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The Connection between COVID-19 and Type 2 Diabetes:

Underscoring the Need for Chronic Disease Prevention and Management

Research increasingly shows that individuals with type 2 diabetes face a greater chance of experiencing severe complications from COVID-19.

August 2021

Kem C. Gardner POLICY INSTITUTE
THE UNIVERSITY OF UTAH
DAVID ECCLES SCHOOL OF BUSINESS

NATIONAL ASSOCIATION OF CHRONIC DISEASE DIRECTORS
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Analysis in Brief

Emerging national and international research increasingly shows that individuals with type 2 diabetes face a greater chance of experiencing severe complications from COVID-19, including hospitalization, ventilation, and death. Unfortunately, people with type 2 diabetes may have other challenges related to their health that the public health emergency (PHE) exacerbates, such as reduced access to medical care, decreased physical activity, and increased food insecurity. Populations with low incomes and many communities of color have less access to these same health determinants and data show they also have a higher prevalence of type 2 diabetes and COVID-19.

This report presents a review of the emerging literature regarding the connection between type 2 diabetes and COVID-19. It also uses state examples to visually illustrate the association between COVID-19 severity, the prevalence of adults living with diabetes, socioeconomic status, social vulnerability, and race and ethnicity. The interconnectedness of these factors points to the need to address public health and chronic disease prevention in a comprehensive, multifaceted way.

Key Findings

- **Individuals with type 2 diabetes and other chronic conditions face a greater chance of experiencing severe complications if they contract COVID-19.** For example, one study found that 1 in 5 patients with diabetes hospitalized for COVID-19 needed a ventilator within seven days of admission, and 1 in 5 died within 28 days.[i, ii]

Diabetes is the **second most common** underlying condition in COVID-19 deaths nationwide.

(CDC, 2021)

- **Numerous indirect impacts from the PHE could worsen the condition of individuals living with type 2 diabetes and prediabetes. These include:**
  - **Delays in seeking care** – As of September 2020, 36% of U.S. adults reported delaying or foregoing health care due to concerns about COVID-19 exposure or because their provider limited services due to the pandemic. More than 75% of adults with delayed or foregone care reported that they had one or more chronic health conditions.[iii]
  - **Stay-at-home directives** – Preliminary findings show an increase in health-risk associated behaviors during isolation due to COVID-19, including a 33.5% reduction in physical activity, a 28.6% increase in sedentary time, and increased consumption of unhealthy food.[iv]
  - **Economic downturn** – Economic downturns are associated with an increase in food insecurity and rates of anxiety and depression, which disproportionately impact persons living with diabetes.
- **COVID-19 underscores the need for continued chronic disease prevention and management.** Programs like the National Diabetes Prevention Program lifestyle change program can help reduce both the onset of type 2 diabetes and other chronic diseases and help address some of the indirect risk factors intensified by the PHE.

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*This report was a partnership with the National Association of Chronic Disease Directors through the **Building Capacity for Public and Private Payer Coverage of the National DPP Lifestyle Change Program** project, supported by the Centers for Disease Control and Prevention (CDC) of the U.S. Department of Health and Human Services (HHS) as part of a financial assistance award totaling **$3.2 million for grant year 4** with 100 percent funded by CDC/HHS. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by CDC/HHS, or the U.S. Government.*

Introduction

COVID-19 underscores the need for continued chronic disease prevention and management, as persons living with type 2 diabetes and other chronic conditions are especially vulnerable to severe illness from the virus. Preventing or delaying the onset of type 2 diabetes and promoting weight loss may have a positive effect on reducing the severity of complications people experience during this and possibly future pandemics. Implementing programs like the National Diabetes Prevention Program (National DPP) lifestyle change program (LCP) can help reduce the onset of both type 2 diabetes and other chronic diseases. Additionally, programs like the National DPP LCP provide opportunities to ameliorate other indirect impacts of the public health emergency (PHE), such as decreased social connectedness, reduced physical activity, and poorer nutrition.

The purpose of this report is to summarize the national and international literature regarding the connection between type 2 diabetes and COVID-19. It also visually illustrates the association between COVID-19 severity, the prevalence of adults living with diabetes, socioeconomic status, social vulnerability, and race and ethnicity through relevant state examples. The interconnectedness of these factors points to the need to address public health and chronic disease prevention in a comprehensive, multifaceted way through programs like the National DPP LCP.

The National DPP LCP is a year-long evidence-based intervention that has been shown to reduce the rate of type 2 diabetes by 58% among program participants. More information on the National DPP LCP is available on p. 10.

Methodology

In April 2020, researchers at the National Association for Chronic Disease Directors (NACDD) and the Kem C. Gardner Policy Institute at the University of Utah began tracking literature related to COVID-19 and type 2 diabetes. The new research was identified using academic databases, press releases, and news articles highlighting recently published studies. Due to the recency of COVID-19, researchers did not place limits on the population studied or methodologic design. After the literature was collected and summarized, researchers re-reviewed each source to include only articles published in academic journals, by research institutes, or by federal or state agencies in this report. As more risk factors for COVID-19 became apparent (e.g., age, race/ethnicity, socioeconomic status, etc.), researchers expanded the literature review to include studies on the factors associated with type 2 diabetes. Some of this literature is included in this report to contextualize the results.

