

THE IMPACT OF SOCIAL DETERMINANTS ON TYPE 2 DIABETES

An analytical study



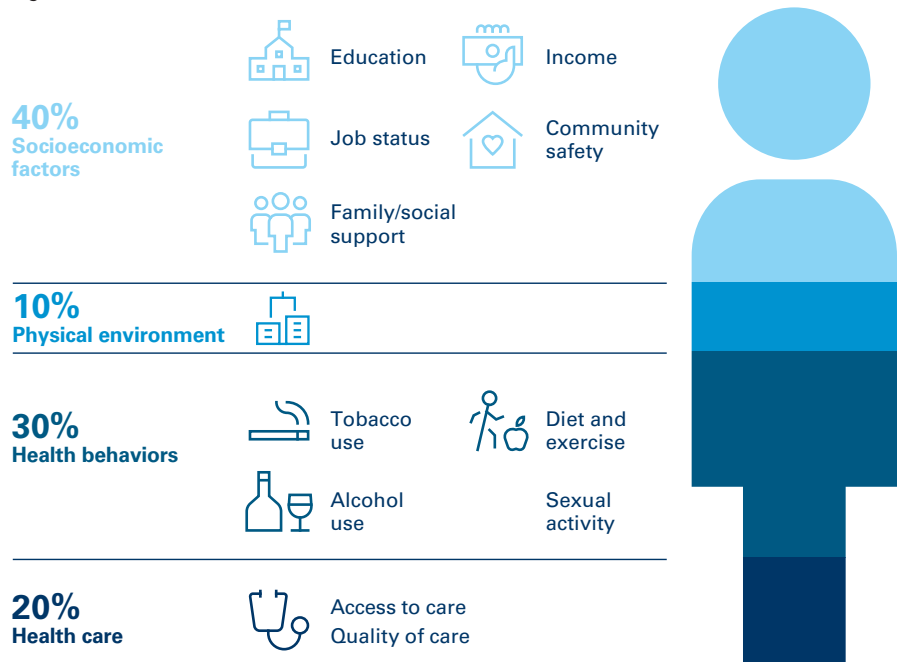
INTRODUCTION

A whole-person analytical analysis was conducted and revealed novel and actionable insights to reduce the burden of diabetes for our members. Integrated social determinant of health (SDOH), clinical, behavioral and financial data were analyzed to understand the impact of social determinants on Type 2 diabetes (T2D) incidence, severity, and progression. Findings from this study support the need to address social determinant interventions to reduce the incidence and severity of diabetes across all lines of business — including commercial markets — contrary to some opinions. While the amount of members without any SDOH factors diminished in the advanced stages of the disease, unique clinical and non-clinical factors emerged for each line of business as it relates to the progression of diabetes. Findings from this analysis have informed our enterprise diabetes strategy and provided a data driven path towards advancing health equity and reducing the social and economic burden of diabetes.

Over the past two decades, the rate of diabetes has doubled in the U.S., now ranking as the seventh leading cause of death.¹ The burden of this disease is not shared equally, however.

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Figure 1: Determinants of health²



¹ What is diabetes? Accessed October 25, 2021. <https://www.cdc.gov/diabetes/basics/diabetes.html>

² County Health Rankings Model. Accessed October 25, 2021.

<https://www.countyhealthrankings.org/explore-health-rankings/measures-data-sources/county-health-rankings-model>

Research has shown that Type 2 diabetes (T2D) disproportionately affects marginalized populations, with the highest prevalence among people of color.³

These disparities are the manifestation of structural racism, concentrating vulnerabilities and risks among people with the fewest resources to cope. Among chronic diseases, T2D is particularly sensitive to interventions altering behavior and lifestyle, which have been the primary focus of interventions to date. Behavioral modification is particularly challenging, and yet only one part of the puzzle.

There is overwhelming evidence indicating that social determinants of health (SDOH) account for roughly 80 percent of an individual's health outcomes (Figure 1). Though disparities are stratified socioeconomically, social barriers are commonly experienced across the population, with 68 percent of individuals experiencing at least one SDOH challenge at any given time.⁴ Thus, focusing on drivers of health beyond traditional health care is an important and underexplored part of disease management and prevention.

To date, the relationship between social determinants and T2D incidence and progression is not well understood. This study aimed to explore these relationships and uncover new and actionable insights and opportunities to reduce the economic burden of diabetes. Using the Robert Wood Johnson Foundation SDOH framework, relationships between upstream factors such as race, ethnicity, and socioeconomic status (SES), midstream outcomes, such as housing and food security, and downstream health outcomes, in this case the incidence and progression of diabetes, were explored. The analysis was conducted in collaboration with a leading health services innovation company and included more than 2 million members from Blue Cross and Blue Shield of Minnesota across multiple lines of business and classified the correlational weight unique SDOH factors had on T2D incidence and progression.¹³

We posited that the risk of incidence and rate of progression would vary across individuals, and that unique SDOH factors would correlate to incidence, severity and progression to varying degrees. Here we review the current understanding of the impact unique SDOH factors have on T2D incidence, followed by a discussion of the current state of disparities, and finally we review the study background, findings and implications. Ultimately, the value in this work comes in the power of an integrated whole-person analytics approach to tailor interventions, alter the course of disease incidence and progression, reduce costs, and improve health equity.

