ILLUMINATION FOUNDATION

DISRUPTING THE CYCLE OF HOMELESSNESS

Data-Driven Solutions for Disrupting the Cycle of Homelessness:

A Data-Driven, Analytical Approach to Illumination Foundation's Integrated Care Model for People Experiencing Homelessness

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Introduction

Illumination Foundation (IF) partnered with Foresight Health Solutions LLC (FHS), a healthcare Artificial Intelligence (AI) analytics company, to complete a study of the diverse risk factors affecting people experiencing homelessness in Orange County, California, and to evaluate the impact of its unique, integrated care model in mitigating these risks. As a result of this study, a comprehensive risk scoring and stratification process was identified for every Orange County client served by Illumination Foundation that incorporated both medical and social determinants of health (SDOH) data .

Furthermore, analytic tools were also used to identify and quantify which of Illumination Foundation's diverse set of services are most likely to reduce and mitigate risks for future costs and hospitalizations. The analyses also provided important insights and results that strengthen the case for alternative payment models that recognize and adequately compensate integrated homeless service providers for managing a complex population with SDOH risk factors while providing more effective enabling services that demonstrate positive results. Through this paper, Illumination Foundation will provide a data-driven analytical framework to define, refine, and evaluate the impact of its innovative care model for those experiencing homelessness.

About Illumination Foundation

Illumination Foundation is a Southern California-based non-profit organization that provides integrated, multidisciplinary services for the most vulnerable homeless clients across Southern California with the goal of disrupting the cycle of homelessness. With 55,000 homeless individuals in Southern California each year, and the continued worsening of the situation during the COVID-19 pandemic, this mission is more important now than ever before.

Individuals experiencing homelessness have a high disease burden, including chronic diseases, infections, mental illness, and substance use disorders (SUDs). This study evaluated data for 1,254 Illumination Foundation clients in Orange County, where the organization is headquartered, to understand the disease burden, healthcare utilization patterns, and social determinants impacting outcomes in this vulnerable population.
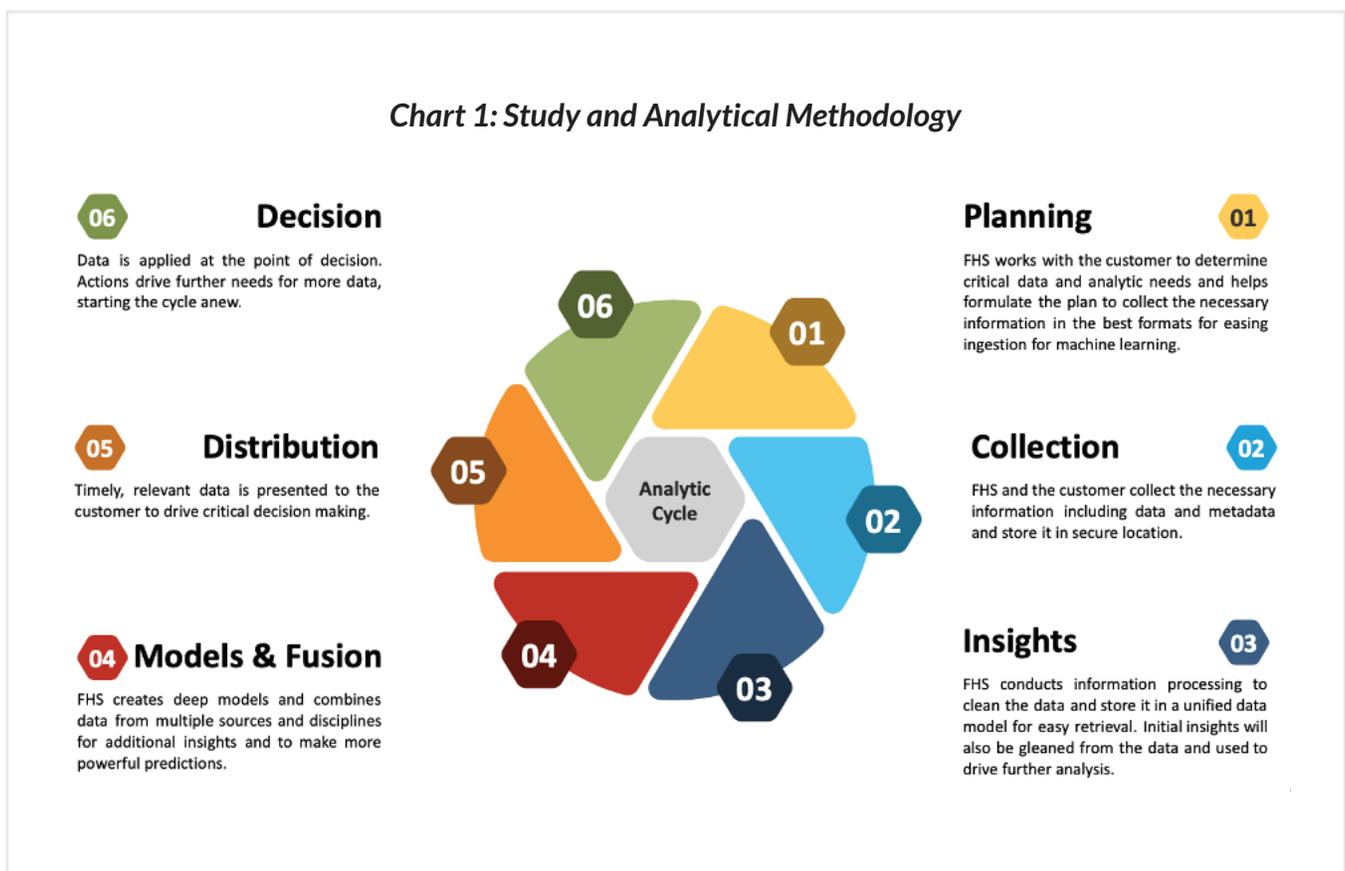
Study Objectives

This white paper seeks to provide an overview of Illumination Foundation's integrated care model and how it is operationalized for services for those experiencing homelessness in Orange County. The paper also seeks to highlight how predictive and prescriptive data analytics have been used to improve the identification of the risks of the population Illumination Foundation serves, as well as to identify the most effective and efficient strategies to manage these risks, improve client outcomes, and reduce cost to the healthcare system. The paper provides data-driven outcomes and results from one Medi-Cal (Medicaid) Managed Care cohort that is served through Illumination Foundation's programs in Orange County and identifies best practices and lessons learned from this population over a 3-year timeframe (July 2017–July 2020).