Data

This report also highlights relevant state examples that visually illustrate the connection between COVID-19 severity, the prevalence of adults living with diabetes, socioeconomic status, social vulnerability, and race and ethnicity with regional or county-level data. COVID-19 data are from state COVID-19 dashboards. While these state-level COVID-19 dashboards are frequently updated, data included in this analysis are from the end of March and early April 2021 for all state examples.

The prevalence of adults living with diabetes comes from the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System (BRFSS), made available through state health departments. The most recent publicly available data from each state is used in the analyses. Socioeconomic status and social vulnerability data are from CDC's Social Vulnerability Index (the most recent data available are from 2018). Data regarding race/ethnicity and population are from the U.S. Census Bureau 2019 County Population by Characteristics data set.

Research Notes and Limitations

1. While this report focuses on complications and implications related to type 2 diabetes, it is important to note that some studies included in the literature review do not differentiate between type 1 and type 2 diabetes. In these cases, the report uses the term "diabetes." Type 1 and type 2 diabetes are expressly noted when studies or data make that differentiation. BRFSS, the primary source for estimating diabetes prevalence for states and nationally, also does not differentiate between type 1 and type 2 diabetes. As such, the prevalence of adults living with diabetes presented in Figures 1–5 is inclusive of both type 1 and type 2 diabetes.
2. As noted above, researchers at NACDD and the Gardner Institute began tracking literature related to COVID-19 and type 2 diabetes in April 2020, and this report includes research published through April 2021. Research showing the connection between diabetes and severe

complications from COVID-19, as well as its indirect impacts, is therefore new and continuing to emerge. Future research may modify some of the findings presented by the research summarized in this report.

3. Data used in the state-level visualizations are from different years due to data availability. Given the different years used in the analysis, data should be interpreted cautiously when comparing data within or between each visualization. For example, diabetes rates from New York are from the state's 2016 BRFSS, and COVID data are as of March 2021. While more current diabetes prevalence data are not publicly available, it may be helpful to note that diabetes prevalence does not change significantly from year to year. As such, these geographic visualizations help underscore the interconnectivity between the different risk factors for type 2 diabetes and COVID-19, contribute to expanding one's understanding of these relationships, and highlight possible areas of increased risk.
4. This report summarizes key findings from multiple studies and data sets to better understand the connection between COVID-19 and type 2 diabetes. The terminology used in the report may not match current convention because the terms are presented as they are used in the different studies or data sets.

Literature Review

Direct Impacts of COVID-19 on Persons Living with Type 2 Diabetes

Severe complications from COVID-19

Emerging national and international research increasingly shows that individuals with type 2 diabetes and other chronic conditions, regardless of age, face a greater chance of experiencing severe complications if they contract COVID-19. For example, a CDC study released in June 2020 reported diabetes as the second most common underlying health condition in COVID-19 patients, manifesting in 30% of patients. The study also found that hospitalizations were six times higher and deaths 12 times higher among those with underlying health conditions compared with those with none.[1] Initial results from another study on the phenotypic characteristics and prognosis of inpatients with COVID-19 and diabetes, published in *Diabetologia*, found that 1 in 10 hospitalized COVID-19 patients with diabetes died within seven days of admission, and 1 in 5 needed a ventilator within seven days.[2] Updated results from this study show 1 in 5 hospitalized COVID-19 patients with diabetes died within 28 days of hospitalization.[3]

A study published in the *Journal of Diabetes Science and Technology* found people with diabetes and uncontrolled hyperglycemia are more likely to have severe complications from COVID-19, including longer hospital stays and death. The combined patient groups with diabetes and uncontrolled hyperglycemia were more than four times as likely to die from COVID-19.[4] Additionally, a *Journal of the American Medical Association* study of 72,314 case records in China indicated a fatality rate of 7.0% among those with diabetes compared with an overall fatality rate of 2.3%.[5] Finally, a study published in *Diabetes Care* shows diabetes is the third-most-common (57%) underlying health condition among Black patients hospitalized for COVID-19. This study also supported other research findings that diabetes is associated with increased intensive care unit (ICU) admission and invasive mechanical ventilation.[6]

Diabetes is the **second most common** underlying condition in COVID-19 deaths nationwide.

(CDC, 2021)

One in Five

One study found that 1 in 5 hospitalized COVID-19 patients with diabetes died within 28 days of hospitalization.

(Wargny et. al., 2021)

Another study showed **hospitalizations were 6x higher** and **deaths 12x higher** among those with underlying conditions compared to those with none.