KEY QUESTIONS LEADERS ARE ASKING TODAY

- 1 How do we stratify and identify members across a disease continuum from at risk to end of life in a way that captures all the factors impacting health?
- 2 How can we identify and address the impact of SDOH for our members with diabetes in a relevant and meaningful way at the individual and population level?
- 3 What opportunities to reduce the burden of diabetes are revealed with a whole-person analytical approach?
- 4 Are there opportunities to change the trajectory of diabetes in our membership through SDOH-based interventions?
- 5 What are the most significant SDOH factors impacting Type 2 risk, severity and progression?
- 6 How do SDOH contribute to progression of disease?
- 7 How do SDOH risk factors vary across lines of business and disease progression?

³ American Diabetes Association, Accessed April 14, 2022. <https://www.diabetes.org/about-us/statistics/about-diabetes>

⁴ Kaiser Permanente Research: Social Needs in America.

<https://about.kaiserpermanente.org/content/dam/internet/kp/comms/import/uploads/2019/06/KP-Social-Needs-Survey-Key-Findings.pdf>



SDOH AND TYPE 2 DIABETES

While it is clear SDOH impact diabetes prevalence and severity, not all variables contribute equally.



Income: Compared to high-income Americans, people who are considered near poor and poor have rates of T2D 74 percent and 100 percent higher, respectively.⁸



Geography: Location is another factor that contributes to incidence and progression of T2D. One study found that mothers who were given housing vouchers to move to low-poverty neighborhoods had HbA1c levels 21.6 percent lower than the control group in a 10-year follow-up study. Another found that poor individuals in poor neighborhoods had twice the rate of T2D compared to poor individuals in non-poor neighborhoods.⁸



Education: 7.2 percent of adults with a college education have T2D compared to 12.6 percent of adults with less than a high school education. Those with less than a high school education have a mortality rate two times higher than college-educated adults.⁸



Race: Black Americans are 60 percent more likely to be diagnosed with T2D compared to their white counterparts.⁸ In one study, women of color exposed to racism had a 31 percent higher risk of T2D compared to those who infrequently or never experienced racism, even after controlling for SES and other factors. Women with the highest exposure to a lifetime of structural racism via discrimination in work, housing, and police interactions had a 16 percent increased risk of developing T2D compared to women who had no experience of structural racism.⁸



Social isolation: Men living alone had a 94 percent higher rate of T2D compared to those cohabitating. Similarly, men who lacked social involvement in clubs or groups had 42 percent higher odds of T2D. For women, lack of social involvement was associated with 60 percent higher odds of prediabetes and 112 percent higher odds of T2D.⁹

STUDY BACKGROUND

Given the significance of upstream and midstream factors on health outcomes, the foundational framework of this study was to use person-level data to develop a whole-person view of the individual, both in terms of clinical and nonclinical data (Figure 13). This framework was then applied to a member-level dataset with 2.2 million members focusing specifically on T2D with the goal of identifying the most important clinical and nonclinical factors impacting T2D incidence and progression.

The primary focus of this study was on T2D progression and population-level risk category. The progression categories included emerging, at risk, and severe, noting that not everyone under analysis was at the same stage of progression within each category. It was postulated that upstream SDOH factors would vary for individuals along T2D progression and that as disease progresses, both the individual SDOH characteristics and an individual's sensitivity to those

DIABETES BY THE NUMBERS

34.2 MILLION

Number of diabetic cases in the U.S. in 2020⁵

90-95%

Proportion of diabetic cases that are Type 2⁶

\$327 BILLION

Annual diabetic-associated health care costs⁷

1 IN **3**

Americans are at risk of developing diabetes. 80-90% of these individuals are unaware⁸

⁵ National Diabetes Statistics Report, 2020. <https://www.cdc.gov/diabetes/library/features/diabetes-stat-report.html>

⁶ Type 2 Diabetes. <https://www.cdc.gov/diabetes/basics/type2.html#:~:text=More%20than%2037%20million%20Americans,them%20have%20type%202%20diabetes>

⁷ The Power of Prevention. <https://www.cdc.gov/chronicdisease/programs-impact/pop/diabetes.htm>

⁸ County Health Rankings Model. Accessed October 25, 2021.

<https://www.countyhealthrankings.org/explore-health-rankings/measures-data-sources/county-health-rankings-model>

⁹ Health Equity Now. Accessed October 25, 2021. <https://www.diabetes.org/healthequitynow>



characteristics would vary by disease stage. In short, someone who was prediabetic would not have the same SDOH characteristics as someone with complex T2D, and those would impact individuals to different degrees. Within each progression category, it was presumed that individual variations in SDOH vulnerability significantly mediated both the risk of T2D incidence and the rate of progression. Additionally, it was presumed that not all SDOH factors contribute equally to disease incidence, severity and progression, and that parsing apart the most significant drivers through whole-person analytics would allow for more targeted and effective interventions. This type of analysis was only possible by having comprehensive, whole-person data on individuals: SDOH, clinical and behavioral at each stage of T2D progression.