Study Methodology

A rigorous analytic process was followed throughout the study to ensure valid and optimal outcomes and results. The first step of the process was detailed planning meetings and interviews with Illumination Foundation's leaders to identify key study objectives and analytic expectations as well as to establish a clear understanding of the data requirements for the project.

After completion of the initial discussions with the team, a data request was created by Foresight Health Solutions and submitted to the data team at Illumination Foundation. This data request document included the data elements needed for the projects, the file formats and layouts, and the specific instructions for secure transfer of data from IF to FHS. Once the data was collected and sent to FHS, we initiated a detailed effort to clean and validate the data, process the data, and prepare a unified data model so that the data would be ready to run through our analytic tools and models. The sequential analytical process used to complete the project is summarized below.

Chart 1: Study and Analytical Methodology

06 Decision

Data is applied at the point of decision. Actions drive further needs for more data, starting the cycle anew.

05 Distribution

Timely, relevant data is presented to the customer to drive critical decision making.

04 Models & Fusion

FHS creates deep models and combines data from multiple sources and disciplines for additional insights and to make more powerful predictions.

Analytic Cycle

Planning 01

FHS works with the customer to determine critical data and analytic needs and helps formulate the plan to collect the necessary information in the best formats for easing ingestion for machine learning.

Collection 02

FHS and the customer collect the necessary information including data and metadata and store it in secure location.

Insights 03

FHS conducts information processing to clean the data and store it in a unified data model for easy retrieval. Initial insights will also be gleaned from the data and used to drive further analysis.

The data for this study covered 1,254 Medi-Cal Managed Care patients served by Illumination Foundation and enrolled in CalOptima—the local, county-operated Health Plan for Orange County's Medi-Cal and Medi-Cal/Medicare dual-eligible recipients—over a 3-year timeframe extending from July 2017 to July 2020. The data was collected from two primary sources:

• CalOptima Health Plan's Enterprise Analytics Department: Provided claims and utilization data for patients directly enrolled in CalOptima or indirectly enrolled through other delegated entities for the three-year study period.

• Illumination Foundation's Data Analytics Department: Provided EMR data for a three-year period from Illumination Foundation's KIPU system and other survey data tracked in local databases or in the Homeless Management Information System (HMIS) operated by the United States Department of Housing and Urban Development (HUD).

Illumination Foundation's Integrated Care Model

Illumination Foundation has established a multidisciplinary yet integrated care model that provides clinical services, behavioral health and substance use services, case management, housing navigation, and supportive housing to those experiencing homelessness. These services are provided in four distinct program settings under one roof:

- Recuperative care
- Emergency shelter
- Housing (temporary and permanent)
- Primary care clinic

This innovative "hub" model was recently implemented at the organization's Fullerton Navigation Center and Recuperative Care site, with the inclusion of primary medical, dental, and behavioral health services offered through a partnership with the Illumination Foundation Medical Group (IFMG). Illumination Foundation is building similar integrated models across Southern California. Illumination Foundation's "hub and spoke" model aims to disrupt the cycle of homelessness by connecting clients to housing run by Illumination Foundation's own housing department.
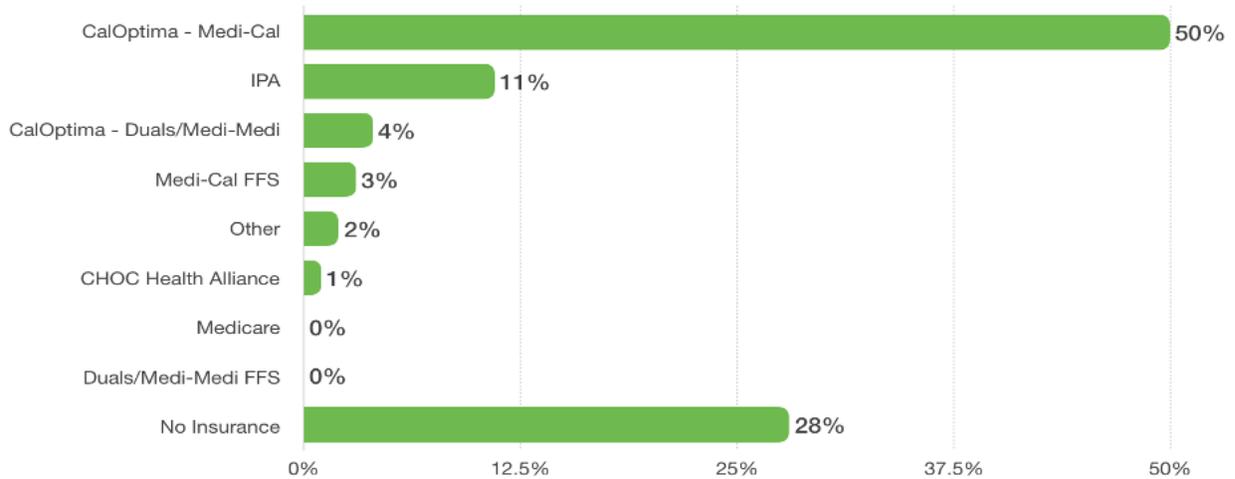
Data-driven Analytical Approach to Managing Risk

At the heart of Illumination Foundation's care model is a data-driven, analytical approach to both identifying and managing the complex and diverse risk factors impacting those experiencing homelessness. This process combines clinical risk analytics as well as AI-based analysis of a combination of historic claims and EMR data designed to predict both the future risks of the individuals served as well as to identify the most effective combination of services that will mitigate these risks. Every client is assigned a case manager who is the primary coordinator and client advocate for the diverse services each client needs in a multi-disciplinary team-based service model.

