WHITE PAPER

Ksenia Whittal, FSA, MAAA
720.282.4965 • ksenia.whittal@wakely.com

Karan Rustagi, FSA, MAAA
720.531.6134 • karan.rustagi@wakely.com

Danielle Bivins
720.226.9815 • danielleb@wakely.com

Windy Marks, FSA, MAAA
windy.marks@azahcccs.gov

Amy Filler
amy.filler@azahcccs.gov

Social Determinants of Health (SDOH) And Risk Adjustment: Arizona Medicaid Innovations

Impact of Incorporating Social Risk Factors in Capitation

Introduction

The Arizona Health Care Cost Containment System (AHCCCS) Complete Care (ACC) managed care program offers physical and behavioral services to eligible Medicaid members in its state. AHCCCS has been operating in Arizona since 1982 and implemented the ACC contract in 2018 to integrate the provision of physical health and behavioral health services by integrated contractors. The program provides coverage to more than 1.8 million Arizonans and is projected to pay $7.8 billion in capitation payments to the participating Managed Care Organizations (MCOs) in contract year 2021.

AHCCCS has recently updated the methodology for risk adjusting capitation rates paid to ACC MCOs. With the recent recognition of the impact that socio-economic factors have on an individual's well-being[1], health outcomes, and health care cost, several state Medicaid programs have begun to incorporate a limited number of social risk factors (commonly referred to as social determinants of health (SDOH)) into their risk adjustment methodologies. For example, Massachusetts and Minnesota are using several SDOH risk markers in addition to traditional demographic

Key Findings

After including SDOH markers, MCO risk adjustment transfers changed by -83% to +6%, and MLRs changed by -0.1% to +0.3%.

Risk scores that do not account for the social risk markers systematically undercompensate plans disproportionately serving these members.

Addition of SDOH-related risk markers improved prospective CDPS+Rx risk adjustment accuracy and increased risk scores for SDOH cohort members, especially for children.

The most significant social risk markers were housing problems, parent problems and criminal problems.

[1] U.S. HHS. Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs. December 2016, *https://aspe.hhs.gov/system/files/pdf/253971/ASPESESRTCfull.pdf* (accessed September 11, 2018).

and clinical condition categories.[2] SDOH are the conditions in which people are born, live, and work that shape health outcomes.[3] These social factors typically encompass socioeconomic adversity, housing instability, access to education, food insecurity, lack of transportation, and others.

Key Findings

Average costs for Medicaid members with SDOHs were 1.2 to 3.4 times higher than an average claimant.

While the prevalence of SDOH risk markers in claim data is low (4-5%), it increased over the two-year study period.

SDOH risk markers were shown to be more statistically significant than a number of HCCs and CDPS+Rx categories.

As coding improves, the impact of social risk markers on risk adjustment will change.

The goals and motivations for AHCCCS to bring SDOH into risk adjustment echo common industry perspectives. Accounting for the varying prevalence of social vulnerability in served populations should lead to more accurate and equitable payments to providers and MCOs. This accounting is particularly relevant in Medicaid managed care programs where MCOs have a strong regional presence and are responsible for members in a particular area. Research has shown that individuals with similar levels of social vulnerability tend to reside in specific geographic areas[4,5,6,7]. Providers serving a disproportionate share of members facing social vulnerabilities are likely to face greater difficulty in managing these members' care and achieving quality outcomes. Identifying and bringing visibility to SDOH through risk adjustment mechanisms is the first step in recognizing these risk factors in payment. Further, it incentivizes better coding of SDOH by providers and can generate additional revenue for enhanced care management. A more accurate alignment between risk and payment provides resources that can be used to assist with some of the social disparities to improve outcomes.

It is important to note the current challenges and limitations in accurately capturing all instances of social vulnerability in a consistent and accessible way. Current data sources are incomplete, or are tied to geographic areas rather than families or individuals. With the anticipated improvement in SDOH data collection and coding over time, the contribution of SDOH factors to risk adjusted payments will evolve and should be closely monitored and reflected in risk adjustment.

