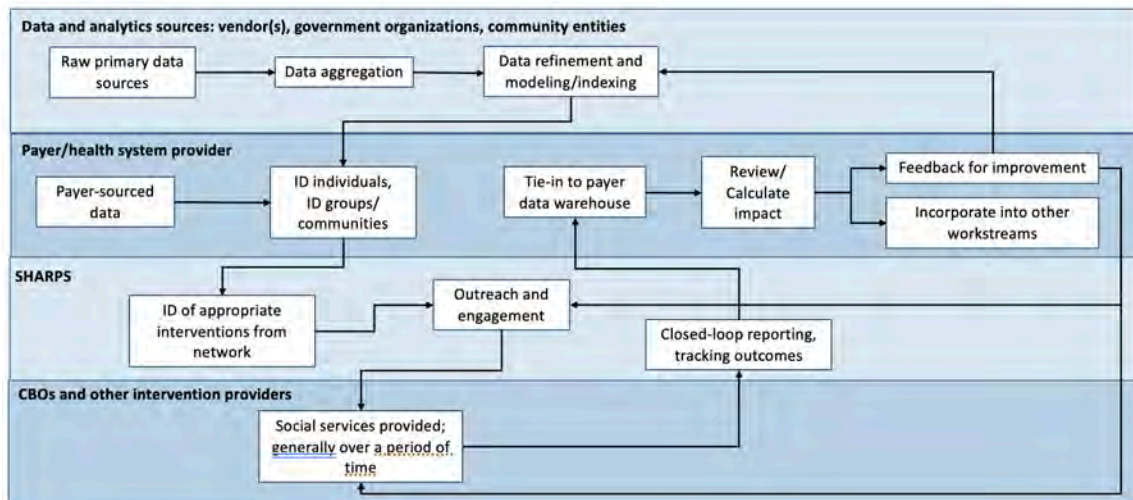
OVERVIEW

Awareness of the need to address DOH has grown exponentially over recent years. Nearly all health care organizations are considering the best way to address DOH for their populations, and this opportunity has given rise to many new organizations or partnerships that address various aspects of DOH. Other organizations have existed for many years but are learning to adapt to new health care entity clients.

At the same time, the health care industry is seeing unprecedented levels of private equity and venture funding across all types of provider and point solution entities, and the DOH segment of the health care industry is no exception. New entrants in DOH space are forming every day and combining with other new entrants or traditional health care entities to create an exciting and dynamic new market. At the same time, CBOs continue to provide the important and necessary foundation to the DOH ecosystem and in many cases are changing their focuses and expanding their revenue models to serve emerging and/or traditional clients, while still following their missions to serve members in the community as they always have.

Figure 3-1 outlines the typical flow of data through various types of organizations as “swim lanes.” Three of these types of organizations—CBOs, social health and resource providers (SHARPs) and data and analytics organizations —will be described in more detail below.

FIGURE 3-1: THE DOH ECOSYSTEM AS IT RELATES TO ANALYTICS AND ACTUARIAL FUNCTIONS



TYPES OF ORGANIZATIONS

SERVICE-BASED ORGANIZATIONS: CBOS AND OTHER SOCIAL INTERVENTION ORGANIZATIONS

At the foundation of the DOH ecosystem are the organizations that actually provide services to populations in need. These include programs or solutions for specific issues such as transportation and food security and can be for-profit or nonprofit. Nonprofit community-based organizations (CBOs) may be funded by private foundations, government or other grants, or other sources. The number of for-profit organizations in this space is growing with an influx of private equity and venture capital in new organizations that seek to efficiently fill gaps in services or in reaching certain populations.

These organizations can range from local service organizations that operate in a small geographic area to sophisticated national or multiregional organizations that can achieve economies of scale and have more infrastructure. Some have comprehensive systems to track data and outcomes, and all of them seek to improve outcomes for populations.

Many CBOs have operated for many years with a mission to address needs in the populations they serve and have now found new clients in health care organizations such as payers and providers. As a result, they are learning to adapt to the structures and operations of the health care industry to have these additional sources of funding.⁶ Some CBOs, such as Meals on Wheels, are national entities that have existed for decades; others are more local, such as those that seek to assist populations with housing instability. All these CBOs are working with new funders in health plans' health systems.

Readers should also be cognizant of protecting the other cultural and community assets that exist in these communities, such as churches, businesses, people and other institutions that buffer the negative effects of historic inequities and matter to the people who live there. Who or what is found there that is an asset to their neighbors? What features and institutions bring joy and economic prosperity to the residents? What elements of the neighborhood respond to or meet the needs of local residents? Understanding the context of the communities that a CBO serves, including the assets within that community—which might include the CBO itself—can help to inform appropriate analyses and evaluation strategies.

For-profit, investor-backed entities have sprung up to fill gaps where CBOs did not exist, or where other solutions could provide more scalable solutions. For example, Papa was founded in 2017 to address

“Disadvantaged” Communities Usually Have Rich Community Assets

One clear example of the power in communities comes from a program that sought to bring fresh food to residents of Wyandotte County, Kansas, who were living in a food desert. A community council developed the Dotte Mobile Grocer, which delivers fresh, affordable food at several different locations throughout the area.

This grassroots approach to reducing the burden of food insecurity and improving access to healthy food was informed by the community members living in this food desert, resulting in a practical and sustainable solution for the immediate needs of local residents. The Dotte Mobile Grocer also served as a safe way for local residents to get groceries during the early days of the COVID-19 pandemic.

⁶ Money Moves the Mare: The Response of Community-Based Organizations to Health Care's Embrace of Social Determinants, Better Care Playbook, <https://www.bettercareplaybook.org/resources/money-moves-mare-response-community-based-organizations-health-cares-embrace-social> (accessed Jan. 2023).

loneliness and isolation in elderly people by sending “Papa Pals” to provide companionship to clients and help them with day-to-day tasks. Lyft and Uber now offer solutions for transportation to medical visits in many cities.

DOH service organizations can receive revenue in any number of ways. CBOs historically received funding from private and government grants but are also developing new payment structures geared toward the health care industry. For example, some local meal delivery programs charge a monthly subscription fee per member for delivery of healthy meals; Lyft and Uber negotiate rates per ride.

SOCIAL HEALTH AND RESOURCE PROVIDERS

Social health and resource providers, or SHARPs, have existed for many years, but have recently proliferated with the increased focus on DOH by payers and health systems.

SHARPs typically provide a platform to connect people with needs to the right solution. They develop networks of CBOs and other organizations, refer people to these resources and track referrals. As they have become more sophisticated and have been utilized (and funded) by health care organizations, many of them have developed closed-loop tracking systems and sophisticated reporting and have developed member outreach and engagement strategies.

Like CBOs, SHARPs may have historically had a broader social services view, but in recent years they have developed more focused solutions specific to serving health care organizations and their populations.

Probably the most widely known SHARP is the United Way’s 2-1-1 system, which connects people to local organizations that provide services such as food programs, housing options, disaster relief, employment and education opportunities and services for vendors. Other SHARPs include national organizations such as UniteUs, findhelp (formerly known as Aunt Bertha) and Healthify as well as other local organizations such as Alluma in the San Francisco area.

Similar to service organizations, many SHARPs are funded by private equity or venture capital companies, and the SHARP sector has recently seen a considerable amount of merger activity to enable successful solutions to scale efficiently. Some SHARPs have also acquired data providers to support their outreach, referral and tracking activities.

Likely the biggest challenge for SHARPs is the ability to connect with members who are not technology-enabled. Some CBOs and service providers actively seek members, but such activities can be very resource intensive and must be local. Another challenge is the management of data privacy and permission, related to sharing data with CBOs and other service providers.