(Stokes et. al., 2020)

The literature points out that many other underlying conditions often associated with type 2 diabetes and prediabetes are tied to increased risk of severe illness from COVID-19 as well. These conditions include:[7]

- Chronic kidney disease
- Heart disease
- Obesity

For example, one of the largest U.S. studies of patients with COVID-19 found that chronic kidney disease and increased body mass index (BMI) are prominent risk factors for COVID-19 hospitalization.[8] The CDC also points to obesity and gestational diabetes as being risk factors that may make pregnant women more likely to experience COVID-19 complications.[9] A meta-analysis of 22 studies published in *Diabetologia* included more than 17,000 people with diabetes and explored key diabetic risk factors linked to severe COVID-19 outcomes. It showed that men with diabetes were 28% more likely to die with COVID-19 than women with diabetes. Additionally, poorly controlled blood sugar levels were among the most influential factors increasing the risk of death in people with diabetes and COVID-19.[10]

The literature also confirms that the COVID-19 virus results in more severe illness in older populations, particularly individuals with diabetes. The *Diabetologia* meta-analysis found that people age 65 and older with diabetes and COVID-19 were more than three times more likely to die than younger people with diabetes and COVID-19.[11] A data snapshot from the Centers for Medicare and Medicaid Services (CMS) shows more than 4 million Medicare beneficiaries were diagnosed with COVID-19 as of March 20, 2021, and more than a million were hospitalized. Data on comorbidities were collected for Medicare's fee-for-service patients, which comprise 57% of the total Medicare population. Half of these patients who were hospitalized for COVID-19 had diabetes.[12]

Possible increased diagnosis of diabetes

New evidence is surfacing that the relationship between type 2 diabetes and COVID-19 could be bidirectional, whereby a COVID-19 diagnosis is associated with increased risk for the onset of diabetes. While not yet definitive, this is an area of emerging and continuing research.[13] A meta-analysis published in the *New England Journal of Medicine (NEJM)* provides information from eight studies containing information on the onset of new diabetes among COVID-19 patients. These studies estimate 14.4% of hospitalized cases resulted in new-onset diabetes or previously undiagnosed diabetes (typically measured as having no previous diagnosis of diabetes and a hemoglobin A1c ≥6.5% or FPG ≥7.0).[14]

In a study using data from Veterans Affairs (V.A.) published in *Nature*, COVID-19 survivors were 39% more likely to have a new diabetes diagnosis in the six months after infection than users of the V.A. Health System who had not had COVID-19.[15] Another study published in *British American Journal* compared patients with diabetes hospitalized with COVID-19 with an exactly matched control group. This study showed that those hospitalized with COVID-19 were diagnosed with diabetes 1.5 times more frequently than the matched control group.[16]

This relationship could also extend to children. Preliminary findings in a study from the United Kingdom show a possible link between COVID-19 and the onset of type 1 diabetes. Cases of type 1 diabetes among children nearly doubled during the peak of Britain's COVID-19 pandemic compared with previous years.[17] Another study of youth published in *Diabetes Care* shows a drastic increase in diabetic ketoacidosis (DKA) among new-onset type 2 diabetes patients during the COVID-19 pandemic, more than doubling from less than 10% in 2018–2019 to 20% in 2020. However, the study acknowledges more information is needed to determine if this increase is related to COVID-19 infection.[18]

36%

of U.S. adults reported delaying or foregoing health care due to concerns about COVID-19 exposure or because their provider limited services due to the pandemic.

More than 75%

of these adults had one or more chronic health conditions.

(Gonzalez et. al., 2021)

COVID-19 isolation is associated with a

33.5% reduction

in physical activity and a

28.6% increase

in sedentary time.

(Marcal et. al., 2020)

Nearly 1 in 3

U.S. adults are experiencing symptoms of anxiety and depression during the COVID-19 pandemic.

(CDC, 2021)

Rates of food insecurity

More than Tripled

from **10.5%** in 2019 to **38.3%** in March and April 2020.

(Fitzpatrick et. al., 2021)

Finally, a study of 413 Italian patients showed that ICU admission and death were more common among patients with diabetes (37.4%) than those without diabetes (20.3%). The association was stronger for those with newly diagnosed diabetes on admission than those with preexisting diabetes.[19]

Indirect Impacts of COVID-19 on Persons Living with Type 2 Diabetes

While the direct impacts of COVID-19 on those with diabetes are concerning, numerous indirect impacts could worsen the condition of individuals living with diabetes and prediabetes as well. These impacts arise from decreased access to care, delays in seeking care, stay-at-home directives, and economic downturns, among other factors.

For example, in the ten weeks following the declaration of the COVID-19 PHE, data from a June 2020 CDC *Morbidity and Mortality Weekly Report* show that visits to the emergency department for uncontrolled high blood sugar declined by 10%.[20] People living with diabetes could experience more severe complications from their diabetes by not seeking appropriate treatment. The pandemic also led to health services becoming partially or wholly disrupted in many countries. The World Health Organization reported that 49% of countries have seen disruptions of treatment for diabetes and diabetes-related complications.[21]

In addition to a lack of access to care, many people chose to postpone or cancel appointments with their health care provider. Data from the Urban Institute show that as of September 2020, 36.0% of U.S. adults reported delaying or foregoing health care due to concerns about COVID-19 exposure or because their provider limited services due to the pandemic.[22] The data also show that more than 75% of adults with delayed or foregone health care had one or more chronic health conditions.[23] Nearly 1 in 3 reported that their delayed or foregone care worsened at least one of their health conditions or limited their ability to work or perform daily activities.[24] Additionally, nearly 30% of parents reported delaying or foregoing health care for their children because of the pandemic. Many parents reported this delayed, or foregone health care negatively affected their children's lives.[25]