Population Demographic Profile

Since Illumination Foundation's headquarters and its origins are in Orange County, this study has focused on the Medi-Cal enrolled homeless patients served in this county. In terms of insurance coverage, 54% of Illumination Foundation's Orange County clients are directly insured by CalOptima, the local Medi-Cal health plan, and 28% of those served are uninsured. The majority of these uninsured clients tend to be those who would be eligible for Medi-Cal **(Chart 2).**

Chart 2: Funding/Insurance Breakdown for Orange County Clients

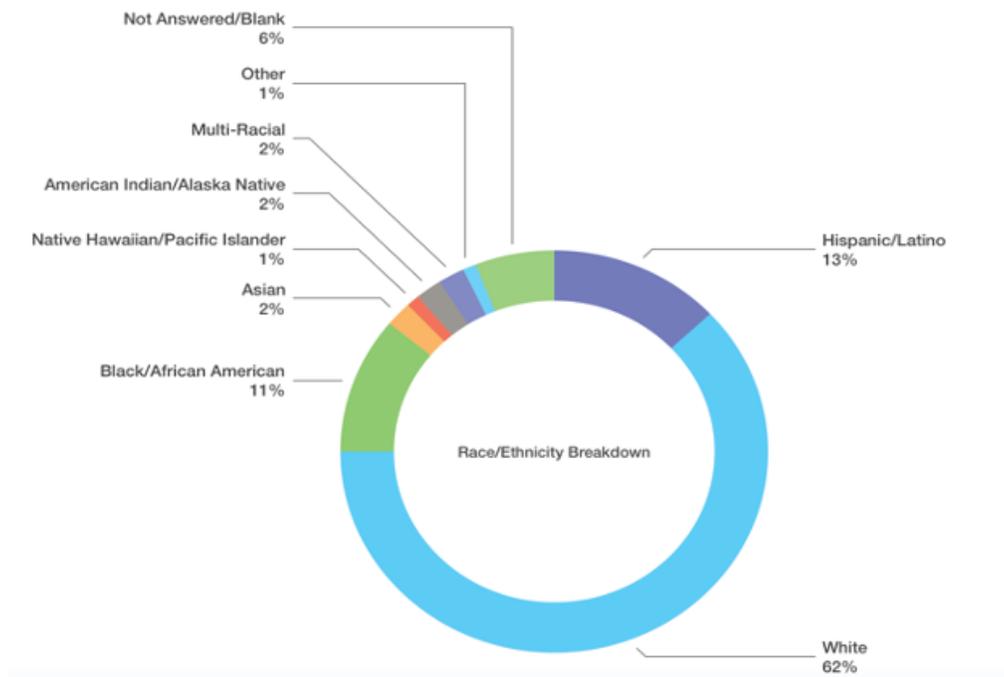| Category	Percent
CalOptima - Medi-Cal	50%
IPA	11%
CalOptima - Duals/Medi-Medi	4%
Medi-Cal FFS	3%
Other	2%
CHOC Health Alliance	1%
Medicare	0%
Duals/Medi-Medi FFS	0%
No Insurance	28%

In Orange County, 60% of clients enter Illumination Foundation's programs through the recuperative care program, 33% come through emergency shelters, and the remaining clients come to Illumination Foundation directly for housing assistance. Illumination Foundation clients extend across a wide range of ages: 22% of clients are children below the age of 18, and 30% of clients are 55 years or older **(Chart 3).** The increasing aging of the homeless population brings additional clinical and social challenges to service delivery.

Chart 3: Age Breakdown for Orange County Clients

Age Group	Percent
0-5	7%
6-17	15%
18-24	4%
25-40	22%
41-54	21%
55-65	22%
66+	7%
Blank	3%
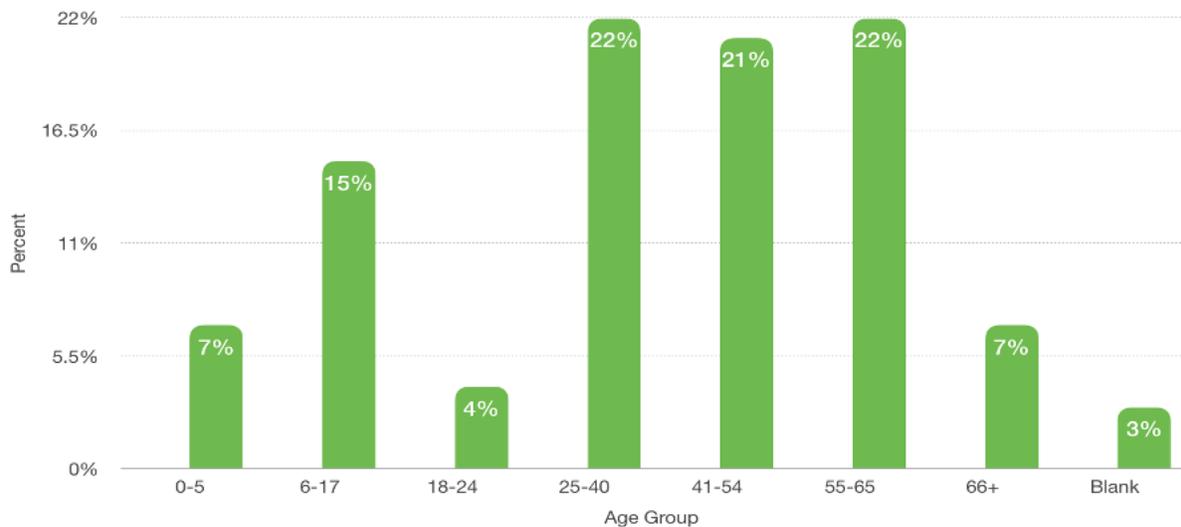
The data also shows 62% of Illumination Foundation's clients are white, 13% are Hispanic/Latino, and 11% are Black **(Chart 4).** Of note, nearly half (46%) of IF's clients are female, which is unusual for most programs serving those experiencing homelessness.