SHARPS In Practice

Deborah has used the United Way’s 2-1-1 system as a resource several times. When she was pregnant, she used 2-1-1 to learn about the WIC program, which enabled her to join SNAP and receive food assistance. She uses that assistance to buy meat and produce but finds that produce is very expensive. She also relies on a food pantry but finds that the fresh food there tends to expire in a short time. She has also used 2-1-1 to get connected to a heating oil program, rental assistance and mobile crisis resources that helped her when Jackie had an ODD breakdown.

SHARPs have varying funding and revenue models but typically are paid by payers or health systems and do not charge CBOs for participating on their platforms.

DATA ORGANIZATIONS

Data organizations in the DOH space perform many different functions, including sourcing primary (raw) data, aggregating data, and building models and indexes.

Raw data can come from many different sources, including the government (such as Census data), consumer data (consumer bureaus such as TransUnion, Equifax and Experian), health care claims data (such as all-payer claims databases or health information exchanges), or other sources.

From the raw data, aggregators refine the data and combine sources to build platforms that enable analysis of data. For example, mySidewalk has a large database that incorporates 5,000 place-based indicators across multiple geographies, which allows a user to analyze, benchmark and visualize data across many community indicators including race ethnicity and age. As another example, TransUnion builds features into its consumer data that are useful to health care entities, including, for example, an individual's number of moves (from home to home) in a defined period.

Aggregations then enable sophisticated predictive models and indexes that can be combined with client-specific data to provide a deeper level of information about a given population. Carrot Health (which was acquired by UniteUs in 2021) builds groupings of social risk factors and then combines these with a Medicare Advantage plan client's claims data to provide insights into the best way of managing the care of the client's population.

Any of these functions (raw data sourcing, refinement/aggregation, modeling) might be performed by a single organization, or by a payer or provider organization. Many organizations perform multiple functions.

CONCLUSION

The ultimate function of this ecosystem is to understand the impact of DOH on populations and thus enable populations in need to receive services to address DOH. Payers such as the Centers for Medicare and Medicaid Services (CMS), Medicaid Managed Care Organizations (MCOs) and other health plans have the most to gain from better outcomes and are typically the most common clients of the organizations in the ecosystem. Payers might be performing some of the functions outlined above, in addition to purchasing those functions from other organizations. Government health departments may also both purchase and perform these functions.

Creative Uses of Spatial Data

Mapping patient data is an important part of understanding the distribution of risk, needs and gaps in access to resources or care and can inform strategic partnerships with CBOs and other service providers. Similar to looking at the differences in health outcomes and social needs based on patient records, place-based information can reveal spatial disparities. Given limited access to identifiable patient address data and restrictions on its use, however, community indicator data can also be used to help identify barriers to engaging with SHARPs and CBOs. For example, public data on internet access—the digital divide—or demographics related to populations who are less likely to be technology-enabled, such as the elderly, can be used to target outreach efforts at the local level.

Section 4: Measurement and Evaluation of DOH Interventions

MEASUREMENT AND EVALUATION OVERVIEW

As solutions for DOH (and other health intervention programs) continue to proliferate and evolve, actuaries and other analytics professionals are called upon to measure outcomes from these programs. For purposes of this report, the authors are assuming that actuaries and analytics professionals are working for the purchasers of DOH programs, which will generally be health care payers (insurers or other risk-bearing entities). Actuaries and analytics professionals may also be asked by SHARPs or even CBOs to help make the business case as they bring their solution to new clients such as payers. The framework below can serve both purposes, although it is most aligned to the purchaser.

Before a program is measured, and even before the program begins to serve members, the framework for measurement and evaluation should be established up front. Several key factors must be known before a program can be accurately measured:

1. What are the strategic *goals* of the program?
2. Who has *organizational accountability* for the program? How does it fit into the ongoing organizational governance structure?
3. What is the *scope* of the program, specifically:
 - *Population*: Which group or members will the program serve?
 - *Patient disease burden*: Is the program specific to members with a particular condition?
 - *Geography*: Does the program operate in a specific location or geographic area?
 - *Network of providers*: Who are the providers of services in the program? Are they community-based organizations, employees of the payer, traditional health care providers or other types of providers?
 - *Pilot or scale*: Is the program in the pilot phase or is it ready to scale? If the latter, what was learned in the pilot to inform measurement going forward?
4. What *services* does the program provide to members, and which members will they serve?
 - Do the services support the intended outcomes for the population?
 - Who is the target population for those services?
 - Are the services well defined and discernible in data?
5. What *data* will support provision of services and feedback to the sponsoring entity?
 - What is the source of the data?
 - What is the content, format and structure of the data?
 - How and how often will the data flow to the sponsoring entity?
 - Data are discussed in much more detail elsewhere in this paper.
6. What is the *reimbursement structure* of the program?
 - How much will the program be paid and in what form (e.g., per service, per-member-per-month, aggregate fee, capital investment)?
 - Is there a desire to delegate risk? How much and to whom?
 - What data will support reimbursement, as well as the costs and benefits of risk transfer, if any?
 - Is the reimbursement design well documented in contract terms?

7. Finally, and perhaps most importantly, what are the *outcomes* that will support the goals that the program hopes to achieve? The outcomes must align with the strategic goals but will be influenced by the other five items on this list.

Once these key elements are known and documented, the next step is deciding which metrics will be measured. The metrics will depend on the framework above, especially the first item on that list, the goals of the program, and the last item, the specific outcomes that will support those goals.

SPECIFIC OUTCOMES TO MEASURE

The outcomes that are measured—the “what” of measurement—can vary considerably depending on the goals of the program and the needs of the population. However, the chosen metrics should meet a few criteria.

First, as mentioned above, the metrics measured should tie into the goals of the program and be reasonably achievable. Next, data to support measurement must be readily available and shared with key stakeholders, especially with the provider of the program services. Third, measures should be reported throughout the measurement period to the extent possible. Reporting should include stratifications at a granularity that helps to expose and measure inequities or opportunities. Fourth, measures should support potential incentives or reimbursement if and when appropriate.

Table 4-1 presents a list of possible DOH outcome measures. Of course, this is not an exhaustive list, and other measures may be found to be appropriate after following the measurement framework if they meet the criteria above.

Table 4-1
Examples of DOH Outcome Measures

Measure
Program engagement rates
Program “graduation rates”
Rates of screening for DOH, such as the OHA program ⁷ discussed below
Measures of access to care <ul style="list-style-type: none"> ● Structural barriers: Cultural competence of providers, geographic, time/hours ● Cultural barriers: Language, health literacy, trust in the system
Program-specific services provided to members and dependents; for example: <ul style="list-style-type: none"> ● Nutrition (e.g., meals delivered) ● Housing (e.g., number rehoused) ● Transportation (number of rides provided)
Member experience and satisfaction
Member perception and retention
Traditionally defined quality measures such as HEDIS measures or STAR scores

⁷ Oregon Health Authority, Office of Health Analytics, SDOH Measure Concepts Table, Social Determinants of Health Measurement Workgroup, <https://www.oregon.gov/oha/HPA/ANALYTICS/Pages/sdoh-measure.aspx> (accessed Jan. 2023).

Public perception, public relations metrics
Stakeholder employee engagement
Traditional utilization measures; for example: <ul style="list-style-type: none"> ● Emergency room visits ● Admissions/readmissions ● Prescription drug adherence
Reduction in total cost of care
Financial return on investment (ROI)

METRIC DEFINITION

The definition of metrics—the “how” of measurement—is a critical component to ensuring measurement of the success of a program. This step should clearly outline the calculation of the metric including the number of items or services measured, data sources, period and other key components of the calculation. These elements are simple yet should be rigorously considered, reviewed by all stakeholders and documented to avoid any ambiguity in interpretation.