Experts are concerned that the rate of prediabetes and type 2 diabetes could also increase due to stay-at-home orders and directives. For example, public health scientists noted in an *Obesity* article that school closures due to the COVID-19 pandemic could exacerbate childhood obesity in the United States.[26] Short-term loss of physical activity and increased sedentary behavior could also increase obesity, diabetes, and cardiovascular disease in children. In a study published in *BMC Public Health*, about 36.0% of surveyed parents indicated their child had much less physical activity, and 41.0% reported their child was sitting more in the early-COVID period (April–May 2020) compared with the pre-COVID period (February 2020). In contrast, only 11.0% indicated that their child had much more physical activity, and 6.0% reported their child was sitting less in the early-COVID period compared with the pre-COVID period.[27]

Throughout the COVID-19 pandemic, persons living with diabetes faced difficult decisions, whether to risk exposure by exercising outdoors or remain indoors to maintain social distancing. Lack of exercise could lead to increased complications from diabetes and increased diagnosis of type 2 diabetes. Preliminary findings from a study published in *Frontiers in Endocrinology* show an increase in health-risk associated behaviors during isolation due to COVID-19, including a 33.5% reduction in physical activity, a 28.6% increase in sedentary time, and increased consumption of unhealthy food. This study estimates that this reduction in physical activity could increase cases of type 2 diabetes from 7.2% to 9.6% and all-cause mortality from 9.4% to 12.5%.[28]

Rates of anxiety and depression have also risen due to the pandemic. Data from the National Health Interview Survey show that from January to June 2019, only 8.2% of adults aged 18 and older experienced anxiety disorder symptoms, and 6.6% had depressive disorder symptoms. The U.S. Census Bureau began conducting the Household Pulse Survey in May 2020 to measure relevant information about the impact of the coronavirus pandemic on U.S. residents, and this survey shows that these rates have more than tripled. Between 28% and 30% of adults have reported anxiety symptoms, and between 23.0% and 30.0% have reported symptoms of depression.[29] These rates could also be higher for persons living with diabetes, as studies estimate they are twice as likely to suffer from depression as persons without diabetes.[30, 31] Additionally, research from *Social Science and Medicine* found a significant increase in the likelihood of obesity, diabetes, and mental health problems after the 2008 Great Recession.[32]

The economic downturn associated with the COVID-19 pandemic has also increased levels of food insecurity, which can lead to type 2 diabetes. The U.S. Department of Agriculture (USDA) reports that 10.5% of U.S. households were food insecure sometime during 2019.[33] A study published in the *Journal of Hunger and Environmental Nutrition* found that rates of food insecurity more than tripled in March and April 2020, with 38.3% of surveyed households reporting moderate to high food insecurity. This study also shows that food insecurity is more pronounced among some communities of color, with 54.7% of Black respondents, 45.0% of Native American respondents, and 53.4% of Hispanic respondents having moderate to high food insecurity.[34] Research shows that food insecurity is correlated with type 2 diabetes. For example, in a study of Latina adults published by the *U.S. National Library of Medicine National Institutes of Health*, participants with very low food insecurity were 3.3 times more likely to have type 2 diabetes.[35]

State Examples

To further illustrate the direct and indirect impacts of COVID-19 on persons living with type 2 diabetes, this report presents relevant state examples that visually highlight the connection between COVID-19 severity, the prevalence of adults living with diabetes, socioeconomic status, social vulnerability, and race and ethnicity at the regional or county-level. States included in the analysis have been working with NACDD, with funding and support from the CDC Division of Diabetes Translation (DDT), to determine ways to advance Medicaid coverage of the National DPP LCP.

Example states include New York, Oregon, and Kentucky, although similar visualizations could be made for any state or region. In addition to helping states better understand the direct and indirect impacts of COVID-19 on persons living with type 2 diabetes, state officials are using this type of information to underscore the importance of continued chronic disease prevention and management and support state action strategies regarding the National DPP LCP.

New York

More than 90.0% of all New York COVID-19 fatalities have at least one comorbidity. Type 2 diabetes is the second most common comorbidity, present in approximately 35% of all fatalities. These results mirror an April 2020 study published in the *Journal of American Medical Association (JAMA*) examining the outcomes of 5,700 hospitalized COVID-19 patients in the New York City (NYC) area. Diabetes was one of the top three most prevalent preexisting conditions among these patients (33.8%).[36]