Chart 4: Race/Ethnicity Breakdown for the Study Population

Not Answered/Blank 6%
Other 1%
Multi-Racial 2%
American Indian/Alaska Native 2%
Native Hawaiian/Pacific Islander 1%
Asian 2%
Black/African American 11%
Race/Ethnicity Breakdown
Hispanic/Latino 13%
White 62%

Population Risk Profile

Using diagnostic group-based predictive risk models, as well as AI-based neural network models, the predictive risk for future costs has been calculated for all Illumination Foundation clients insured through CalOptima's Medi-Cal program. The analysis is based on combining medical claims data obtained from CalOptima with Illumination Foundation's EMR data that covers a range of social determinants of health information.

While there are many diagnostic-based, predictive risk tools available on the market, most are commercially licensed and can be expensive for community-based social services organizations. One model that is freely available yet statistically rigorous and accurate is the Hierarchical Condition Categories (HCC) diagnostic risk adjustment model developed by the Centers of Medicaid and Medicare Services (CMS). While this model is primarily used for risk analysis and adjustment for Medicare populations, there are specific factors that are available for clients who are also dually enrolled in Medicaid. Since this model is well-reputed, extensively used, and is frequently updated and re-calibrated as new data is available, it was determined that the HCC model would provide the most accurate analysis of the diagnostic risk of Illumination Foundation clients. Using the HCC model version 24, the average HCC diagnostic risk score for IF's CalOptima clients was found to be 2.079, or more than twice as risky as the average Medicaid/Medicare client in the population. The study population's risk distribution is presented in **Chart 5** below. In the study, 141 of the clients had a risk score of 4 or higher, with the most at-risk client registering an HCC risk score of 10.98—close to 11 times the risk of the average person in the population.

**Chart 5: Population Risk Score Distribution**
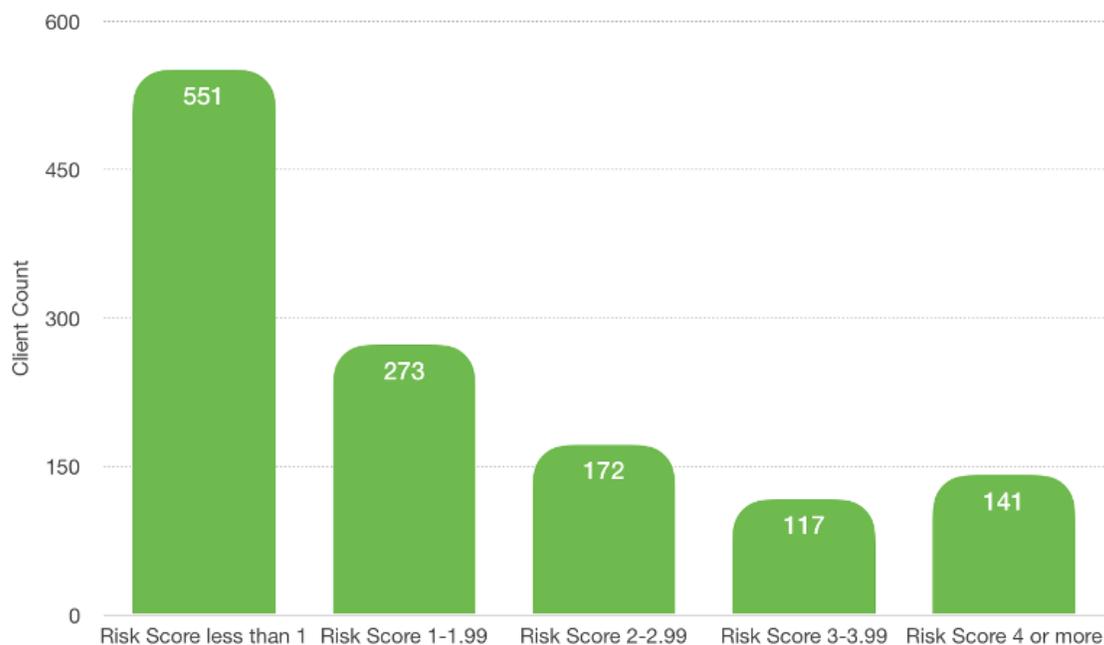
A high HCC risk score is driven by the additive effect of comorbid diagnoses. The HCC risk model includes 79 diagnostic groups covering a broad range of medical and behavioral health conditions, and the higher the risk score for the client, the higher the risk for future costs or complications. In our study, 1,045 of the 1,254 clients had at least 2 comorbidities, and 245 of these clients were found to have 10 or more diagnostic groups occurring simultaneously **(Chart 6).** These numbers are far greater than population averages and indicate the serious clinical challenges and complexity involved in serving these clients experiencing homelessness.

Chart 6 - Population Comorbidities
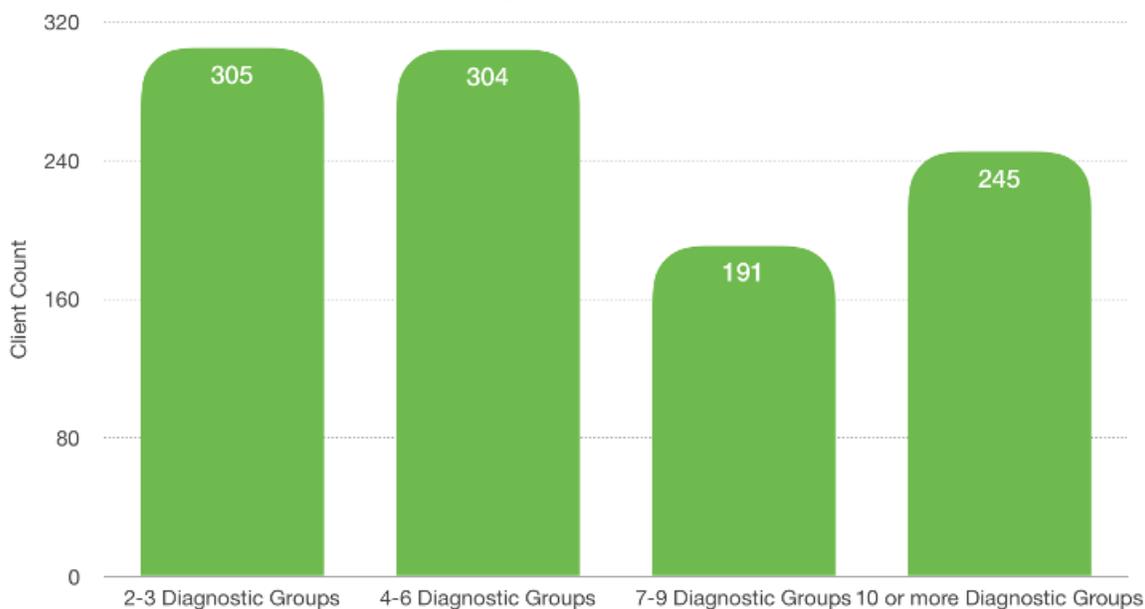
The most common diagnostic groups found in the population included sepsis/septicemia, moderate to severe substance use, COPD, diabetes with complications, congestive heart failure, depressive/bipolar disorders, and acute renal failure. **Chart 7** shows that all these conditions have a high volume of occurrence in the study population, and also have a high relative risk coefficient, which points to the complexity and challenges involved in serving this population.