The Oregon Health Authority’s (OHA’s) DOH screening program provides a helpful example of a framework of how to measure outcomes. OHA’S public-facing report⁸ for this program includes detailed descriptions of the numerator and denominator of calculation of rate of screenings, the data that support the numerator and denominator, policy and data considerations, and timelines for various components of the program such as structure, reporting and outcome performance goals.

OUTCOME MEASURE BENCHMARKS

The benchmark against which success will be measured—the “how much” of measurement—should be fair and achievable, but also meaningful in terms of improvement in outcomes. The metric can be against some absolute target or can be a measure of improvement toward a benchmark. Benchmarks can be developed with internal data or from external sources such as Census data or organizations like the Rural Health Information Hub.⁹

Cost is the most common metric that is measured, because cost savings tend to be the focus of many health care intervention programs. However, it is not the only metric. As will be discussed in the next subsection, measurement only of cost in terms of financial return-on-investment (FROI) may distract from other, more important measures. Other types of outcomes may generally be more meaningful to measure for success of DOH programs.

Specific methods of measurement and evaluation can and should involve rigorous statistical analysis; such methods are beyond the scope of this paper, but several excellent resources are available to assist in

⁸ Oregon Health Authority, Office of Health Analytics, SDOH Measures, Social Determinants of Health Workshop, <https://www.oregon.gov/oha/HPA/ANALYTICS/Pages/sdoh-measure.aspx> (accessed Jan. 2023).

⁹ Rural Health Information Hub, <https://www.ruralhealthinfo.org/> (accessed Jan. 2023).

understanding evaluation methods.^{10,11} Regardless of the method, an analysis of outcomes should be designed to consider several factors across the dimensions outlined in Table 4-2.

TABLE 4-2: MEASUREMENT DIMENSIONS AND CONSIDERATIONS

Measurement Dimension	Options	Considerations
N (size of intervention population)	Size of intervention population will affect confidence interval around the result	Tested population may be small; the larger the population, the more credible the results
Time	<ul style="list-style-type: none"> Compare pre- vs post-intervention experience, or post-intervention experience only Be short enough to be relevant but long enough for to evaluate experience 	<ul style="list-style-type: none"> Interventions are generally measured and evaluated in at least one-year periods, both pre- and post-intervention Does the budget timeframe align with the intervention timeline?
Outcomes Metrics	<ul style="list-style-type: none"> Which metrics should be measured? Disease-specific measures or all-cause/total cost of care? Measure improvement or measure absolute result? 	<ul style="list-style-type: none"> Will specific conditions be measured or the population as a whole? Does the relevant measure depend on the underlying conditions/medications?
Comparison Cohort	<ul style="list-style-type: none"> Participant group only Eligible, nonparticipants Broader population beyond members eligible for intervention Matching techniques (e.g., propensity scoring) 	What is the better comparison: <ul style="list-style-type: none"> A similar population without the program or The same population pre- or post-intervention?
Risk Normalization	<ul style="list-style-type: none"> Define exclusion criteria to remove outliers Risk adjustment techniques 	What is the appropriate risk adjustment method, and does it have the potential to worsen or amplify inequities and disparities?

THE POTENTIAL PITFALLS OF ROI—AND ANY OTHER EVALUATION MEASURES

Actuaries and analytics professionals in the health care space are increasingly asked to evaluate programs to demonstrate FROI. FROI is a traditional measure, but in a few major areas a focus solely on FROI falls short.

OUTCOME MEASURES

First, FROI is only one measure of overall program effectiveness, and with DOH programs, it is critical to measure multiple dimensions of program effectiveness viewed with measurement of any of many

¹⁰ I. Duncan, *Managing and Evaluating Healthcare Intervention Programs*, 2nd ed. (New Hartford, CT: ACTEX Publications, 2014).

¹¹ A. Mackenzie, J. Wang, S. Teppema, I Duncan, Payment Accuracy in Value-Based Care Contracts, Nov. 6, 2021, Austin Medical Sciences, <https://austinpublishinggroup.com/medical-sciences/fulltext/ams-v6-id1056.pdf> (accessed Jan. 2023).

outcomes. Program effectiveness might measure any of several metrics as outlined in the earlier sections of this report or include new measures. Requiring a FROI on a program without looking at other outcome measures may quickly prohibit investments from the very beginning.

INVESTMENT RESOURCE AVAILABILITY

The second area where FROI may fall short is that resources needed for up-front investment may not be available. FROI requirements can be especially difficult for provider organizations such as health systems or physician practices because they may not have the infrastructure or front-end capital to invest in programs such as telehealth and transportation, even if such programs promised a positive ROI. However, smaller and more localized health systems may be more nimble and closer to their communities, and better able to reach their patients who have social needs. By placing an ROI requirement on investments, local investment might never occur.

Payers such as health insurers generally have more resources than health care providers, such as community benefit funds, and the potential ability to build costs of programs into rates or benefit designs on a more timely basis. MCOs and Medicare Advantage (MA) plans can incorporate benefit add-ons, and commercial insured plans can price the services into their premium rates.

With respect to requiring a FROI for an investment to be made, a solid precedent can be found to invest in health-related services that don't necessarily demonstrate an immediate ROI, with preventive care services such as mammograms. Sometimes one must make health investments simply because it is the right thing to do.

THE LONG POCKET PROBLEM

The third area where FROI falls short is the timeframe required to see returns on investments; this is sometimes referred to as the "long pocket problem." DOH programs generally take many months to demonstrate results in terms of outcomes, and results nearly always exceed the one-year horizon that many health care plans operate within.

In the current world, programs that extend beyond a year need to be "re-upped" each year for budgeting purposes, making programs with multiyear returns difficult to sustain. Extended-year budget considerations may be more likely to succeed when program evaluations are codeveloped with actuarial and accounting and finance teams.

THE WRONG POCKET PROBLEM

Closely related to the "long pocket problem" is the "wrong pocket problem" (the fourth area where FROI falls short). With DOH, the entity investing in DOH solution may not be the entity who benefits financially from that investment. Many reasons can be found for the difference between investment and benefit, but a common reason is that in any health plan, a portion of the covered population will leave the plan each year. This is especially pronounced in the Medicaid population, where about 10% of the

Adverse Childhood Experiences Have an Outsized Effect on Lifetime Health

As a child, Deborah was abused and still suffers from acute post-traumatic stress disorder (PTSD). She recognizes the need for mental health care and has seen mental health providers for therapy for many years. She sees a clear improvement in both her level of pain and her overall physical health when she is mentally healthy. However, she has experienced significant discontinuity in her mental health care because her providers shift into and out of network with her MCO. She finds it emotionally taxing to have to tell her story so often, and in addition she knows that PTSD is something that takes time to work on. She likens this work to "a movie in slow motion": each time she changes providers she has to start the "movie" over. Deborah believes that her biggest challenge is discontinuity in the mental health care system.

population “churn”—that is, disenroll and then re-enroll, frequently in another Medicaid plan—within a year.¹²

DATA LIMITATIONS

Finally, FROI can fall short because it is difficult or even impossible to measure with the available data, and programs in this situation may never receive an investment simply because they can’t be accurately measured. The COVID-19 pandemic’s impact on practically every aspect of society has already complicated, and will continue to complicate, measurement of DOH programs, especially those with pre-and-post comparisons. In the two years of the pandemic, health care utilization was highly variable by month, by type of service and by place of service, making any data analysis using historical data during the pandemic period fraught with complications. In addition, many DOH programs are not scaled to a level where they can be credibly measured; however, small “N” programs can still be valuable and improve outcomes even if they are difficult to measure accurately.