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[2] https://www.shadac.org/sites/default/files/FINAL_SHVS-Risk-Adjustment-Brief.pdf, https://www.shvs.org/wp-content/uploads/2017/07/SHVS_SocialDeterminants_HMA_July2017.pdf
[3] World Health Organization. Social Determinants of Health. *http://www.who.int/social_determinants/sdh_definition/en/* (accessed September 11, 2018).
[4] Dwyer-Lindgren L, Bertozzi-Villa A, Stubbs RW, Morozoff C, et al. US County-Level Trends in Mortality Rates for Major Causes of Death, 1980–2014. JAMA. 2016 Dec 13; 316(22): 2385–2401.
[5] Mehmud SM. Nontraditional Variables in Healthcare Risk Adjustment. Society of Actuary. July 2013.
[6] Social Epidemiology. Editors: Berkman LF and Kawachi I. Oxford: University Press. 2000.
[7] Dwyer-Lindgren L, Bertozzi-Villa A, Stubbs RW, et al Inequalities in Life Expectancy Among US Counties, 1980 to 2014 Temporal Trends and Key Drivers. JAMA Intern Med. 2017;177(7):1003-1011.

The objective of this paper is to answer several questions that might be of interest to similar agencies in other states looking to implement SDOH into their payment methodologies:

- What impact does incorporating SDOH risk markers into CDPS+Rx model have on MCOs' risk transfers and financial position?
- Does incorporating SDOH risk markers into the CDPS+Rx model improve payment accuracy?
- What specific SDOH risk markers provide the most significant contribution to risk scores?

Findings and Observations

Wakely analyzed the impact of incorporating additional, statistically significant SDOH-related risk markers into the prospective CDPS+Rx 6.4 risk adjustment model. The standard model is calibrated to a national Medicaid population. Wakely re-calibrated the model to the Arizona Medicaid population using Arizona Medicaid data. Wakely compared the implications of using two sets of model coefficients – with and without the inclusion of the SDOH-related risk markers.[8] The two sets of resulting risk scores were then used to calculate budget neutral risk adjustment revenue transfer amounts that modify MCOs' initial capitation revenue set by region[9] and risk group.[10] The key observations of this comparison addressing the three questions are summarized below.

1. What impact does incorporating SDOH risk markers into CDPS+Rx model have on MCOs' risk transfers and financial position?
    a. At the MCO level, after including SDOH markers, risk adjustment transfers changed by -83% to 6% (-$2.1 to $1.7 million), and medical loss ratios[11] (MLRs) changed by -0.1% to 0.3%, with greater variation in MLRs further broken down by region and risk group (-0.5% to 2.4%). Table 2 presents further details.
    b. The MCO with the lowest proportion of members with SDOH risk markers (relative to other MCOs) experienced the largest increase in the loss ratio by 0.3%, ranging from 0.1% to 0.3%. While the impact is modest, to put this impact in perspective relative to

[8] The two sets of the model coefficients were developed separately, allowing variation in other risk markers (HCCs and demographics) to in the model that did not use SDOH risk markers.
[9] Arizona's Medicaid program has three Geographic Service Areas (GSAs): North, South and Central.
[10] Arizona's Medicaid program sets capitation rate for seven risk groups: newborns, children ages 1-20, adults ages 21+, dual eligible, SSI without Medicare, expansion adults, and Proposition 204 childless adults.
[11] Medical loss ratio in this analysis was defined as a ratio of incurred claims (with five months of runout) adjusted for amounts excluded from capitation payments (reinsurance, rebates, maternity kick payments) to the sum of capitation revenue and risk adjustment transfer amount (payable/receivable).

national data, the average Medicaid MCO margins typically range from 0.5-2.5%[12] and the actual average underwriting margin in 2019 was only 0.3%.[13] Therefore, incorporating SDOH risk could lead to a meaningful change in the underwriting margin for issuers providing coverage to a disproportionate share of members with SDOH.

c. In this analysis, the average costs for Medicaid members with SDOH-related risk markers were 1.2 to 3.4 times higher than the cost of an average utilizing member (excluding members without encounters) across risk groups. While the prevalence of members with social risk markers that can be identified in encounter data is currently low (4-5%), the high cost of these members translates into a meaningful risk adjustment impact.

2. Does incorporating SDOH risk markers into the CDPS+Rx model improve risk score accuracy and payment equity?

   a. The addition of SDOH-related risk markers improved prospective CDPS+Rx risk adjustment model accuracy (R-squared, predictive ratios in Tables 3-5) and increased average risk scores for members with SDOH risk markers by 8-64% (depending on risk group, greatest improvement was in the children population). 14

   b. The results show the power of calibrating state-specific weights as a means of reducing prediction error and increasing validity of the risk adjusted capitation payments to MCOs. Most notably, the results suggest that models that do not account for the SDOH risk markers systematically undercompensate plans serving these members.