Chart 7: Study Population Diagnostic Risk Profile
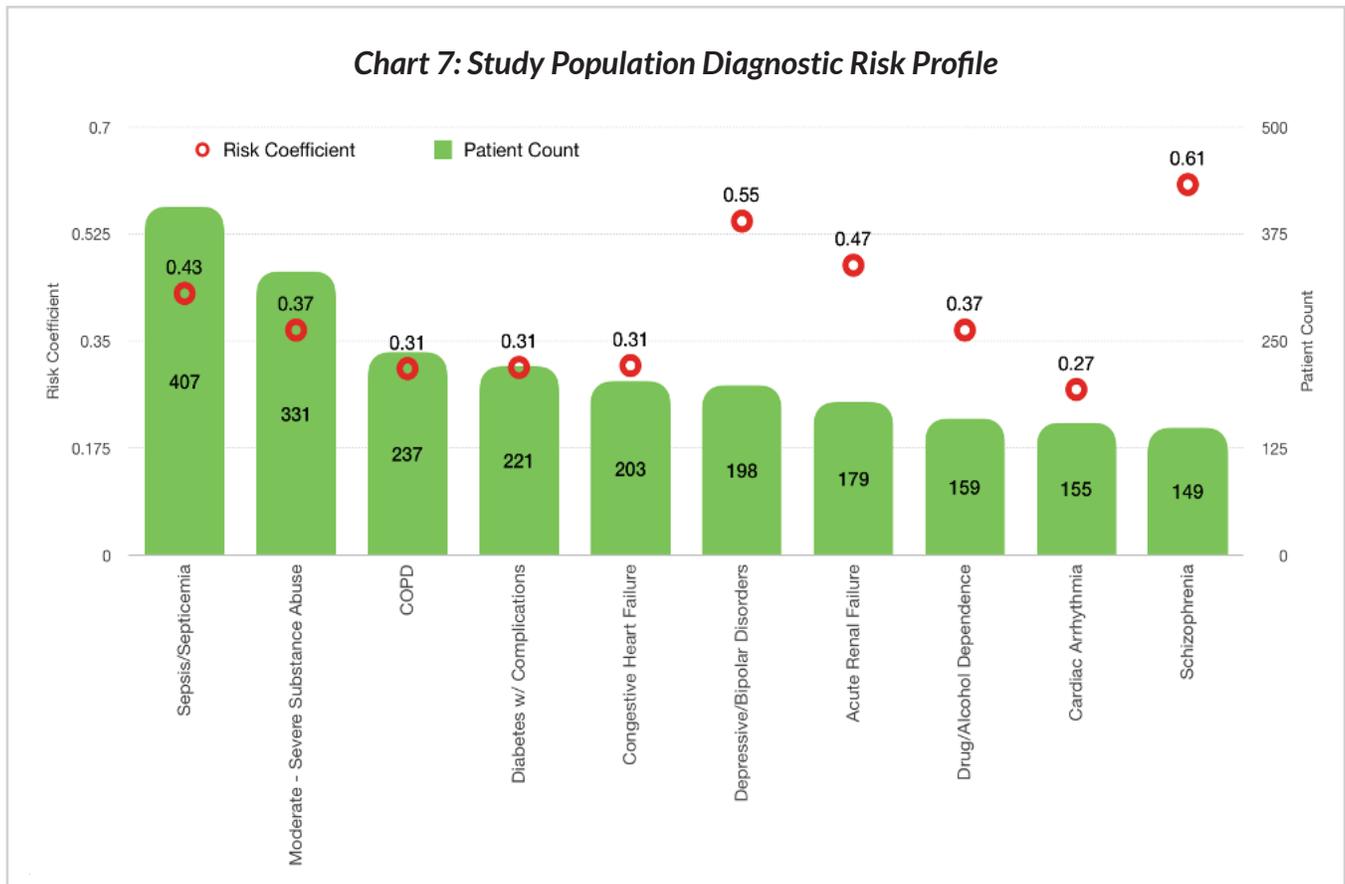
Adding to the challenge is the extremely high rate of behavioral health disorders in the population, with 81% having at least 1 behavioral health diagnosis and 44% having a substance use diagnosis.

Social Determinants of Health as a Driver of Risk

Social determinants of health (SDOH) play a significant role in risk and in outcomes for the homeless population in general and for Illumination Foundation clients specifically. As part of this study, Illumination Foundation and its analytic partner FHS collected SDOH data tracked by staff within the organization's EMR to evaluate the impact these SDOH factors play on overall client risk. The key factors that were evaluated and included in study of risk were homelessness (nearly all the clients fell into this group), food insecurity, income issues, unemployment, transportation issues, and living alone. The primary data source used for capturing SDOH data was surveys completed by case managers and housing navigators. However, since the counts of SDOH factors identified through surveys were lower than expected, FHS also used its AI-based Natural

Language Processing (NLP) module to identify discrete SDOH factors from EMR notes written by staff in cases where no structured/coded information on these SDOH factors was available. This NLP analysis was able to find an additional 270 patients in the study population who exhibited one or more SDOH contributing factors even in the absence of structured or coded survey data. The counts of clients identified with specific SDOH factors through survey tools and through NLP analysis of EMR text are presented in **Chart 8** and show that for some factors, such as food insecurity, NLP analysis of staff notes greatly increased the total count of clients identified with that SDOH challenge.