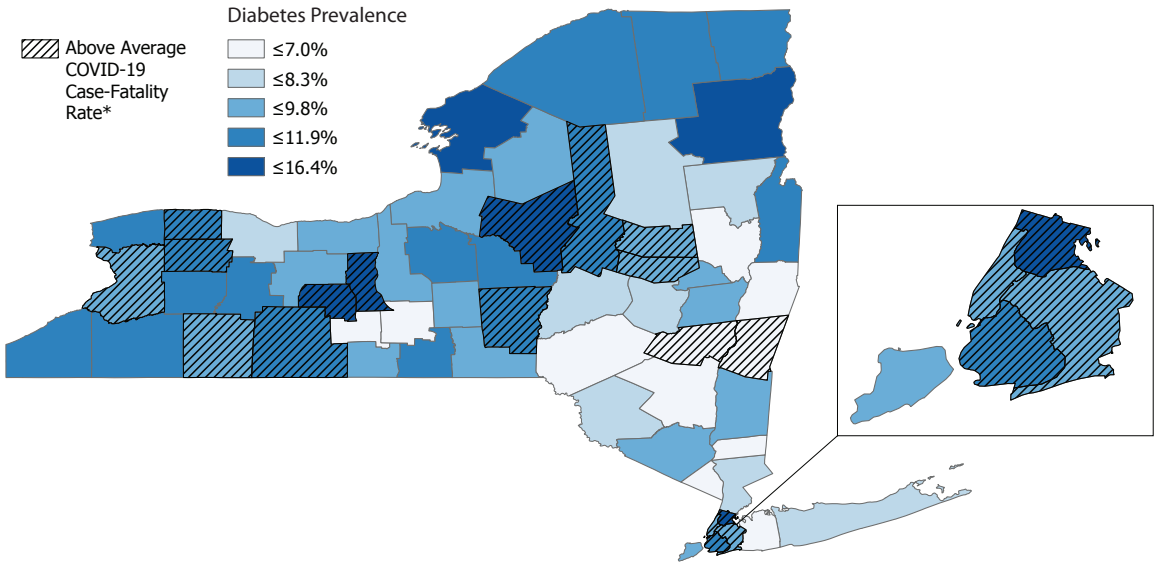
Approximately 10.5% of New York residents have been diagnosed with type 2 diabetes, according to data from the 2017 Behavioral Risk Factor Surveillance System (BRFSS). Figure 1 shows diabetes prevalence in New York by county while highlighting counties with an above-average COVID-19 case-fatality rate (defined as COVID-19 deaths as a percent of total COVID-19 cases). Note that four of the five NYC boroughs, the state's metropolitan urban area, have above average case-fatality rates. Most of the counties with the highest diabetes prevalence also have above-average COVID-19 case-fatality rates. The counties that do not have high COVID-19 case-fatality rates are located primarily in the northeast area of the state. This area is more rural and has experienced a limited spread of COVID-19.

Oregon

Oregon tracks COVID-19 metrics by race/ethnicity. Some populations of color make up larger shares of the state's COVID-19 cases, hospitalizations, and deaths than they do of the state's population. For example, Oregon's Black population makes up only 2.2% of the state's overall population but 4.1% of COVID-19 cases, 4.3% of COVID-19 hospitalizations, and 2.5% of COVID-19 fatalities. Many communities of color also experience higher rates of diabetes (see Table 1). These disparities could be due to reduced access to health care and health insurance, social and environmental contributors, health behaviors, and other biological and non-biological factors.[37]

To prioritize vaccine distribution in an equitable way, Oregon utilized the CDC's Social Vulnerability Index (CDC SVI). The CDC SVI comprises four aggregated themes and 15 individual variables. The four CDC SVI themes include Socioeconomic Status, Household Composition & Disability, Minority Status & Language, and Housing Type & Transportation. Social

Figure 1: New York Adult Diabetes Prevalence by County, 2016



Note: COVID-19 data are as of March 29, 2021.
*COVID-19 fatalities as a share of total COVID-19 cases.
Source: New York Health Department Behavioral Risk Factor Surveillance System Health Indicators by County and New York Health Department COVID-19 Data Tracker.

Table 1: Oregon Diabetes Prevalence and COVID-19 Metrics by Race/Ethnicity

Race/Ethnicity	Share of Population, 2019	Adult Diabetes Prevalence 2010–2011	Share of COVID-19 Cases	Share of COVID-19 Hospitalizations	Share of COVID-19 Fatalities
Two or More races	4.0%	NA	2.8%	2.5%	2.7%
American Indian/ Alaska Native	1.8%	14.0%	3.0%	3.4%	2.3%
Asian	4.9%	7.0%*	5.2%	4.7%	3.3%
Black	2.2%	23.0%	4.1%	4.3%	2.5%
Hispanic/Latino	13.4%	15.0%	33.9%	24.4%	12.4%
Native Hawaiian/ Pacific Islander	0.5%	7.0%*	1.5%	2.3%	1.2%
White	86.7%	7.0%	83.4%	82.8%	88.0%

Note: COVID-19 data as reported in the March 24, 2021, weekly data report. Percent of COVID-19 cases, hospitalizations, and fatalities are calculated among individuals where the race is known, excluding "Not available," "unknown," and "other" to match U.S. Census Bureau categorization. Diabetes prevalence is dated due to the need for an oversampling of populations of color that are not completed annually.
NA – Data not available
*Asian and Native Hawaiian/Pacific Islander diabetes prevalence were reported together.
Source: Oregon Health Authority and U.S. Census Bureau

Figure 2: Oregon Adult 2014–2017 Diabetes Prevalence and 2018 Social Vulnerability by County