THE ROLE OF ACTUARIES IN MEASUREMENT

Actuaries and data professionals in health care inhabit a world that has rules that must be followed to stay in business. In some cases, these rules magnify the need to demonstrate FROI and in some cases run counter to addressing DOH. For example, for health plans operating within a risk adjustment system, they (and sometimes their contracted providers) are incentivized to improve coding and can most easily do this via visits from members who are more likely to have past diagnoses. But if these are members who visited last year, who are the members who aren’t coming into the clinic at all? Would a plan be creating better outcomes for more of its members if it addressed upstream causes—such as transportation, convenient hours or trust in the system—which keep the member from engaging with the system in the first place? When the incentives encourage certain easy-to-accomplish practices for reimbursement and revenue, it is not surprising that resources are scarce for other activities such as addressing DOH. Actuaries and analytics professionals must strike a balance between finding new ways to measure “the right things” and adhering to the traditional areas that keep our principals in business.

Further, a discussion of investment in social infrastructure raises questions regarding which entity(ies) should be making investments—for example, the payer, the provider, the public health system—for which social needs and for which populations. Such policy questions are beyond the scope of this paper, but the authors look forward to continued discussion about the role that actuaries can play in this area.

Actuaries are typically involved in ROI calculations in two ways: estimation of ROI before implementation of a program, and then evaluation of cost savings after the program has been implemented.

Pre-implementation, many health insurance organizations have financial and actuarial governance standards that require estimated FROI to exceed a threshold, such as 2:1 over some limited period (generally one year). These standards are well meaning and can frequently provide guardrails around programs that have not (and will never) demonstrated evidence of success in improving outcomes or

¹² B. Corallo et al., Medicaid Enrollment Churn and Implications for Continuous Coverage Policies, Dec. 14, 2021, Kaiser Family Foundation, <https://www.kff.org/medicaid/issue-brief/medicaid-enrollment-churn-and-implications-for-continuous-coverage-policies/>. (Accessed March 2023)

benefit to members, and these standards provide more quantitative rigor around anecdotal evidence that might bias decision making by other stakeholders at the investing organization.

Section 5: Approaches to DOH in Actuarial and Analytics Workstreams

Actuarial workflows already include numerous DOH indicators and have for a long time. Generally, DOH indicators are labeled with names that disguise their underlying nature or are part of an adjustment that contains a strong DOH contribution but are not identified as such. Actuaries have incorporated data elements that have shown a predictive capability for expected health expenses, such as geographic factors, benefit richness factors or industry factors. DOH are not the sole components of these—relative costs of the delivery system and other contractual attributes are significant contributors—but as has been demonstrated, where you live impacts your health as does your economic status and employment status. As the study of health expense drivers has grown in sophistication, actuaries continuously strive to modify indicators to be more specific, and incorporation of DOH is an important part of this growth in sophistication.

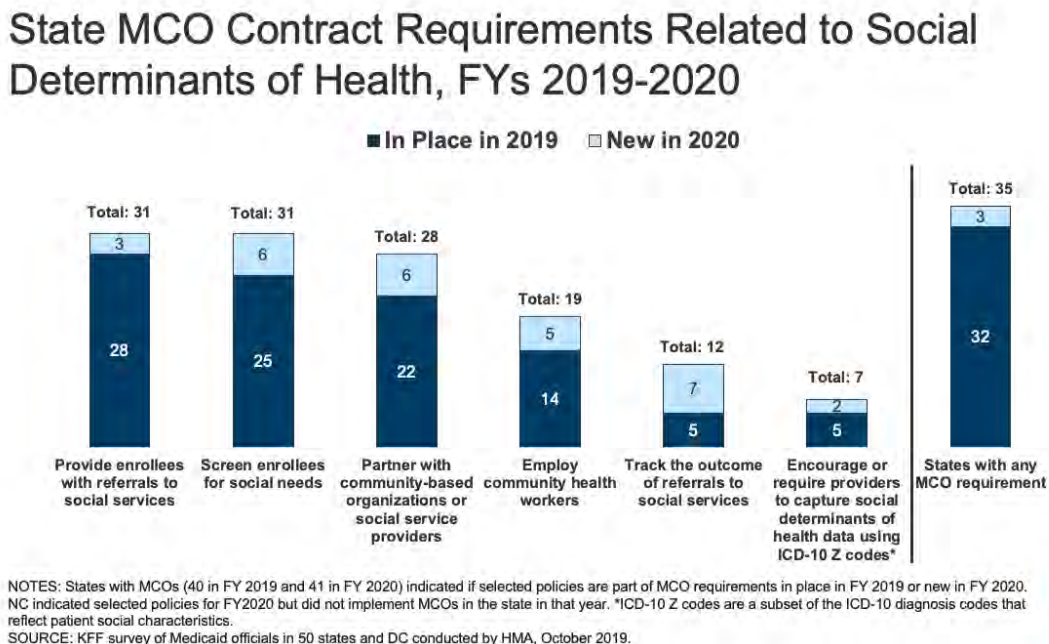
CURRENT DOH APPLICATIONS AND THE ACTUARIAL WORKFLOW

Although each type of actuarial work will have its own needs and methods to incorporate DOH into the work, actuaries frequently start with questions about total cost of care, quality and the nature of covered benefits. The next questions relate to how incorporation of DOH can assist with understanding ways to improve patient outcomes and quality of care in an equitable way. An example of this might be understanding that a high-deductible health plan may shift upfront costs to the member, but if the member does not have the ability to pay for the initial care, they may defer needed care, which results in worsening health, higher financial costs and reduction in health care quality and the quality of life of the individual.

MEDICAID

Actuaries practicing in Medicaid are already frequently using DOH indicators in rating, trend estimates, program design and care management activities. The role of state decisions in advancing the use of DOH indicators and of addressing DOH needs is instructive. States have included “health-related services” in their covered benefits, such as provision of housing support, inclusion of community health workers in provider panels or employment-related services. Through waivers (such as 115 or 1915 waivers) they have modified their programs to include DOH services that would not otherwise be covered by Medicaid. They may mandate or encourage managed care plans that administer Medicaid programs to design and implement in “in lieu of” services to address deficiencies in circumstances so that use of health services can be forestalled by early interventions. Figure 5-1, from the KFF, describes the state uptake of some of these contractual requirements.

FIGURE 5-1: KAISER FAMILY FOUNDATION SUMMARY OF MEDICAID SDOH



Although the data shown in Figure 5-1 are for 2019 and 2020, the overall number of states with DOH requirements has not changed in the 2021 data. However, DOH programs have continued to evolve in more recent years in those states.

As states increase their integrations of DOH requirements into the Medicaid managed care universe, actuaries setting rates and evaluating performance will need to include the costs of these services, measure their effectiveness and project future growth in these services.

Medicaid programs also use risk adjustment to adjust capitation rates to reflect risk due to the presence of diagnosed medical conditions (beyond the differentiation by category of aid). One state, Arizona, has begun explicitly including a measure of SDOH in these adjustments, in conjunction with an actuarial consulting firm.

An informal but broad survey of actuaries in Medicaid departments within managed care organizations found that most Medicaid actuaries are aware of the ways in which DOH characteristics influence Medicaid beneficiaries’ relative use of services. Most of the managed care plan actuaries interviewed indicated that at least some discussion took place, and in some cases formal work groups established, with the idea of incorporating some DOH measures into their workflow. In most cases, these efforts are currently parallel to the current other actuarial analysis being performed and are used to inform rather than develop actuarial work product.

MEDICARE ADVANTAGE

The impact of DOH on relative costs for aged and disabled members has been a part of the Medicare Advantage (MA) actuaries’ analytic toolkit and workflow for years, through the use of disability indicators and area factors. In addition, actuaries assist with different payment methods for providers depending on location or through the explicit identification of community-based versus facility-based care.

In 2019 CMS expanded the list of nonmedical supplemental benefits enabling MA plans to address DOH by including services such as home meal delivery, medically prescribed diets, nonemergent medical transportation and air conditioners, as long as the benefit met one of four criteria:

1. It must diagnose, prevent or treat an illness or injury,
2. It must compensate for physical impairments,
3. It must ameliorate the impact of injuries or conditions or
4. It must reduce emergency and health care utilization.