Chart 8: Comparison of SDOH Data identified through Surveys versus NLP on EMR Text
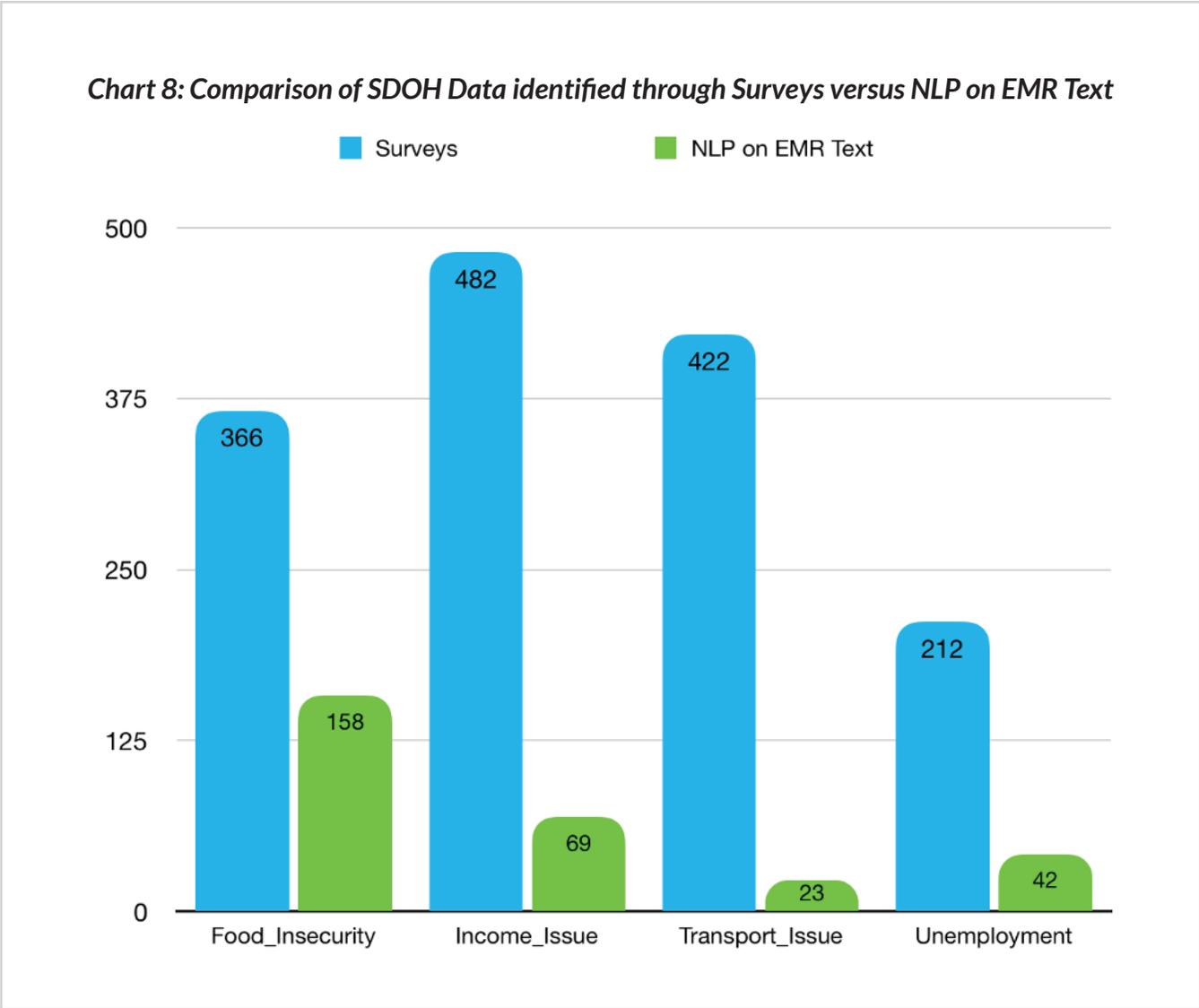
Adding SDOH factors to the risk model through multiple sources of data (structured surveys or unstructured text) was important because the analysis revealed that SDOH factors when present indeed elevated the average risk of the population significantly, as demonstrated in **Chart 9** on the next page. For example, for the population with food insecurity, risk increased by 58% compared to those without food insecurity, and for unemployed clients, the risk increased by 100% compared to those who had some form of employment.

Chart 9: Average Risk Increase from Common SDOH Factors

SDOH Factors	Risk when SDOH factor is Absent	Risk when SDOH factor is Present	Percent Increase in Risk
Transportation Issue	1.2	1.8	50%
Income Issue	1.2	2.1	75%
Food Insecurity	1.2	1.9	58%
Unemployment	1.2	2.4	100%

The counts of unique clients in each of the key SDOH categories (combined survey and EMR notes data) is presented in **Chart 10** below. Apart from showing the variability in the captures of information across the various SDOH categories, the chart also displays the risk coefficient for each of these categories, indicating that some SDOH factors, like transportation challenges, have a more significant impact on risks for future costs compared to others.