Note: The SVI is on a scale of 0 to 1, with 1 being the most vulnerable and 0 being the least. The more vulnerable a county is, the larger the yellow circle.
Source: Oregon Health Authority and CDC Social Vulnerability Index

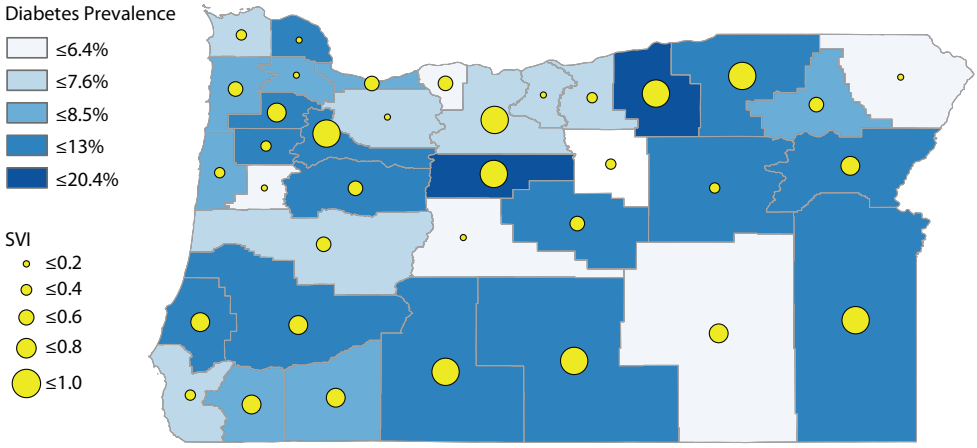
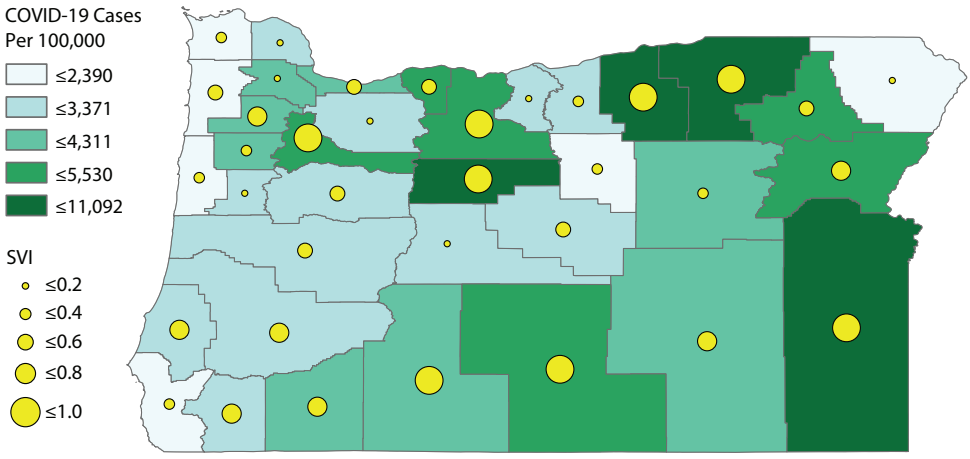


Figure 3: Oregon COVID-19 Cases per 100,000 Population and 2018 Social Vulnerability by County

Note: The SVI is on a scale of 0 to 1, with 1 being the most vulnerable and 0 being the least. The more vulnerable a county is, the larger the yellow circle. COVID-19 data are as of March 29, 2021.
Source: Oregon Health Authority and CDC Social Vulnerability Index



vulnerability scores for each of these themes are derived from normalized percentile ranks for each CDC SVI variable.[38] This index indicates the relative vulnerability of various counties.

Figure 2 shows Oregon diabetes rates and CDC SVI by county. While diabetes and other chronic disease measures are not included in the calculation of the CDC SVI, this map shows the relationship. Counties with the highest diabetes rates (shown in darker blue) also tend to have higher CDC SVI scores (shown as larger yellow circles). This indicates that those living in socially vulnerable areas also face a higher likelihood of having diabetes. Figure 3 shows COVID-19 cases per 100,000 population and CDC SVI by county. Counties with the highest COVID-19 case rates (shown in darker green) also tend to have higher CDC SVI scores (shown as larger yellow circles). Thus, the counties with the highest vulnerability and higher diabetes prevalence also have high rates of COVID-19.