Incorporating propensity to engage with the health system, care management, and the ability to manage one’s health gave a clearer picture of individual-level differences. Integrating all these factors provides a whole-person analytical framework that produces actionable insights.

Figure 2 shows the analytical delivery framework that was leveraged to conduct the analysis and the type of deliverables associated within each stage. The next section discusses the results of the analysis and the output for the findings in each of these categories.

Figure 2: Analytical delivery framework

Integrated data	Integration of clinical, behavioral and SDOH data for a whole-person view of those who fall within the continuum of diabetes progression	Person-level connection of clinical, behavioral and SDOH dataset
Descriptive analytics	Understanding the populations’ utilization, SDOH, and cost data from a high level, with the ability to drill down	Tableau and GIS workbooks to identify opportunity areas for intervention
Diagnostic analytics	Correlation and regression modeling to identify significant factors (clinical/behavioral/SDOH) that correlate with diabetes progression	Correlation maps and decision tree analysis
Predictive analytics	Statistical and predictive models that identify the high-risk, high-want patients based on their propensities and characteristics	What we know about the member impacts on their outcome
Prescriptive analytics	Identify, recommend, and implement care management outreach campaigns to the identified patients; measure, adjust, deploy	How we can change outcomes: analytics, strategy and care delivery

RESULTS AND FINDINGS: INTEGRATED ANALYTICS

To create a dataset that captured a whole-person point of view, person-level clinical, behavioral and SDOH data was integrated together. Rather than focusing only on high-cost, high-risk factors and individuals, focus was placed further upstream in the disease process to identify people at risk for developing severe T2D. Within this dataset, person-level SDOH data consisted of financial insecurity, housing insecurity, social isolation and transportation insecurity. The T2D continuum was segmented into the following three categories for the diagnostic analytics portion of this analysis:

- 1. Emerging risk:** Indication of prediabetes
- 2. At risk:** T2D diagnosis, with no factors from Severe T2D category
- 3. Severe T2D:** T2D with severe complication(s), for example T2D related to admission, ER visit, and renal complications

RESULTS AND FINDINGS: DESCRIPTIVE ANALYTICS

Upon integrating the clinical, behavioral and SDOH dataset, we sought to broadly understand this population from a cost, utilization and SDOH perspective through descriptive analytics. Figure 3 shows two sample tables from an overall Tableau dashboard that was created to visually display the SDOH characteristics of the population across the T2D progression spectrum.

The first table shows the population's distribution and likelihood to experience SDOH insecurities on a scale from very low to very high. It shows that more than half of members are experiencing high or very high levels of social isolation, food insecurity, transportation insecurity and financial insecurity. The second table depicts SDOH burden broken down by disease stage. This view helps to focus on which individual members are the most vulnerable. The second table shows that as disease progresses, the share of members with two or more SDOH factors with high or very high insecurity increases. Similarly, as disease progressed, the share of members with no SDOH factors decreased.

Figure 3: Sample Tableau dashboard, filtered to show all lines of business and diabetes condition levels. SDOH count is in regard to the number of members with high or very high insecurity in one of the five SDOH categories. The bolded numbers represent the highest percentage in each category for the population.

	Food insecurity	Social isolation	Housing insecurity	Transportation insecurity	Financial insecurity
Very high	27.0%	35.0%	15.3%	52.0%	33.6%
High	5.9%	16.8%	8.1%	10.2%	17.2%
Moderate	8.2%	19.9%	16.7%	19.1%	18.9%
Low	17.3%	16.2%	28.5%	12.5%	16.4%
Very low	41.6%	12.2%	31.4%	6.2%	14.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Population Distribution

	SDOH count					
	0	1	2	3	4	5
Advanced	25.9%	26.8%	18.7%	11.9%	9.5%	7.2%
At risk	28.6%	27.8%	17.9%	10.6%	8.2%	6.9%
Stable	28.1%	25.9%	17.5%	11.1%	9.2%	8.3%
Emerging	27.8%	27.1%	17.6%	10.4%	8.8%	8.3%
Prediabetes	31.6%	28.8%	16.8%	8.9%	7.2%	6.6%
No RF	17.0%	22.2%	16.8%	11.8%	14.4%	17.8%
Total	19.7%	23.4%	17.0%	11.4%	13.0%	15.5%



Figure 4 shows the size of the population by line of business and T2D progression within the analysis. The population characteristics resembled what would be expected in the general population. Approximately 13 percent of the membership had a T2D diagnosis, with the Medicare and Dual populations having 2.5 to three times the rate of the overall population.

Figure 4: Population size under analysis. Dual eligible are members who qualify for both Medicaid and Medicare.