As a result of the expanded ability to provide these services the number of plans offering them tripled in the 2021 plan year, showing that an appetite is present as well as a need for plans to identify and address DOH within their continuity of care.

An Avalere study published in 2021 showed that the most common MA supplemental benefits for 2022 were meals, transportation, nutrition and in-home support services. All MA plans submit a bid with estimates of costs and savings associated with each component of the benefits, and these will have been developed using actuarial methods.

The DOH needs of the beneficiaries dually enrolled in Medicare and Medicaid are obvious. DOH that drive less optimal health outcomes are inherent in the makeup of the disabled and low-income criteria to be qualify as a dual eligible. The U.S. Department of Health and Human Services (HHS) has laid out a discussion of how policy might be developed within a MA plan, and many touch points are found (beyond just MA pricing and bid preparation) where actuarial insight would be important (Figure 5-2).

FIGURE 5-2: POLICY RECOMMENDATIONS FOR ADDRESSING SOCIAL NEEDS OF DUALY ENROLLED BENEFICIARIES IN MA PLANS



It is clear from publications such as “The CMS Framework for Health Equity 2022–2032” that the incorporation of SDOH measures into the MA domain—including, among others, amelioration programs, quality ratings, data curation and payment methods—will continue to evolve. As with many innovations in the payment and delivery system instituted by Medicare, a strong likelihood can be found that these new methods will migrate to the commercial payment space.

Interestingly, the role of DOH and Medicare Advantage Star ratings is not as commonly discussed, but a connection definitely exists between star measures and certain DOH. Star ratings may offer more insights to actuaries about the ways in which a MA program interacts with the covered population.

COMMERCIAL PLANS

Actuaries working with employer groups are finding a growing interest in health equity and, to a certain extent, DOH, especially among very large, self-insured employers.

In the interviews for this report, several insurance company actuaries indicated that parts of their organizations were developing metrics to assess DOH within their covered populations, including commercial plans. Most of these were in medical or health economics; most did not have active actuarial participation.

At the time of writing this paper, the practice of explicitly including DOH in the actuarial workflow for commercial insurance is very much in its infancy, especially for the small- and medium-group lines of business. Geographic methods of assigning DOH scores can fail for small collections of individuals. As a thought experiment, consider a firm of creative workers living and working in a gentrifying area, or a firm of attorneys in a small rural town, or a small company with remote workers all over the country, dispersed during the COVID-19 pandemic. The DOH of these small groups could be strongly different than the three-digit zip code of the employer or employees might suggest.

THE ROLE OF THE EMPLOYER

An example of the new attention being paid to the impact of DOH on costs and utilization is clear on websites posts such as the CVS/Aetna publication “Social Determinants of Health and Company Performance.”¹³ The Northeast Business Group on Health produced a flipbook¹⁴ that outlined the DOH issues facing employers, noting specific actions that five insurance companies, including Aetna, are taking to support groups seeking to address equity issues. The Business Group on Health goes so far as to make the statement “Addressing social DOH—the circumstances in which people are born and live—is a business and moral imperative.”¹⁵

Actuarial considerations proposed by the Business Group on Health focus on using benefit designs to address equity issues as an acknowledgment that lower income and health outcomes have a connection. Often information critical to understanding the DOH characteristics of the organization, such as income and education, are known by the employer and could be incorporated into the eligibility information used for enrollment.

ACTUARIAL PRACTICE SUPPORTING PROVIDERS

Underlying all actuarial work and pricing is the financing of the delivery system. Providers, perhaps because they encounter the implications of DOH on individual patients, are aware and informed about the mismatch between claims-based measures of patient severity and the actual nature of the condition of patients after taking all inputs into account. At each stage in sophistication an opportunity is present to incorporate measures of DOH to reflect challenges and burdens in aligning compensation with the level of challenges to ensure quality care.

¹³ Aetna, Promoting Health Equity for Low-Wage Workers: How Employers Can Reduce Health Care Costs, Increase Productivity and Help Employees Stay Healthy, <https://www.aetna.com/employers-organizations/resources/social-determinants-of-health-and-company-performance.html> (accessed Jan. 2023).

¹⁴ Northeast Business Group on Health, Social Determinants of Health: A Guide for Employers—February 2022, <https://online.flippingbook.com/view/703279374/> (accessed Jan. 2023).

¹⁵ Business Group on Health, Social Determinants Infographic: Employer, Feb. 18, 2022, <https://www.businessgrouphealth.org/en/resources/social-determinants-infographic-employer-actions> (accessed Jan. 2023).

FIGURE 5-3: LEVEL OF RISK VS LEVEL OF SOPHISTICATION AND COMPLEXITY AND MATURITY OF CAPABILITIES NEEDED TO ACHIEVE FINANCIAL UPSIDE

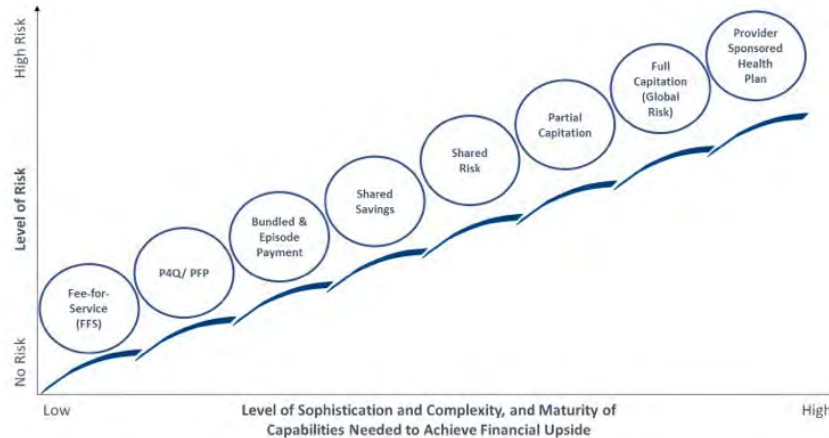



Figure 5-3 is a visual representation of the progressive sophistication of types of reimbursement methodologies. In general, the farther to the right, the more important it is to quantify and incorporate DOH into the payment model. Fee for service medicine may reflect some of the differences by using modifiers to codes indicating additional complexity, but these adjustments are coarse at best. Reimbursement for value-based care is more likely to have the ability to reflect the differing complexity and challenges providers face in delivery of care to populations because as the risk shifts from specific service to whole person care, adjustments that contemplate “the conditions in the environments where people are born, live, work, play, worship and age” are important to include.

Actuaries who work for providers in value-based payment schemes interviewed were aware of DOH and were actively investigating how to adjust provider payments and risk arrangements to reflect the differences in DOH between populations, but not necessarily currently implementing changes in contracting and payment, beyond process measures.

Policymakers and thought leaders are carefully examining the accountable care organization program landscape to ensure that the payment methods reflect underlying DOH and equity issues. CMS released a brief that showcased the Allina Health/Blue Cross and Blue Shield of Minnesota partnership to address DOH.¹⁶ The discussion highlights some model development guiding principles to incorporate into an alternative payment model.

¹⁶ Centers for Medicare and Medicaid Services, *Aligning Provider and Payer Activities to Address Social Determinants of Health*, July 2021, <https://innovation.cms.gov/media/document/ahcm-casestudy-allina> (accessed Jan. 2023).

**SDOH 2.0 Model Development
Guiding Principles** 

- ✓ Transition to universal SDOH screening for all patients, regardless of insurance status or type.
- ✓ Focus on addressing food insecurity, housing, transportation, utility payment, medication affordability, health insurance coverage/medical bill support, and social isolation.
- ✓ Incorporate patient-level SDOH screening information into existing care models and electronic medical records.
- ✓ Connect patients with HRSNs to resources.
- ✓ Define SDOH success for Allina Health.