3. What specific SDOH risk markers provide the most significant contribution to the risk score?

   a. Among the markers considered in this analysis, the most impactful markers for the Arizona Medicaid population varied by population. For TANF eligible members, housing problems and criminal problems were the most significant. For children aged 1-20, the most significant markers were parent problems and criminal problems. Zip code markers provided a modest contribution to the overall model performance and did not differentiate members as well as claim-based markers.

   b. It is reasonable to expect that different SDOH risk markers could be statistically significant in different states and different Medicaid populations. For example, the

[12] https://www.soa.org/globalassets/assets/Files/Research/medicaid-managed-report.pdf
[13] https://milliman-cdn.azureedge.net/-/media/milliman/pdfs/articles/medicaid-managed-care-financial-results-for-2019.ashx
[14] Note that it is expected that the risk scores by cohort change after model recalibration, and/or inclusion of additional variables. For demographic cohorts, we also observed changes in the risk scores ranging from -5% to +4% in the largest cohort (Age 1-20), and ranging from -30% to 12% for smaller TANF and SSIWO cohorts.

Massachusetts model included SDOH related markers for housing instability and a composite census-based neighborhood stress score, and Minnesota model incorporated social risk markers for poverty, homelessness, involvement of child protective services and past incarceration.15

c. Note that only statistically significant markers were selected in each calibration cohort. It was encouraging to see that the SDOH risk markers were shown to be more statistically significant than several diagnosis-based hierarchical condition categories (HCCs).

d. As coding of social risk factors improves over time (such as in the ICD-10 coding system), the impact of SDOH markers on risk adjustment will change and should be monitored over time. Claim-based (or Z-code) risk markers are more powerful and specific than the area-based markers. The observed prevalence of Z-code markers has increased over time during two-year time study period (see Table 1), and several MCOs had a disproportionate share of members with social risk markers in their covered population.

Data and Methodology Overview

Wakely developed a customized risk adjustment model using the CDPS+Rx risk adjuster version 6.4 developed by the University of California, San Diego and incorporated social determinants of health (SDOH) as additional risk markers.

Wakely performed statistical testing to determine whether including additional variables related to SDOH resulted in higher model accuracy and which variables are most relevant to include. Wakely initially included all potential markers that can be created from both SDOH-related diagnosis codes (Z-codes) within the International Classification of Diseases, Tenth Revision (ICD-10) and 5-digit zip code markers informed by the Centers for Disease Control's (CDC) Social Vulnerability Index (SVI) data.

ICD-10-Based Risk Markers

The ICD-10 codes that are closely related to the social determinants are a subset of codes starting with the letter "Z" and are commonly referred to as Z-codes. Nine broad categories of Z-codes (Z55-57, Z59-Z60, Z62-65) were considered as candidate risk markers in the model. Only a subset of these categories had material prevalence and were determined to be statistically significant in the AZ Medicaid population during the two-year study period.[16] These categories included:

[15] https://www.shadac.org/sites/default/files/FINAL_SHVS-Risk-Adjustment-Brief.pdf
[16] The experience data spanned July 2017 – June 2019.

- Z59XXX Codes related to housing problems
- Z62XXX Codes related to child/parent problems
- Z63XXX Codes related to family problems
- Z65XXX Codes related to criminal problems

There are several limitations of using ICD-10 Z-codes to identify SDOH. Under-coding and censoring are the main concerns, since a member can only be identified with a particular social issue at the point of receiving medical care, if the health care provider becomes aware of and codes the observed social issue(s). Therefore, it is likely that only a small portion of true social vulnerabilities with most significant health care manifestations get coded and make their way into administrative claim data. Individual member screening at the time of enrollment with a consistent survey tool used by all MCOs would be preferable and would better collect and identify a more realistic underlying prevalence of social vulnerabilities in a covered population. Of course, this approach is resource intensive and difficult to implement on a large scale.