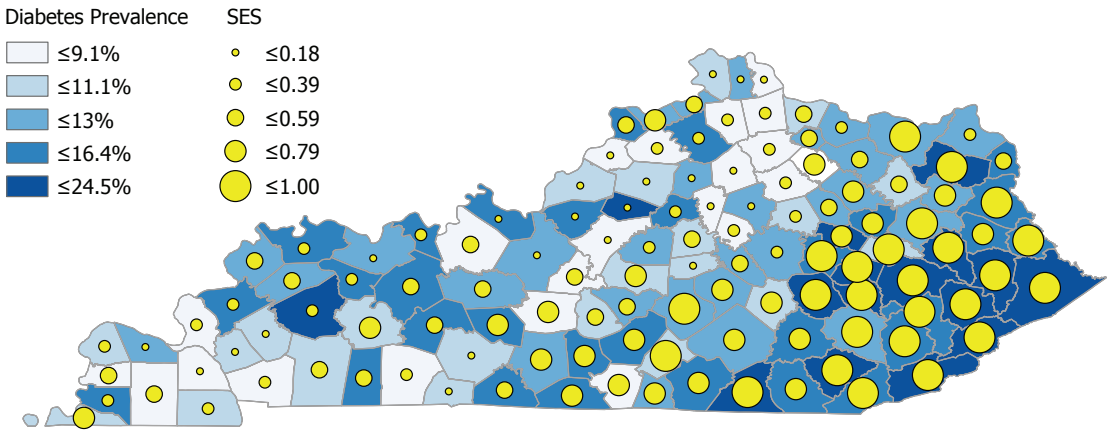
Kentucky

In Kentucky, 13.7% of the population, or approximately 474,500 adults, are diagnosed with diabetes. Kentucky's diabetes prevalence is above the national average, and Kentucky ranked fourth in the nation in 2016 for having the highest mortality rate due to diabetes, increasing from 14th in 2014.[39, 40] Diabetes is the sixth leading cause of death in Kentucky, and from 2000 to 2018, diagnosed diabetes more than doubled in Kentucky adults, increasing from 6.5% to 13.7%.[41, 42]

One of the measures contributing to the CDC SVI is socioeconomic status (SES). This measure uses American Community Survey data to measure those below poverty, unemployed, low-income, and with no high school diploma. This measure helps represent the relative socioeconomic need of a county compared with others in the state. A score of 1.0 indicates the highest socioeconomic need, while a score of 0 indicates the lowest. Figure 4 shows Kentucky diabetes prevalence and SES as measured by the CDC's SVI tool. Note that counties with the highest diabetes prevalence (shown in darker blue) also have higher socioeconomic needs (shown with larger yellow circles). This indicates adults living in counties with high socioeconomic needs also have a higher probability of having diabetes.

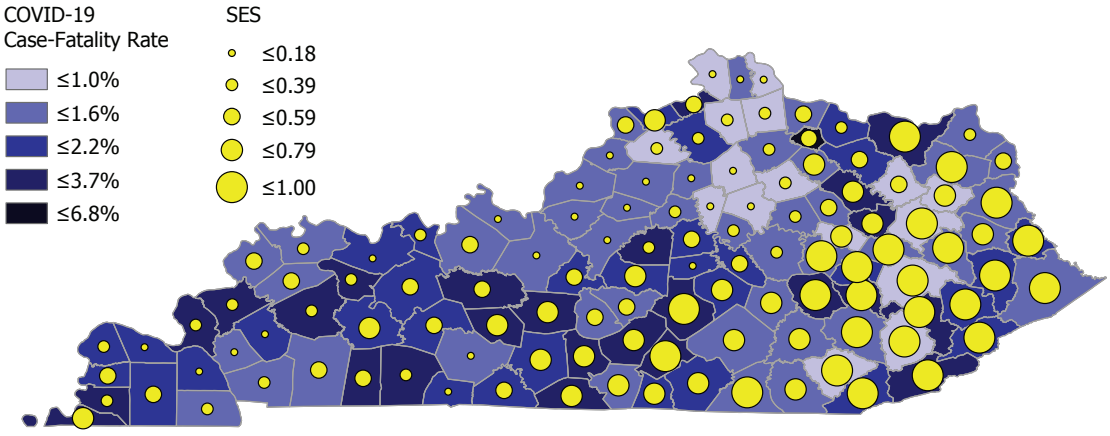
This is particularly concerning because the economic fallout from the pandemic has disproportionately impacted low-income populations.[43] Figure 5 shows the COVID-19 case-fatality rate and socioeconomic status by county. While the connection here is not as strong, this could be due to urbanicity. Diabetes prevalence and SES need are highest in eastern Kentucky, which is also the most rural area of the state where COVID-19 has not spread as widely.

Figure 4: Kentucky Adult 2014–2018 Diabetes Prevalence and 2018 Socioeconomic Status by County



Note: SES is on a scale of 0 to 1, with 1 being the most vulnerable and 0 being the least. The more vulnerable a county is, the larger the yellow circle.
Source: Kentucky Environmental Public Health Tracking Behavioral Risk Factor Surveillance System and CDC Social Vulnerability Index

Figure 5: Kentucky COVID-19 Case-Fatality Rate and 2018 Socioeconomic Status by County



Note: SES is on a scale of 0 to 1, with 1 being the most vulnerable and 0 being the least. The more vulnerable a county is, the larger the yellow circle. COVID-19 data are as of April 7, 2021. COVID-19 case-fatality rate COVID-19 fatalities as a share of total COVID-19 cases.
Source: Kentucky Environmental Public Health Tracking Behavioral Risk Factor Surveillance System and CDC Social Vulnerability Index

Discussion

The literature and state examples highlighted above illustrate the interconnectedness of the many risk factors associated with COVID-19 and type 2 diabetes. Not only are individuals living with type 2 diabetes at higher risk for experiencing COVID-19 complications, but they also face other risk factors that the COVID-19 pandemic may have exacerbated. These risk factors include a lack of access to care, delayed care, reduced physical activity, increased anxiety and depression, and increased food insecurity. These risk factors disproportionately impact areas with high social vulnerability, socioeconomic needs, and populations of color—areas and populations that also tend to have higher rates of diabetes and to be at higher risk of COVID-19.