The Health Care Payment Learning and Action Network has been fundamental in the development of accountable care organizations (ACOs) and other alternative payment methods; they established the Health Equity Advisory Team to provide guidance to ACOs on making sure that equity is fostered in payment arrangements.^{17,18} They highlight the need to incorporate a social risk score for best practices in developing care transformation methods, acknowledging that DOH are fundamental to understanding patterns of use in members attributed to ACO panels.

CONSULTANT RESEARCH AND TOOLS

Much of the most visible research and publications on using SDOH in actuarial workflows is being produced by actuarial consulting firms. Many of the publications have been developed to support actuarial work in the Medicaid and Medicare disciplines, but the methods being developed can generally be adapted to work in the commercial space.

A continuum is found in the consultant tool kit from DOH-based adjustment to diagnosis-based risk scores to advisory material for organizations just beginning to think about how to incorporate DOH into their evaluation of population utilization patterns and needs.

OTHER HEALTH PRODUCTS

The idea that the nature of a person's experience influences how they use health care and what kinds of outcomes are likely to emerge does not just apply to conventional major medical coverage. Other insurance products such as dental, worker's compensation and long-term care show the same sorts of disparity, and actuarial work in these areas will need to reflect those differences to align payment to risk.

¹⁷ Health Care Payment Learning & Action Network, Advancing Health Equity through APMs: Guidance for Equity-Centered Design and Implementation, <https://hcp-lan.org/advancing-health-equity-through-apms/> (accessed Jan. 2023).

¹⁸ Health Care Payment Learning & Action Network, Advancing Health Equity through APMs: Guidance on Social Risk Adjustment, <http://hcp-lan.org/workproducts/APM-Guidance/Advancing-Health-Equity-Through-APMs-Social-Risk-Adjustment.pdf> (accessed Jan. 2023).

Section 6: Ethical and Practical Considerations

Statisticians, like artists, have a bad habit of falling in love with their models. —George E. P. Box

QUESTIONS TO ASK YOURSELF WHEN WORKING WITH DOH DATA

HOW AM I APPROACHING MY MODELING?

In its blog post “Aiming for Truth, Fairness and Equity in Your Company’s Use of AI” the Federal Trade Commission (FTC)¹⁹ laid out seven directives for best practices in modeling using artificial intelligence (AI), which apply to all types of modeling:

1. Start with the right foundation.
2. Watch out for discriminatory outcomes.
3. Embrace transparency and independence.
4. Don’t exaggerate what your algorithm can do or whether it can deliver fair or unbiased results.
5. Tell the truth about how you use data.
6. Do more good than harm.
7. Hold yourself accountable—or be ready for the FTC to do it for you.

It is important to have a certain sense of humility and perspective. The science and art of model building don’t proceed without some missteps, especially with an emerging topic incorporating entirely new data elements and characteristics, such as DOH. Sometimes the missteps will not be visible to the person creating the models; all of us have blind spots. Actuaries need to listen to the people who are being modeled as well and align them with the output of spiffy statistical models. Listening to lived experience comments on modeled behavior (such as why appointments are canceled) will not only improve the assumptions in the models, but will also foster understanding of a shared goal. It is better to be ready to admit when a model has a flaw. Admit it and fix it.

The book *Voices in the Code*²⁰ presents the story of a nonprofit, UNOS, that allocates kidneys to recipients by using a score. Although the methodology that UNOS uses is a mature model, the humility that they use in recognizing the limitations of highly precise results is instructive. This book was also summarized in “The Kidney Transplant Algorithm’s Surprising Lessons for Ethical AI”²¹ from the online magazine *Slate*.

Actuaries and data professionals must not fall for any cognitive biases. The use of valid statistical methodology such as cluster analysis will help to avoid such flaws as confirmation bias, but it can still produce flawed results. If flawed results align with a bias, errors can occur. This is particularly a problem when the underlying data contain biases, and all the data that health actuaries use contain biases. Biased

¹⁹ E. Jillson, Aiming for Truth, Fairness and Equity in Your Company’s Use of AI, Apr. 19, 2021, Federal Trade Commission, <https://www.ftc.gov/business-guidance/blog/2021/04/aiming-truth-fairness-equity-your-companys-use-ai> (accessed Jan. 2023).

²⁰ D. Robinson, *Voices in the Code*, Sept. 2022, Russell Sage Foundation, <https://www.russellsage.org/publications/voices-code> (accessed Jan. 2023).

²¹ D. Robinson, The Kidney Transplant Algorithm’s Surprising Lessons for Ethical AI, Aug. 31, 2022, Slate.com, <https://slate.com/technology/2022/08/kidney-allocation-algorithm-ai-ethics.html> (accessed Jan. 2023).

data produce biased results, and actuaries need to acknowledge known biases and have a duty of care to approach results with a healthy sense of skepticism and attempt to rectify any bias.

AM I ASKING THE RIGHT QUESTION?

If one wants to target results to rectify disparities in coverage, the delivery of health care and total costs of care that arise because of DOH, it is important to know *how* the disparity manifests itself. The actuary should build models that align with well-formulated disparity analyses, such as those related to maternal health, diabetes prevalence or likelihood of receiving timely intervention during a stroke.

A hearty curiosity will be important, and it may mean the actuary will need to go outside of the traditional vehicles for actuarial continuing education, by reading or attending seminars, meetings and webinars of allied professions who have studied disparities more deeply.

DOES MY WORK REFLECT A FAIR USE OF DATA AND MODELING?

This question is a particularly thorny one, but that does not absolve the actuary from the responsibility to ask it. Actuaries are advised to keep abreast of reports and developments that highlight examples of modeling or data use that are flagged as unfair. When modeling is unfair, it can harm the modeled population—by not offering benefits or opportunities, or by delivering lower quality services. Actuaries are well advised to expand their definition of peer review to members outside the profession. They must explicitly reveal any potential sources of unfairness that they have observed.

Although this report does not concern itself with the development of AI tools or models directly, much is to be learned from the AI community about the fair use of data and modeling. Two good sources of examples of tests to see if data use is fair and equitable are the Aequitas bias audit toolkit developed by the Data Science Institute at the University of Chicago²² and the Fairlearn Assessment, an open-source community with the mission to improve the fairness of AI systems.²³ Aequitas emphasizes the need to match the fairness criteria for the specific use case. Fairlearn has a user guide that discusses various aspects of modeling including a list of traps that modelers can fall into as they perform fairness assessments. Fairlearn lists the steps to be performed as identification of harm, identify groups harmed, quantify the harms and compare harms across groups.

AM I MAKING THINGS BETTER OR WORSE?

Actuaries need to step back from their results and models to think about the unintended consequences of super-refined modeling. It is possible that modeling might reinforce inequities in the system? For instance, many payment models reward providers for low utilization as a measure of cost savings, but low utilization might be the result of DOH-driven access challenges, and such incentives would exacerbate the disparities in care and potentially increase long-term costs.

Actuaries who do this modeling should be familiar with the specter of redlining (or reverse redlining), an example of past practices that were once acceptable and used maps of “hazardous” neighborhoods to

²² Aequitas, Data Science and Public Policy, Carnegie Mellon University, <http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/> (accessed Jan. 2023).

²³ Fairlearn.org, Improve Fairness of AI Systems, <https://fairlearn.org/> (accessed Jan. 2023).

exclude from services, particularly financial services. Insurance companies, and their actuaries, used data to create these models.

IS MY WORK SUSTAINABLE?