Geography-Based Risk Markers

Since the prevalence of the Z-codes observed in the administrative claim data was low, Wakely also included a geographic risk marker based on the CDC's 2016 'Social Vulnerability Index' (SVI), which provides a ranking of vulnerability in four social domains at the county and census tracts level. Here is a brief description of the data:

"CDC's SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking."[17]

Census tracts are the most granular geographic areas currently available, and they provide a helpful split of a geographic area, which is particularly important in highly populous counties. However, the process of assigning a census tract to a member was outside of the scope of this project. Instead, Wakely mapped census tracts to five-digit zip code level and then created a binary SVI risk marker to identify members living in any of 44 five-digit zip code areas with the greatest social vulnerabilities[18] (top 15% of the general population in Arizona). Not surprisingly, the proportion of members residing in the vulnerable areas of the state was significantly higher among ACC membership, ranging from 17% to 66% by MCO (see Table 1 below). A potential

[17] "CDC's SVI 2018. Source: https://healthdata.gov/dataset/social-vulnerability-index-2018-united-states-county.
[18] Please see Appendix A for the list of 44 zip codes identified in this approach.

future enhancement / modification of this approach would be to enable census tract assignments for all eligible members to make full use of the available information.

Detailed Results Tables

Based on this analysis, Wakely found that the predictive value of traditional CDPS+Rx risk scores can be improved by the inclusion of several SDOH risk markers. Table 1 presents the overall average and range of prevalence of the Z-code risk markers and SVI risk marker at MCO level for the two 12-month time periods used in this analysis. These results suggest that the coding frequency is increasing over time from 4.0% average prevalence of any Z-code risk marker in the average population in the first year to 5.5% average prevalence in the second year. There is also reasonable variation of prevalence by MCO, with several MCOs serving a greater proportion of members with social vulnerabilities.

Table 1: Prevalence of SDOH Related Risk Markers in AZ Medicaid Population

Time Period ->	July 2017 – June 2018		July 2018 – June 2019	
SDOH-Related Risk Marker	Range by MCO	Average	Range by MCO	Average
Z59, Housing Problems	0.0% - 1.4%	0.9%	1.3% - 2.9%	1.8%
Z62, Parent Problems	1.0% - 2.1%	1.1%	1.5% - 4.2%	1.7%
Z63, Family Problems	0.0% - 0.9%	0.7%	1.3% - 1.7%	1.5%
Z65, Criminal Problems	0.6% - 2.9%	1.9%	1.1% - 5.6%	2.0%
SVI Zip Code	17.0% - 24.6%	20.8%	32.3% - 66.0%	38.5%
Any Z-code	2.8% - 5.2%	4.0%	5.1% - 12.2%	5.5%

Table 2 summarizes the MCO-level risk adjustment transfer amounts calculated using risk adjustment model without inclusion of the SDOH risk markers [A] and with the inclusion of SDOH [B],[19] and the difference in resulting risk adjustment transfer amounts and medical loss ratios, alongside the prevalence of Z-code risk markers. Note that while the actual risk adjustment transfers are calculated in the budget neutral manner for the risk group and region for each MCO, these results have been aggregated across risk groups and regions for each MCO. In general, the risk adjustment revenue transfer differences range from -83% to 6%, or -$2.1 to $1.7 million for MCOs. The MCOs with a lower prevalence of SDOH risk markers experienced a reduction in positive risk adjustment revenue transfers, and vice versa.

[19] Negative amounts are payable transfers, and positive amounts are receivable amounts.

Table 2: Risk Adjustment Transfer Comparison

MCO	RA Transfer Difference (millions)	RA Transfer % Difference	MLR Difference	Z-code Prevalence
A	($2.1)	-83.1%	0.3%	2.8%
B	$1.7	-45.9%	-0.1%	4.0%
C	$0.0	-3.8%	0.0%	4.3%
D	$0.7	-3.5%	-0.1%	4.3%
E	$1.4	2.7%	-0.1%	4.4%
F	($0.3)	4.7%	0.0%	5.2%
G	($1.4)	6.2%	0.1%	3.8%

Tables 3 and 4 present the comparison of three sets of models considered during the model development process, starting with the standard nationwide prospective CDPS+Rx 6.4 model ([1]), updating the coefficients to be state-specific ([2]), and finally adding SDOH risk markers ([3]). The progression in R-squared[20] and predictive ratio[21] metrics for select demographic and SDOH cohorts demonstrate modest improvement in R-squared in all three calibration cohorts (increase in values), and the reduction in the model prediction bias in select member cohorts (as predictive ratios get closer to 1.00). The results show the power of calibrating state-specific weights as means of reducing prediction error and increasing accuracy of the risk adjusted capitation payments to MCOs. Most notably, the low values of predictive ratios for the Z-code member cohorts suggest that models that do not account for these risk markers ([1] and [2]) systematically undercompensate plans serving these members.