**Chart 10: Population SDOH Contributors of Risk with Relative Risk Coefficients**
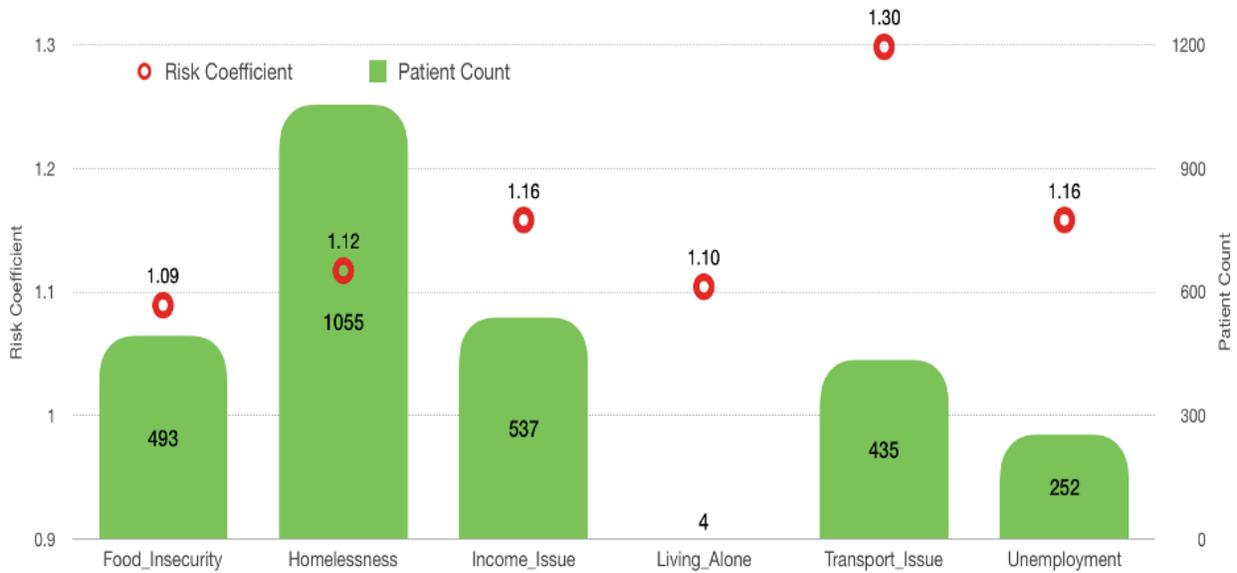
Since none of the standard, diagnostic risk models incorporate SDOH factors into their risk calculations, Foresight Health Solutions combined the diagnostic data from claims with SDOH data collected from the EMR to implement an innovative AI-based, neural network model for risk determination to calculate a holistic risk score for Illumination Foundation's clients that accounted for both clinical and SDOH risk factors. This model has been shown in studies in other similar populations to be far more accurate than existing diagnostic group-based risk models and achieves a prediction accuracy within single digits of the actual observed costs.

The analysis confirmed what has been anecdotally known within the social services arena—it is the combination of medical, psychological, and social issues faced by clients experiencing homelessness that makes them the most challenging to manage and to impact positively in terms of outcomes.

Study Results

Through a partnership with CalOptima, we were able to access claims data for 1,254 clients served by Illumination Foundation over a 3-year period. Using this longitudinal data, the study evaluated both cost and utilization results over this 3-year period. The results measured client medical costs and acute care service utilization 1 year before entering the program and compared those to costs and utilization levels 1 year after a final exit from an Illumination Foundation program. The study also included evaluation of costs and utilization while the client was enrolled in an Illumination Foundation program, but those results, while impressive in their impact, are not presented in this white paper since the duration of enrollment in the Illumination Foundation program varied greatly from one client to another.

For the study population, **Chart 11** summarizes the impact Illumination Foundation services have on both ER visit utilization and inpatient hospitalizations and shows that the annual ER visits declined by 22.2% after completion of and exit from services at Illumination Foundation. Inpatient admissions decreased by 26.3% using the same measurement parameters.

Chart 11: Illumination Foundation Program Impact on ER Visits and Inpatient Hospital Admissions
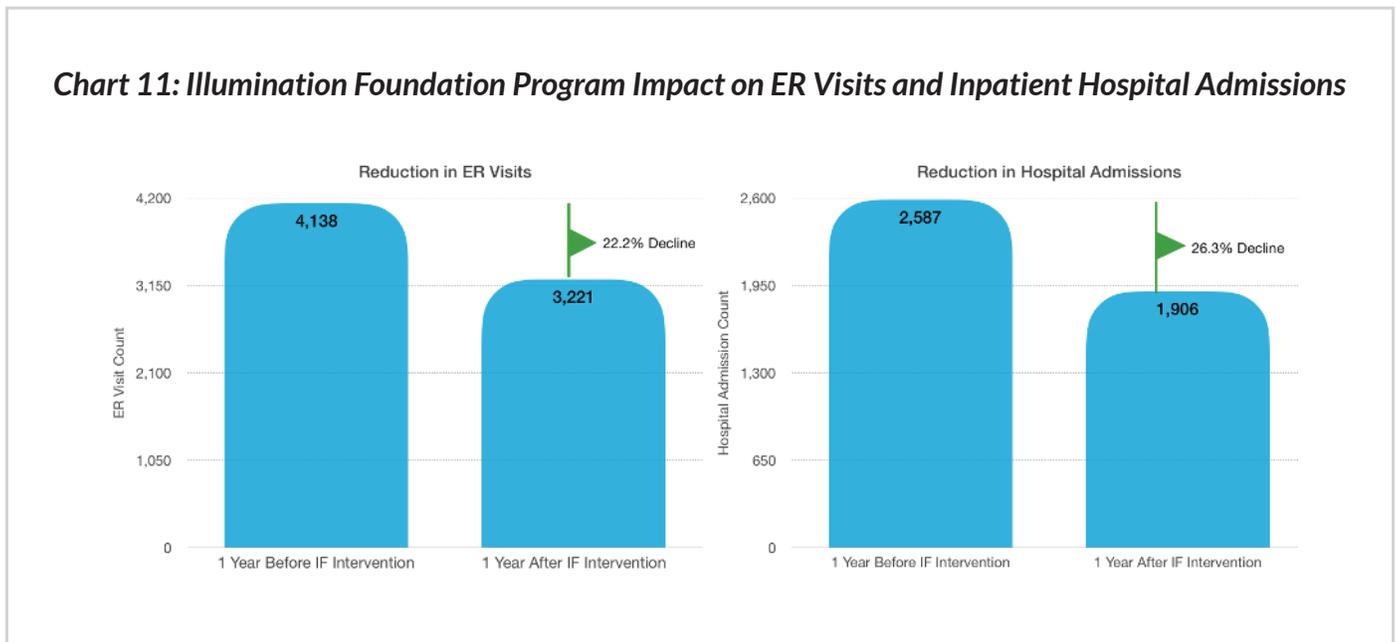
In terms of overall cost reductions for selected CalOptima clients, data revealed a total of $25.698 million in annual costs before entering our program, and this was reduced to $17.797 million in annual costs after completing services (30.7% decline). On a PMPM (per member per month) basis, this cost reduction was found to be 22.9% **(Chart 12).**