Much of the actuarial and other modeling work in this area is being developed by individuals who have recognized the need to incorporate DOH in their work. Many of them will be developing their models in isolation, transforming a personal vision into actionable methodologies. However, some potential pitfalls of development in isolation or by a sole visionary are found. The list below outlines characteristics of sustainable models for DOH:

- *Sponsored*: Great ideas need sponsorship from leaders that will provide the long-term support and vision to move the model from the back room into the workflow.
- *Replicable*: If the work is developed on a subset of the population or for a given period, those results should be relied upon to produce consistently reasonable results when applied to other groups or periods.
- *Scalable*: If the modeling is developed on a small subset of the population, as it is extended to a larger, potentially more diverse population, it must remain valid.
- *Easy to use*: For this modeling to be really effective, it cannot be burdensome and must be efficient when it is incorporated into workflow, with a minimum of tweaks, patches and fixes.
- *Accessible across disciplines*: The modeling will need to be used by other stakeholders, such as medical management or medical economists.
- *Responsive*: This rapidly developing area of interest will generate interest from many parties, including legislators, policymakers and consumers. Any modeling must contemplate the certainty of changes going forward as customers and others define their own use cases and needs.
- *Simple*: Models must not overly complex and be as transparent as possible.
- *Integrable*:²⁴ A model should align with and mesh with other modeling when appropriate. It should not “live on an island” and present an isolated method that cannot work with other models.
- *Transferable*: A model may be developed by a visionary, but to be really effective, it must be usable, modifiable and explainable to whoever might take over the model in the case of a position change or expansion.
- *Meaningful*: A model should have outcomes that are material and useful for business use.
- *Time-proof*: A model should take the long view as much as possible, so that it is useful in future periods.

IS MY WORK IN ALIGNMENT WITH EMERGING PRACTICE?

The use of DOH in health actuarial work is a developing science, and an impressive array of people are working on the topic. As the topic matures, best practices will develop by consensus. The actuary would be wise to keep abreast of the developments and even to recognize when a well-used model is either no longer applicable or that using a localized model is counterproductive because of an inability to benchmark.

²⁴ Is Integrable a Correct Adjective for ‘Capable of Integration’, Stack Exchange, <https://english.stackexchange.com/questions/244609/is-integrable-a-correct-adjective-for-capable-of-integration>.

The following organizations and resources are examples of those that can provide guidance; these types of organizations are constantly evolving and expanding:

- The National Committee for Quality Assurance (NCQA) Social Determinants of Health Guide²⁵ can provide guidance on the design and implementation of strategies to address DOH.
- The Association for Community Affiliated Plans (ACAP) Center for SDOH²⁶ provides a wide array of services for health plans in nurturing and disseminating best practices in the field of SDOH; it will continue to develop tools and resources for policymakers, thought leaders and others in the health care space.
- The Health Care Payment Learning and Action Network (HCPLAN) Health Equity Advisory Team (HEAT) provides guidance on incorporating social risk adjustment into alternate payment arrangements.
- The Gravity Project²⁷ is a collaborative project to build national data standards for the identification and use of information on DOH, and it provides other news and information related to DOH.
- Articles and publications such as those promulgated by the SOA Research Institute, *The Actuary Magazine* or the SOA's HealthWatch will help the actuary stay up to date with the best concepts. The SOA research project on SDOH entitled "How Does Where You Live Impact Your Health"²⁸ or HealthWatch's recent article on responsible machine learning²⁹ are exemplary.

The incorporation of SDOH into the delivery and financing of health care is a burgeoning field, and many papers, webinars and conferences give valuable insights. Although many of them may focus on subsets of the list of DOH, or on types of medical care or certain populations, the best of them can give the actuary valuable insight into those DOH with the most material impact on outcomes and costs.

CONCLUSION: AM I DOING THE RIGHT THING?

It is impossible to overstate the importance of using the data resources at our disposal in a responsible manner. The level of detail in claims data that actuaries routinely use was already a tremendous responsibility, and now more sensitive, personally identifiable information will be added to our data repositories.

A whole component of the practice of data science deals with data ethics. The actuary should be able to be confident that not only their own use of the data, but also any use that they are aware of, should follow

²⁵ NCQA.org, Social Determinants of Health Resource Guide, Oct. 9, 2020, <https://www.ncqa.org/white-papers/sdoh-resource-guide/> (accessed Jan. 2023).

²⁶ ACAP Center for SDOH Innovation, <https://sdohinnovation.org/> (accessed Jan. 2023).

²⁷ The Gravity Project, <https://thegravityproject.net/> (accessed Jan. 2023).

²⁸ J. Barrett et al., How Does Where You Live Impact Your Health? Mar. 2022, Society of Actuaries, <https://www.soa.org/resources/research-reports/2022/live-impact-health/> (accessed Jan. 2023).

²⁹ J. Dolstad et al., Responsible Machine Learning: Living Up to Our Professional Code of Conduct, ASOPs, and Corporate Requirements, Sept. 2022, Health Watch, <https://www.soa.org/sections/health/health-newsletter/2022/september/hw-2022-09-dolstad/> (accessed Jan. 2023).

ethical principles. Although the actuary should be able to rely on their principals (clients and employers) to develop policies that foster the ethical gathering, storage and use of data, such policies do not absolve them from the responsibility to call out any concerns about any practices they observe.

The following precepts regarding individual data ownership can help guide actuaries in their own data work:

1. The individual—including the patient, health plan member or employee—has ownership of their own data. A person must consent to their data being used. We have all signed the agreement, clicked the box, said I agree. An area of concern is hidden agreements to allow the use of personal data that persons might agree to without understanding the implications of their agreement.
2. Not only do individuals own their data, but they also have a right to know how you are going to use the data. Be transparent!
3. Even if a person has granted use and you have told them what you are going to do with the data, you must guard personal privacy.

Consider Anya and Anna, from the Introduction to this report, or Deborah and Jackie, from the sidebar stories, in the context of these precepts. Now consider yourself or your family members: would I feel ok if this was my information, or the information of my family member?

Actuaries should also turn to the Code of Conduct and Actuarial Standards of Practice (ASOPs) for guidance on how to handle individual data. These have been promulgated to make sure that actuarial work can continue to be appreciated for a high standard of reliability and fairness. The ASOPs are evolving to better reflect the emergence of new types of data including the responsible use of personal characteristics.

Last, an actuary or data professional should recognize that their work may be technically correct but ethically problematic. This can be a difficult balance to achieve when helping a stakeholder manage risk points to solutions that go in one direction, while the responsibility to be a good member of the community points in another.

Section 8: Acknowledgments

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Any opinions expressed reflect the authors' opinions alone and not those of their employers. Any errors belong to the authors alone.

Appendix 1: Literature Review

INTRODUCTION

The topic of DOH as they impact the financing and modeling of health is one of the most active ones in current health policy. The COVID-19 epidemic accelerated an already rich discussion of how and when current methods of population health stratification, benefit design, provider contracting, premium calculations and trends, and forecasting should incorporate DOH into the actuarial workflow. Nearly all the published material is from outside the actuarial profession, although much of it focuses on only a few DOH aspects rather than the entire spectrum. Inevitably the topic of equity becomes a focal point because although DOH are not specifically racially based, the inequities in the American health delivery system fall disproportionately on people of color. PubMed currently has over 20,000 articles published with the tag SDOH since 2016 (5,000 in 2021). Although many of these articles concern a much more focused question than actuaries would normally address, most of them discuss the very questions being faced as a profession.

This literature review is nontraditional. It includes information published outside of the academic, peer-reviewed setting and includes notes and commentary from organizations and programs involved in addressing the need to transform the delivery system to better account for DOH.

QUANTIFYING SDOH—FINDING DATA

Both too much data and a dearth of data exist, and many authors have been writing about the quantity and quality of available data.