Line of business	Total population	No T2D	T2D	T2D condition levels under analysis			
				Emerging risks	Non-severe	Severe	% of total T2D
Medicare	312,951	210,448	102,503	40,815	33,946	27,742	34%
Medicaid	406,260	376,896	29,364	9,664	10,812	8,888	10%
Commercial	1,545,259	1,380,146	165,113	86,841	52,566	25,706	54%
Dual eligible	12,368	7,359	5,009	930	1,669	2,410	2%
Total	2,276,838	1,974,849	301,989	138,250	98,993	64,746	100%
% of total	100%	87%	13%	6%	4%	3%	

RESULTS AND FINDINGS: DIAGNOSTIC ANALYTICS

The purpose of the diagnostic analysis was to determine the significant predictors of T2D incidence and severity levels from the available demographic, SDOH, behavioral and clinical data. The methodology leveraged prepared a member-level dataset with demographic details, SDOH indicators, lifestyle factors, and T2D incidence and severity levels. Then, interrelationships among them were identified and their impact on T2D severity levels were analyzed through decision trees.

Logistical regression modeling was used to show the comparative importance of different SDOH factors on incidence and progression of T2D, across four lines of business. Figure 5 shows the most important SDOH and nonclinical factors for the overall incidence of T2D across lines of business. Unlike the clinical factors, there were differences across lines of business and SDOH factors. Among the Medicare population, the most important factors were midstream factors like financial insecurity, transportation insecurity and social isolation. The most important factors for Commercial and Medicaid were level of engagement (health ownership index, HOI) and the most important for Dual Eligible Special Needs (Dual Eligible) were around ethnicity, language and security factors.



Comparative Scale Against Median

2x 1.1-1.2x 1x <1x

Figure 5: Top nonclinical factors for T2D incidence by line of business

Commercial	Medicaid	Medicare	Dual Eligible
HOI – low health status	HOI – low health status	Financial insecurity	Ethnicity
Socioeconomic status	HOI – low health ownership	Socioeconomic status	Language code
HOI – low health ownership	Socioeconomic status	Transportation insecurity	HOI – low health status
Propensity to engage	Propensity to engage – IB	Housing insecurity	Socioeconomic status
Propensity to engage – CM	Propensity to engage	Social isolation	Financial insecurity
Propensity to engage – IB	Language	Food insecurity	Housing insecurity
Language code	Ethnicity	Ethnicity	HOI – low health ownership
Housing insecurity	Housing insecurity	HOI – low health status	Transportation insecurity
Ethnicity	Propensity to engage – CM	Language	Food insecurity
Food insecurity	Food insecurity	HOI – low health ownership	Propensity to engage – CM
Financial insecurity	Financial insecurity	Propensity to engage	Social isolation
Transportation insecurity	Social isolation	Propensity to engage – IB	Propensity to engage
Social isolation	Transportation insecurity	Propensity to engage – CM	Propensity to engage – IB

Figure 6 shows the relationship between the most important nonclinical factors and T2D severity. A couple items stand out. First, SDOH security issues stand out across the board, regardless of the line of business. Among the most important SDOH security issues were financial, housing and transportation. Second, SDOH factors varied significantly across lines of business, unlike previous analysis. Similarly, sensitivity to nonclinical factors varied by line of business, with Dual Eligible and Medicare being the most sensitive. While it appeared Medicaid had the least sensitivity to nonclinical factors, this is likely due to under reported data due to barriers to accessing care experienced by Medicaid members and lower reimbursement rates relative to commercial. Also, there was significant impact of SDOH factors on incidence and severity among the commercial population, contrary to mainstream assumptions that SDOH factors are only significant for elderly and low-income members.

Comparative Scale Against Median

2x 1.1-1.2x 1x <1x

Figure 6: Top nonclinical factors for T2D severity by line of business

Commercial	Medicaid	Medicare	Dual Eligible
Socioeconomic status	HOI – low health status	Financial insecurity	Financial insecurity
HOI – low health status	Housing insecurity	Transportation insecurity	HOI – low health status
Housing insecurity	HOI – low health ownership	Socioeconomic status	Housing insecurity
Financial insecurity	Propensity to engage	Housing insecurity	Propensity to engage – IB
Social isolation	Socioeconomic status	Social isolation	Transportation insecurity
Food insecurity	Propensity to engage – CM	Food insecurity	Socioeconomic status
Propensity to engage	Ethnicity	Ethnicity	Social isolation
Propensity to engage – CM	Food insecurity	Language	Ethnicity
Language code	Financial insecurity	HOI – low health status	HOI – low health ownership
Ethnicity	Transportation insecurity	HOI – low health ownership	Propensity to engage
Propensity to engage – IB	Social isolation	Propensity to engage	Food insecurity
HOI – low health ownership	Propensity to engage – IB	Propensity to engage – IB	Language code
Transportation insecurity	Language	Propensity to engage – CM	Propensity to engage – CM



Overall, the diagnostic modeling work showed that there are similarities in underlying clinical and nonclinical factors and T2D incidence in general; however, that did not hold true regarding severity of T2D. While there were diagnostic factors consistent across lines of business, there were unique factors as well that can be leveraged to create line of business specific, actionable decision trees.