Chart 12: Illumination Foundation Program Impact on Total Costs and PMPM Cost Savings
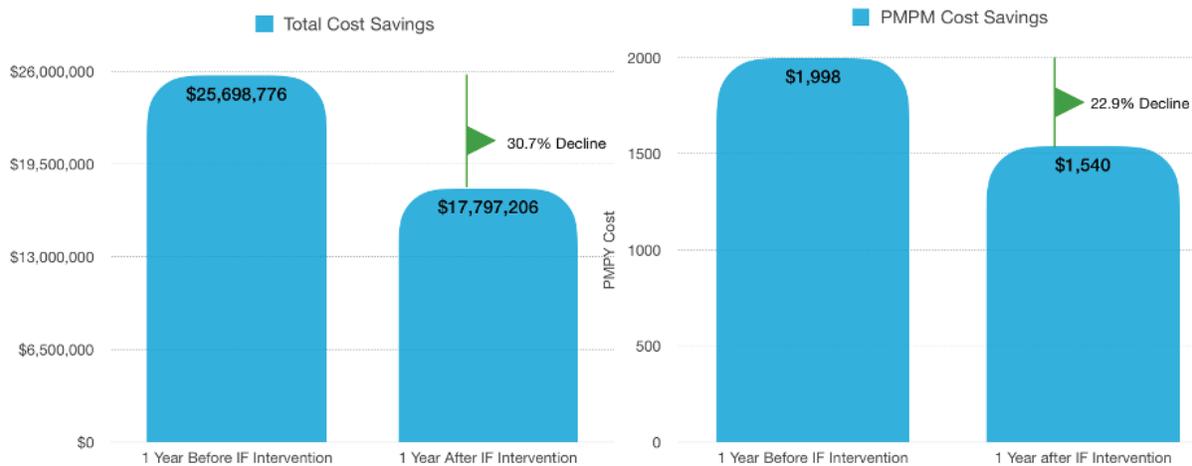
In addition to the analysis of cost savings and acute service utilization reductions in aggregate, Illumination Foundation also used advanced analytics to determine which of its multi-disciplinary services have the greatest impact on cost savings. For this analysis, clients and the services they received at IF, along with their costs, were tracked over time; PMPM cost savings were calculated based on the difference between their PMPM costs for 1 year before receiving the service and for 6 months after the service was provided. The counts of the services frequently provided at Illumination Foundation, along with the PMPM cost savings for each of these service categories, are presented in **Chart 13** below. For example, the data analysis revealed that behavioral health therapy sessions and medication assistance services resulted in immediate and significant cost savings for patients within 6 months of post-service intervention, with savings calculated at $814.54 and $805.22 PMPM respectively.

Chart 13: Comparative Cost Savings Impact within a 6-month Post-Intervention Period

Service Category	PMPM Savings	Count of Services Provided	Count of Unique Patients Served
Behavioral Health Therapy Sessions	$814.54	466	154
OTC Medication Assistance and Counseling	$805.22	1,924	236
Multidisciplinary Team Action	$652.33	376	105
Information Meet and Greet	$590.49	3,580	443
Crisis Intervention	$517.59	202	104
Medical Advocacy	$489.53	559	213
Medical and Case Management Education	$440.06	329	130
Income Assistance	$378.19	288	151
Case Management	$322.07	9,021	706
Behavioral Health/Substance Use Assessment	$168.16	574	435
Housing Case Management	$17.21	968	104

The analysis also included a comparison of cost-savings impact when considering a 6-month post-intervention period against a 1-year post-intervention period **(Chart 14).** This analysis showed that some services, such as housing case management, basic needs assistance, and transportation assistance, do not offer immediate cost savings, and in the short term (6-month period) may actually increase costs. However, over a longer 1-year period, the analysis showed positive cost savings achieved, demonstrating that some services have a longer-term benefit for clients. This type of service-level impact analysis has helped Illumination Foundation continually refine its model of care to ensure that the leadership team and frontline staff focus on the services that achieve the greatest return on investment for their funders and payers.

Chart 14: Comparative Cost Savings in a 6-month and a 1-year Post-Intervention Period

Service Category	PMPM Savings after 6 months	PMPM Savings after 1 year
Behavioral Health Therapy Sessions	$814.54	$964.02
OTC Medication Assistance and Counseling	$805.22	$1007.95
Multidisciplinary Team Action	$652.33	$1066.25
Information Meet and Greet	$590.49	$873.35
Crisis Intervention	$517.59	$754.78
Medical Advocacy	$489.53	$883.27
Medical and Case Management Education	$440.06	$740.84
Housing Case Management	$17.21	$218.14
Basic Needs Assistance	($33.007)	$31.40
Transportation	($203.99)	$152.86

Conclusion

Through the data, this paper has shown that even while serving the most vulnerable and complex clients experiencing homelessness, it is possible to improve the lives of this population and generate healthcare cost savings while doing so. The key to the success of the Illumination Foundation approach is in the following critical components:

- A multidisciplinary, integrated and client-centered model of care
- A strong focus on accurate and timely collection of data on all clients' medical, behavioral, and SDOH risk factors, along with capture of costs associated with these clients
- The appropriate use of advanced data analytic tools and methods to identify risk factors early
- To stratify clients based on a holistic evaluation of all risks
- Management of these risks through ongoing service-impact analysis to ensure the right blend of services in order to provide short-term positive impact as well as long-term value

The unique care model described above is replicable and financially sustainable, and similar models tailored to local geographic and population characteristics can be implemented in other communities and states. While Illumination Foundation has made significant investments in the establishment of this care model and has shown some exciting results, continuous refinement and enhancements of the model using a data-driven approach is critical. In the months ahead, Illumination Foundation will share these changes and the results of these efforts with policy makers and other health and social services organizations.