In an issue brief, “Social Risk Factor Screening in Medicaid Managed Care,” the State Health and Value Strategies program suggests a screening tool design and a set of guidelines to help form data collections that will integrate with quality and payment structures. They have an interesting discussion about the connection between social risk factors (SRFs) and common SDOH that helps understanding of what a data collection might seek to identify. They identify three common tools to identify SRFs: the Protocol for Responding to and Assessing Patients’ Assets, Risks, and Experiences (PRAPARE) tool, the Accountable Health Communities Health-Related Social Needs (AHC HRSN) tool, and Health Leads’ Social Needs Screening Tool.

An article in *Health Affairs* notes that children’s inequities might be distinct from adult inequities. They suggest understanding and using the Child Opportunity Index 2.0 might add a layer of understanding.

USING SDOH NOW AND IN THE FUTURE—WHAT EXISTS AND WHAT IS MISSING

Several programs have been in operation for a while and numerous articles published on their results both as participants and as commentators.

In the article “Payment Structures That Support Social Care Integration with Clinical Care: Social Deprivation Indices and Novel Payment Models,” Huffstetler and Phillips describe the models used by the United Kingdom, New Zealand, Massachusetts and the Hennepin Healthcare System to align payment policies with medical and social need. They note that some financial results are promising, but not yet patient outcome improvements.

The Massachusetts Managed Care Payment Formula is further discussed in a *JAMA* article, “Social Determinants of Health in Managed Care Payment Formulas,” which discusses in depth the methods used by MassHealth to add housing instability, behavioral health, disability and neighborhood characteristics.

Although the nature of disability means that Medicaid has already established separate payment models for disability and has mental health as a risk indicator, the neighborhood results were new and of great interest.

The Arizona Health Care Cost Containment System (AHCCCS) Complete Care (ACC) managed care program updated its methodology to recognize the impact of SDOH. In a white paper presented by AHCCCS and the actuarial consulting firm Wakely, the authors noted that the inclusion of SDOH markers in the CDPS+Rx risk adjustment model, based on geography and ICD10 identifiers, increased the average score for those with risk markers by 8% to 64%, with the greatest improvement in the child population. The article goes on to note that this result will not be generalizable to all populations and that it is important to use state-specific calibration.

The United States Preventive Service Task Force is the clearinghouse for determining best practices in preventive medicine. In an article in *JAMA*, a discussion surrounds how best to address clinician screening for social risk factors and to identify those with implications to health outcomes. This is important for actuaries to think about going forward because the record of the PCP interaction in the form of ICD-10 codes and Level III HCPCs may be the most uniform source of data going forward. The meta-analysis looked at a comprehensive list of studies and programs and is a rich source of information.

IDENTIFYING THE GAPS/ERRORS IN MODELING

Cautionary tales exist on the problems with current actuarial/population modeling, although time has not been sufficient to develop a sufficient track record to identify gaps in current modeling methods.

However, although one may not have had sufficient time to vet all the models for the identification and use of DOH on the use of health care, a significant number of troubling results emerge from harm reduction models used in predicting harm or violence. The article “Risk Assessment Tools in Criminal Justice and Forensic Psychiatry,” which examined a very large number of these tools, reported that half the people modeled to be high risk were not correctly classified. These models used various social characteristics as well as historical behavior to model future outcomes, so they are not entirely dissimilar to the types of modeling being discussed here.

In an article published in *JAMIA*, “Bias at Warp Speed: How AI May Contribute to the Disparities Gap in the Time of COVID-19,” the authors note that the feeding frenzy of modeling that has been provoked by the COVID-19 health emergency has given some cause for alarm: “The most frequent problems encountered were unrepresentative data samples, high likelihood of model overfitting, and imprecise reporting of study populations and intended model use.”

Perhaps one of the most notable articles that highlighted issues with current claims-based modeling techniques was “Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations.” This article reminds us that looking at medical claims and their accompanying diagnoses alone would not give a full picture of the population, and that further, the missing information was likely to have SDOH characteristics. This article shows how a narrow reliance on one aspect of personal information led to a biased care strategy.

THE ROLE OF THE PAYER – MEDICARE, MEDICAID AND EMPLOYER GROUPS.

The Centers for Medicare and Medicaid services often lead the way in program implementation and improvements. Along with many other federal government agencies they published a framework to identify shortcomings in addressing equity issues. The focus that CMS is placing on equity and DOH is reflected in programs within Medicare Advantage and Medicaid Managed Care Organizations. An example

of a population where the importance of highlighting the cojoined issues of equity and DOH is of paramount importance is in the dual eligible population.

Employers are also thinking about the ways in which DOH are impacting the health of their employees. For employers, the considerations reach beyond direct medical costs and include subjects such as absenteeism, employee satisfaction and employee retention.

ETHICAL COLLECTION AND USE OF DATA

All aspects of data collection that concern the lives of individuals are sensitive, and many articles have discussed the careful collection, manipulation and use of the information garnered. Here are a few relevant resources.

In “Aiming for Truth, Fairness, and Equity in Your Company’s Use of AI,” a blog published by the Federal Trade Commission that specifically mentions health modeling, the author proposes several considerations, outlined in the “Ethical and Practice Considerations” section of this paper.

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A key concept in the ethical collection and use of data is the concept of ground truth, the term for information that is a result of direct observation rather than information that is inferred. This is not a new concept—it has been a concern in geographic mapping for many years—and it is a close cousin to the “sniff test” that actuaries use when looking at results. An interesting article published in the *International Journal of Behavioral Nutrition and Physical Activity* showed what happened if the mapping of food stores in a small region relied solely on a business analytics tool versus a ground-truthing exercise. The result was a rather disappointing positive predictive value of 0.57.

A white paper published by the Urban Institute in March 2021, “Five Ethical Risks to Consider before Filling Missing Race and Ethnicity Data,” has insights that can be extended to any categorization of modeled DOH. The five topics are the following:

- Excluding the people modeled from ownership of their own data and the use of that data.
- Violating individual informed consent.
- Compromising the privacy of individual members of the population being studied.
- Producing inaccurate estimates and or promoting false conclusions.
- Generating data that may harm members of the population cohort being modeled.

However, the meta-study done to support the United States Preventive Services Task Force indicated that although challenges to SDOH screening and intervention programs are seen, the actual unintended consequences observed in these studies were rare.

THE WAY FORWARD

The way forward will lead us from where professionals in the field currently are to where they need to be. A few recommended articles articulate proposals for going forward.

In a blog post on Health Affairs, Anna Morenz and Joshua Liao suggest that while waiting for the data to catch up, one should examine the ways in which New Zealand and the United Kingdom have used composite indexes. They also note that using social risk variables as a checklist without understanding regional or community needs would be important and suggest that a combination of individual measurements gathered at the patient level combined with insights of the community would be a good approach.

An issue brief, “How Are Payment Reforms Addressing Social Determinants of Health?”, published by the Duke Margolis Center for Health Policy in conjunction with the Milbank Memorial Fund lays out three policy points that are a focus of reforming value-based payments and lays out a detailed table of value-based-purchasing payments currently in use or in development. The article further comments on what considerations are needed going forward.

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Appendix 2: Interviews

The authors wish to express our deepest gratitude to the people who shared their experience and provided us with the qualitative data for this report. The organizations listed below are the affiliation of the interviewee at the time of the interview and may have changed since then.

”Deborah” (interview with a person struggling with SDOH)

Kurt Waltenbaugh, Carrot Health

Christopher Pilkington, Current Health

Kristi Kempe, Findhelp

Jaffer Traish, Findhelp

Karena Weikel, Geisinger Health Plan

Hans Leida, FSA, MAAA, Milliman

Erica Rode, FSA, MAAA, Milliman

Natalie Kane, PhD, my Sidewalk

Sarah Martin, PhD, mySidewalk

James Dolstad, ASA, MAAA, FCA, Optum

Jim Bohnsack, TransUnion

Karan Rustagi, FSA, MAAA, Wakely

Ksenia Whittal, FSA, MAAA, Wakely

Lalithya Yerramilli, ZignaAI

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