PREDICTIVE AND PRESCRIPTIVE ANALYTICS: T2D PROGRESSION BY SDOH FACTORS — R2 ANALYSIS

Figure 7 shows the SDOH factors with the largest impact on T2D progression among the Medicaid population. For Medicaid members, HOI — low health status, transportation insecurity, and HOI — low health ownership showed better prediction strength in comparison to other SDOH factors at all condition levels of T2D. Additionally, socioeconomic status was a stronger predictor in T2D severity level compared to language and ethnicity.

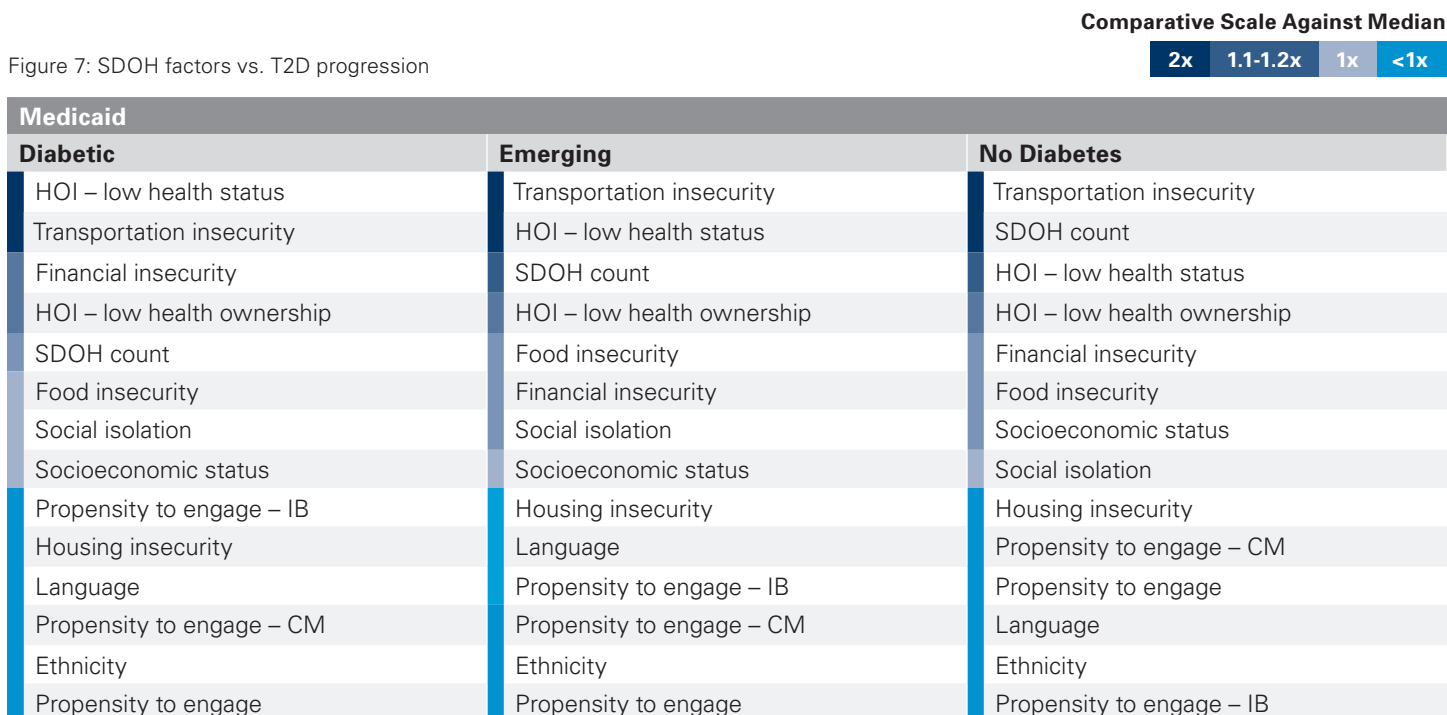


Figure 8 shows the SDOH factors with the largest impact on T2D progression among the commercial population. For commercial members, health ownership — low health status was the strongest among all SDOH factors at all condition levels. Additionally, propensity to engage — IB (inbound call) and propensity to engage — CM (care management) showed an inverse relation in determining the T2D condition level.

Comparative Scale Against Median

2x 1.1-1.2x 1x <1x

Figure 8: SDOH factors vs. T2D progression

Commercial		
Diabetic	Emerging	No Diabetes
HOI – low health status	HOI – low health status	HOI – low health status
Transportation insecurity	Social isolation	Transportation insecurity
Social isolation	SDOH count	SDOH count
SDOH count	HOI – low health ownership	Social isolation
Language	Transportation insecurity	Financial insecurity
Financial insecurity	Financial insecurity	HOI – low health ownership
HOI – low health ownership	Food insecurity	Food insecurity
Propensity to engage	Housing insecurity	Housing insecurity
Ethnicity	Ethnicity	Socioeconomic status
Food insecurity	Propensity to engage – CM	Propensity to engage
Propensity to engage – CM	Socioeconomic status	Language
Housing insecurity	Propensity to engage	Ethnicity
Socioeconomic status	Language	Propensity to engage – CM
Propensity to engage - IB	Propensity to engage – IB	Propensity to engage – IB

Figure 9 shows the SDOH factors with the largest impact on T2D progression among the Medicare population. For Medicare members, propensity to engage — CM (likelihood for someone to engage in care and disease management programs) showed comparatively better relationship in determining the early stage of T2D. Additionally, socioeconomic status showed a good relationship in predicting T2D at the advanced level.