This interconnectedness highlights the importance of continued chronic disease prevention and points to the need to address public health and chronic disease prevention with a comprehensive, multifaceted approach. This approach can be addressed through programs like the National DPP LCP.

The National DPP LCP is a year-long evidence-based program developed by the CDC that focuses on helping participants make positive lifestyle changes such as eating healthier and getting more physical activity. It can be delivered in person, online, through distance learning, or a combination approach in group settings. Research shows that people with prediabetes who participate in this structured lifestyle change program can cut their risk of developing type 2 diabetes by 58% (71% for people over 60 years old).[44] Several studies have found that the National DPP LCP is also effective in reducing the onset or severity of other chronic conditions, such as cardiovascular disease, cognitive decline, and obesity.

Not only does the National DPP LCP reduce the incidence of type 2 diabetes, but it also provides an opportunity for individuals to overcome the indirect impacts of the PHE through physical activity, nutrition counseling, and social connectedness. For example, many National DPP LCPs continued during the PHE due to the availability and rapid adoption of virtual delivery modalities, which provided participants with connection and social support during periods of social distancing.

More specifically, Medicaid coverage of the National DPP LCP can help increase access to the program in socially vulnerable and low socioeconomic areas. These areas may be hardest hit by the long-term effects of chronic disease and the direct and indirect impacts of pandemics and PHEs.

The National Diabetes Prevention Program

An estimated 88 million U.S. adults—greater than 1 in 3 adults in the U.S.—have prediabetes. With prediabetes, blood sugar is higher than normal but not high enough to be diagnosed as diabetes. People with prediabetes are at increased risk for type 2 diabetes (the most common type of diabetes), heart disease, and stroke.

To better address the growing problems of prediabetes and type 2 diabetes, Congress authorized the CDC to establish the National DPP. This public-private initiative provides the framework for type 2 diabetes prevention efforts in the United States, including the development of the National DPP LCP. To learn more, the CDC provides comprehensive information and resources on the National Diabetes Prevention Program website: https://www.cdc.gov/diabetes/prevention/index.html

Conclusion

The National DPP LCP and other chronic disease prevention programs are upstream interventions that can mitigate COVID-19 complications and accrued chronic disease burden from the public health emergency, particularly for at-risk communities. While COVID-19 vaccines are readily accessible in the U.S., the CDC is still learning how many people must be vaccinated against COVID-19 before the population can be protected (through population or herd immunity). CDC is also still learning how effective the vaccines are against new variants of the virus that cause COVID-19. Many scientists expect the SARS-CoV-2 will likely become an endemic virus and will not be eliminated.[45] Mitigating the acute and long-term impacts of chronic disease now can, in turn, help reduce the harmful effects of the ongoing circulation of coronavirus and help improve people's health and lives.

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At-A-Glance 2021

BY THE NUMBERS

~7,000
Members nationwide

40+
staff at NACDD headquarters

50+
subject matter expert consultants

~40
million dollars in revenue

35+
federally-funded projects/programs under 5 major cooperative agreements

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We are the National Association of Chronic Disease Directors (NACDD), a professional association of more than 7,000 public health professionals and thought leaders working in State and Territorial Health Departments, national nonprofits, health systems, federal agencies, academia, and the private industry.

We seek to enhance the work of state and territorial chronic disease leaders to prevent chronic disease and to promote health for all.

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- Alzheimer's/Healthy Aging
- Arthritis
- Biomarkers
- Building Resilient Inclusive Communities (BRIC)
- Healthy Communities
- Cancer Prevention and Control
- Cardiovascular Health
- Coordinating Center for Public Health Practice
- Diabetes Prevention and Control
- GEAR Groups
- Pacific Chronic Disease Council
- Oral Health
- State Activation and Response (STAR)
- Vision and Eye Health
- Workplace Health Promotion

CHRONIC DISEASES IMPACT ALL OF US*

About half of all American adults (117 million people) have at least one chronic health condition; one-quarter of Americans experience more than one chronic disease.

Our communities are losing revenue — 75 percent of our nation's healthcare spending is for treatment of chronic disease.

Preventable chronic diseases dominate the leading causes of death and disability in the U.S., with heart attack and stroke causing nearly half of all mortality.

The CDC reports that chronic diseases can co-exist with and intensify symptoms of mental illnesses, such as depression.

**Figures cited from CDC.*

260 Million
Americans reached through NACDD project collaboration

Every American Benefits from NACDD Activities

Patients and their families can experience higher qualities of life and lower their risks for serious illness through access to programs that help people adopt and maintain healthy lifestyles and behaviors.

Our society can save billions of dollars every year by preventing some cancers, diabetes, heart disease, and arthritis.

Businesses have more productive workforces due to reduced absenteeism.

Healthy school-aged children have better academic achievement and greater future job potential and opportunities.

Our nation is more secure with fit recruits and healthier, stronger communities.

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