Table 3: Model Comparison of R-squared Statistics

Calibration Risk Cohort	CDPS+Rx Nationwide Weights [1]	CDPS+Rx AZ Specific Weights [2]	CDPS+Rx AZ Specific Weights+SDOH [3]
Age 1-20 Cohort	0.120	0.154	0.165
TANF	0.251	0.268	0.279
SSI Without Medicare	0.225	0.239	0.241

[20] R-squared is a proportion of variance (0 to 1.00) that is explained by the predictive model. The higher values imply higher predictive accuracy.
[21] Predictive ratio is a ratio of the predicted value to the actual value in a given cohort. The ratio closest to 1.00 indicates the highest accuracy, the ratios below 1.00 indicate under-prediction, and ratios over 1.00 indicate over-prediction.

Table 4: Model Comparison of Predictive Ratio Statistics

Calibration Risk Cohort	SDOH-Related Risk Marker	CDPS+Rx Nationwide Weights [1]	CDPS+Rx AZ Specific Weights [2]	CDPS+Rx AZ Specific Weights+SDOH [3]
Age 1-20	**Z59, Housing problems**	0.898	0.780	0.995
	Z62, Parent problems	0.669	0.602	0.994
	Z63, Family problems	0.745	0.667	0.996
	Z65, Criminal problems	0.629	0.550	0.993
	SVI Zip Code	0.982	0.934	1.000
TANF	**Z59, Housing problems**	0.714	0.847	0.997
	Z62, Parent problems	0.743	0.868	1.004
	Z63, Family problems	0.848	0.939	0.998
	Z65, Criminal problems	0.747	0.879	1.005
	SVI Zip Code	0.940	0.974	1.003
SSI Without Medicare	**Z59, Housing problems**	0.871	0.948	0.956
	Z62, Parent problems	0.628	0.722	0.938
	Z63, Family problems	0.898	0.969	0.923
	Z65, Criminal problems	0.831	0.907	0.964
	SVI Zip Code	0.994	1.057	1.006

Conclusion

Social determinants of health continue to be top of mind for stakeholders in health care, as a potential vehicle for improving health outcomes, increasing health equity, and reducing costs. Medicaid managed care programs and participating MCOs have a vested interest in improving member's well-being and managing costs. Identifying and bringing visibility to SDOH through risk adjustment mechanisms is the first step in recognizing these risk factors in payment, incentivizing better coding of SDOH by providers, and providing additional revenue for enhanced care management.

The results of this analysis indicated that incorporating SDOH risk markers into risk adjustment does lead to a meaningful financial impact on the MCOs that serve a disproportionate share of the vulnerable members. Models that do not account for the social risk markers systematically undercompensate plans disproportionately serving these members, as the average costs for Medicaid members with SDOHs were 1.2 to 3.4 times higher than an average member. The addition of SDOH-related risk markers (specifically, those that identify housing problems, parent

problems, and criminal problems) improved prospective CDPS+Rx risk adjustment model accuracy and increased risk scores for SDOH cohort members, especially for children.

While the observed prevalence of SDOH risk markers in encounter data was low (4-5%), the anticipated improvement in SDOH data collection and coding over time will amplify the contribution of SDOH factors to risk adjusted payments and it should be continuously monitored and evaluated.

Appendix A: Arizona Zip Codes with Greatest Social Vulnerability

ZIP Code	County
86507	Apache
86503	Apache
86505	Apache
85607	Cochise
86020	Coconino
85542	Gila
85530	Graham
85348	La Paz
85344	La Paz
85325	La Paz
85346	La Paz
85328	La Paz
85301	Maricopa
85031	Maricopa
85015	Maricopa
85017	Maricopa
85008	Maricopa
85006	Maricopa
85003	Maricopa
85007	Maricopa
85009	Maricopa
85001	Maricopa

ZIP Code	County
85005	Maricopa
85281	Maricopa
86441	Mohave
86409	Mohave
86439	Mohave
86510	Navajo
86031	Navajo
85911	Navajo
85941	Navajo
86054	Navajo
86025	Navajo
85701	Pima
85719	Pima
85705	Pima
85703	Pima
85714	Pima
85756	Pima
85634	Pima
85132	Pinal
85117	Pinal
85131	Pinal
86046	Yavapai