Comparative Scale Against Median

2x 1.1-1.2x 1x <1x

Figure 9: SDOH factors vs. T2D progression

Medicare		
Diabetic	Emerging	No Diabetes
Financial insecurity	Propensity to engage – CM	Propensity to engage – CM
Socioeconomic status	Propensity to engage – IB	Financial insecurity
Transportation insecurity	HOI – low health status	Transportation insecurity
SDOH count	Food insecurity	HOI – low health status
Housing insecurity	Propensity to engage	Housing insecurity
Propensity to engage – IB	Financial insecurity	Socioeconomic status
Propensity to engage – CM	Housing insecurity	Propensity to engage – IB
Social isolation	HOI – low health ownership	SDOH count
Food insecurity	Transportation insecurity	Social isolation
Propensity to engage	SDOH count	HOI – low health ownership
HOI – low health status	Ethnicity	Food insecurity
Language	Socioeconomic status	Language
HOI – low health ownership	Social isolation	Propensity to engage
Ethnicity	Language	Ethnicity



Figure 10 shows the SDOH factors with the largest impact on T2D progression among the DSNP population. For DSNP members, financial insecurity and transportation insecurity emerged as the strongest SDOH factors among all for the Severe T2D condition level. Language and ethnicity showed an inverse relation in determining the T2D condition level at all stages.

Comparative Scale Against Median



Figure 10: SDOH factors vs. T2D progression

Dual Eligible		
Diabetic	Emerging	No Diabetes
Financial insecurity	Propensity to engage – CM	Propensity to engage – CM
Socioeconomic status	Propensity to engage – IB	Financial insecurity
Transportation insecurity	HOI – low health status	Transportation insecurity
SDOH count	Food insecurity	HOI – low health status
Housing insecurity	Propensity to engage	Housing insecurity
Propensity to engage – IB	Financial insecurity	Socioeconomic status
Propensity to engage – CM	Housing insecurity	Propensity to engage – IB
Social isolation	HOI – low health ownership	SDOH count
HOI – low health status	Transportation insecurity	Social isolation
Propensity to engage	SDOH count	HOI – low health ownership
Food insecurity	Ethnicity	Food insecurity
HOI – low health ownership	Socioeconomic status	Language
Language	Language	Ethnicity
Ethnicity	Social isolation	Propensity to engage

In the next part of the analysis, decision tree modeling was used to identify the individuals most likely to progress from prediabetes/T2D to complex T2D. All of the factors within the whole person analytical framework were considered and those found to best predict progression were used to develop the decision tree. Of note, trees were constructed using SDOH and clinical data, but SDOH factors were not the most significant predictors of progression.



Figure 11: Sample decision tree output — Medicaid (prediabetes and T2D progression to severe T2D)

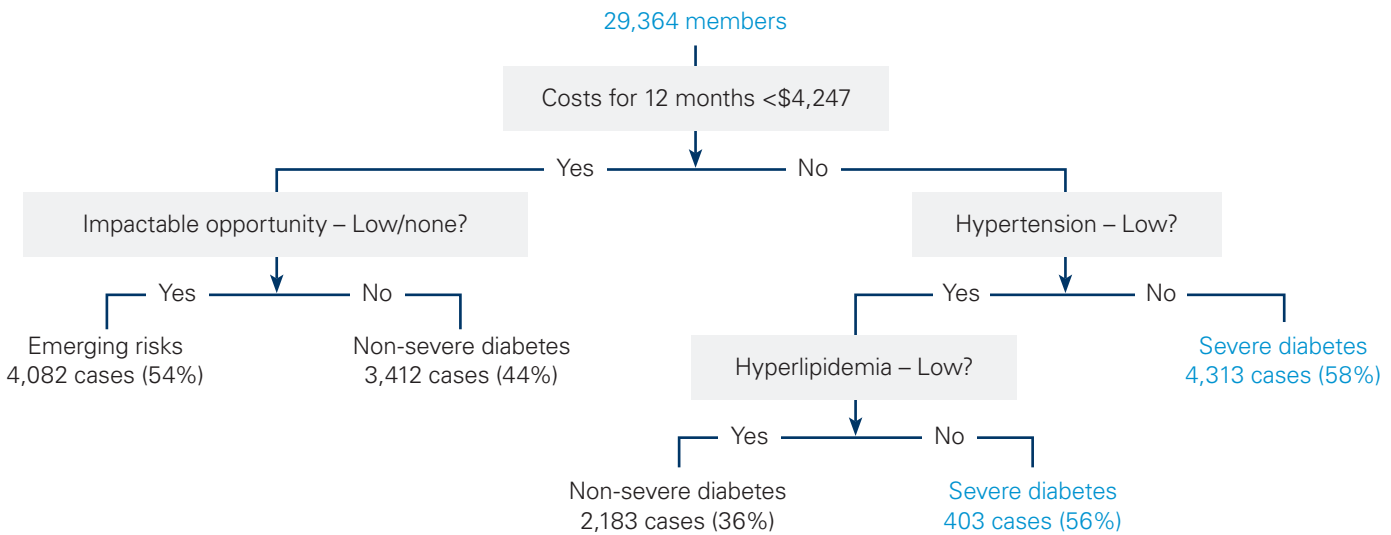
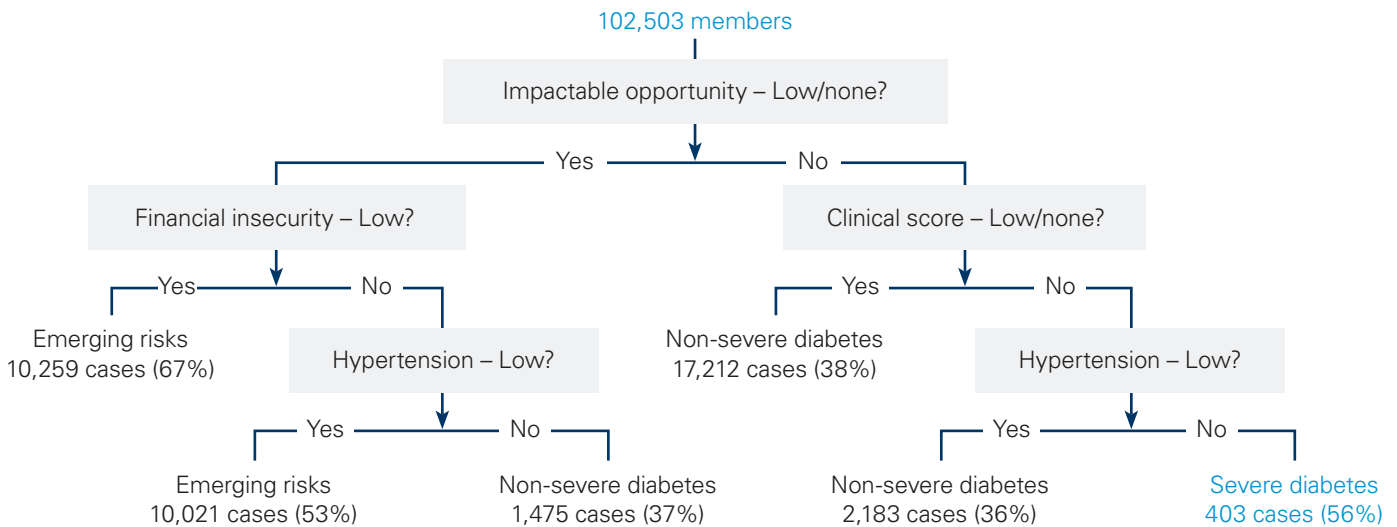


Figure 11 shows an example of the decision tree analysis for the Medicaid population. The same model was developed for all lines of business. In this case, the decision points for 30,000 members along the continuum were funneled down to the ones most likely to end up with severe T2D. Starting at the top, the cost threshold was the most important. After that, whether someone was already diagnosed with hypertension, followed by hyperlipidemia were the strongest predictors of a member progressing to severe T2D. Overall, approximately 4,700 members (~16 percent) were identified to be most likely to become severe diabetics.

Figure 12: Sample decision tree output — Medicare (prediabetes and T2D progression to severe T2D)



The power of this analysis comes from knowing the detailed SDOH and clinical characteristics of the 4,700 members who are likely to progress from prediabetes/T2D to severe T2D. Their underlying comorbidities are known, as well as their risk characteristics, SDOH characteristics, barriers to care, and finally their motivators via level of engagement and health ownership.

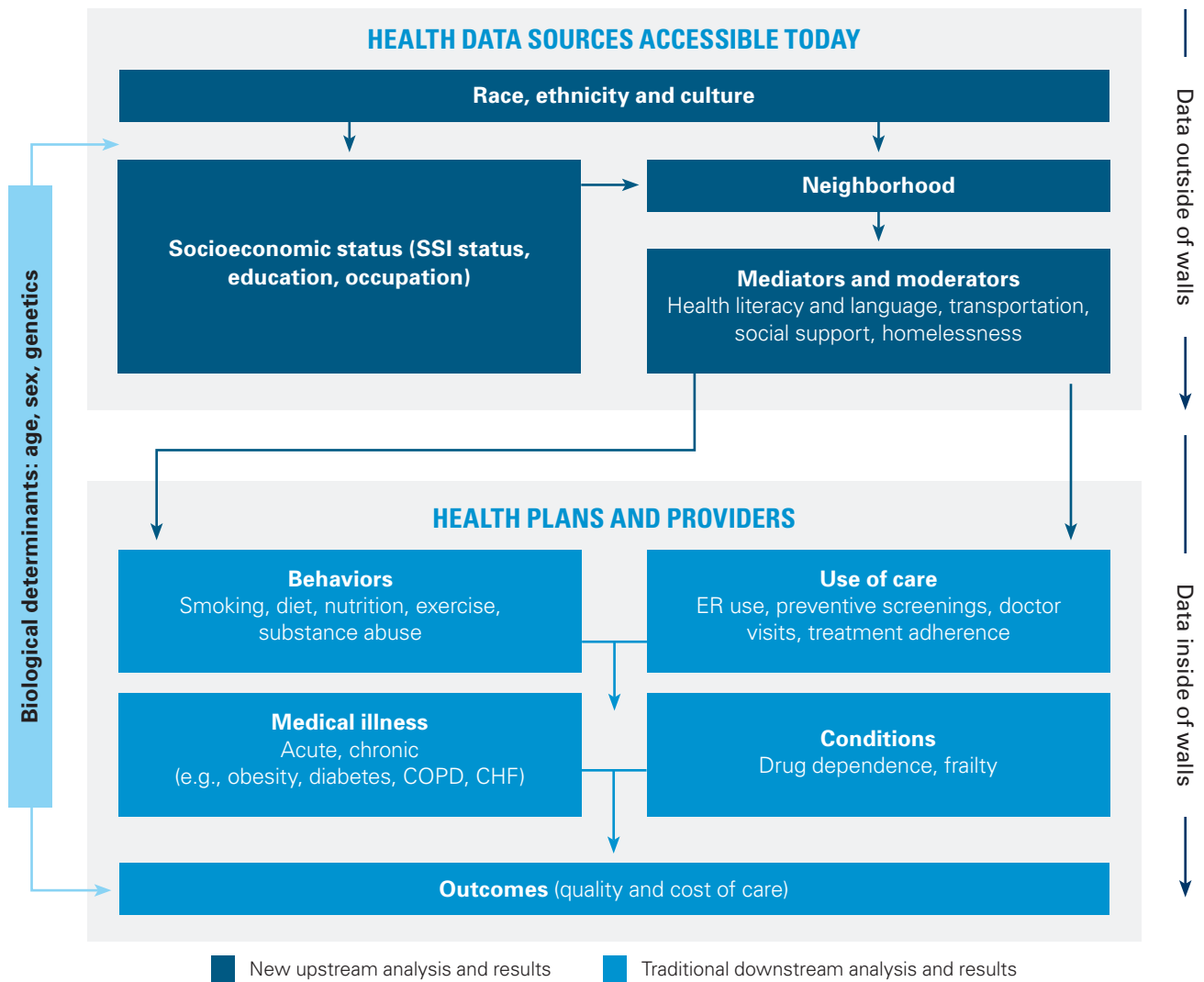
By having this person-level information for a very targeted population, particular needs can be addressed and programs tailored to account for barriers and motivators, thus allowing members to be connected to the appropriate clinical and social resources. This will ultimately result in more effective and efficient systems of care.



POPULATION HEALTH ANALYTICS PLATFORM

Uncovering new and actionable insights is dependent on a member-centered, prospective analytic platform that leverages whole-person data: clinical, behavioral, SDOH and utilization. By conducting analyses such as the decision tree, learnings can be immediately incorporated into practice. In this case, reports by line of business can be created enabling care teams to easily identify individuals and engage them in outreach or care management programs to realize maximum impact — ensuring members who are at greatest risk receive timely intervention and that health plan resources are used most effectively.

Figure 13: SDOH framework



CONCLUSION

For this analysis, the framework used was the Robert Wood Johnson Foundation on SDOH, which connects upstream factors and midstream outcomes to downstream health outcomes, in this case the incidence and progression of T2D. This work presents a novel framework designed to better understand and address social determinants at the individual level before disease becomes severe, leading to altered outcomes. In practice, this framework offers an actionable tool for applied health equity work at the individual and population level.

These results showed the importance of SDOH, clinical, and nonclinical factors across different populations based on the line of business and along T2D progression. There were differences in the underlying factors along T2D progression across lines of business, but also significant consistencies in relation to onset of T2D. SDOH factors were not seen to have as important of an impact on progression across line of business, though they were impactful in relation to onset and severity. Though there was not a correlation between SDOH factors and disease progression in the Medicaid population, this is likely due to under reported data due to barriers to accessing care experienced by Medicaid members and lower reimbursement rates relative to commercial.

This model and analytical framework provides a whole-person view of an individual in a quantitative way, moving backwards from outcomes to upstream predictors. The variations identified across lines of business suggest successful interventions to reduce T2D incidence will look different for each line of business. For Dual Eligible, the focus would be on culturally tailored interventions that incorporate tools to address SES and financial security. Interventions for Medicare would address transportation insecurity and common SDOH factors. Medicaid interventions should consider focusing on programming to coach and address ownership and engagement while focusing on improving SES. Commercial interventions would focus on addressing SES, as well as health ownership and engagement. Characterizing these differences across lines of business allows for tailored program design and interventions to alter the course of disease incidence and progression, reduce costs, and ultimately improve health equity that are data-driven. This analysis focused on T2D; however, this framework could be applied to any disease increasing the opportunity for improved care management, reduced disparities, and better outcomes.

