

eAppendix

Methods eAppendix: Description of the Neighborhood Stress Score

The neighborhood stress score (NSS) was previously developed¹ as a composite measure of economic stress that is calculated using seven census variables including:

- % of families with incomes < 100% of the federal poverty level,
- % of families with incomes < 200% of federal poverty level,
- % of unemployed adults,
- % of households receiving public assistance,
- % of households with no car,
- % single-parent among households with children, and
- % of people age ≥ 25 without high school degree.

For an individual MassHealth member, their score is based on their most recent address of record, geocoded to the census block group level. Each variable (v_1, v_2, \dots, v_7) is first standardized by subtracting its mean and dividing by its standard deviation (i.e., $z_1 = (v_1 - \text{mean}(v_1))/\text{SD}(v_1)$). Next all seven standardized variables are summed ($S = z_1 + z_2 + \dots + z_7$) and NSS is defined as $\text{NSS} = (S - \text{mean}(S))/\text{SD}(S)$. We standardized the NSS to have mean 0 and standard deviation 1 in the full MassHealth managed-care-eligible population (i.e., those for whom MassHealth is the primary payer who were enrolled in primary care clinician managed fee-for-service or managed care organizations).

References

1. Ash AS, Mick EO, Ellis RP, Kiefe CI, Allison JJ, Clark MA. Social Determinants of Health in Managed Care Payment Formulas. *JAMA Intern Med.* 2017 Oct 1;177(10):1424-1430.

eAppendix Table 1. Categories of Service and Procedure Codes Used to Identify LTSS

MassHealth Category of Service	Procedure Codes
I-11 Nursing \ Clinical Social Worker	
I-11 Nursing \ Home Health Aide	
I-11 Nursing \ Independent Nurse	
I-11 Nursing \ Other	
I-11 Nursing \ Skilled Nurse	
P-10 Nursing \ Clinical Social Worker	
P-10 Nursing \ Home Health Aide	
P-10 Nursing \ Independent Nurse	
P-10 Nursing \ Skilled Nurse	
P-24 HCBS/Waiver Services	
P-26 LTSS \ Day Habilitation	
P-26 LTSS \ Other LTSS	
P-26 LTSS Personal care \ Personal Care Attendant	
I-10 Therapies \ Occupational Therapy ^a	
I-10 Therapies \ Physical Therapy ^a	G0151, G0152, G0153, G0154, G0156, T1022
I-10 Therapies \ Speech Therapy ^a	G0151, G0152, G0153, G0154, G0156, T1022
P-09 Therapies \ Occupational Therapy ^a	G0151, G0152, G0153, G0154, G0156, T1022
P-09 Therapies \ Physical Therapy ^a	G0151, G0152, G0153, G0154, G0156, T1022
P-09 Therapies \Speech Therapy ^a	G0151, G0152, G0153, G0154, G0156, T1022
P-15 Non-emergency Transportation ^a	T2003
<p>^aThe first RUGS-HC category, Special Rehabilitation, depends on the duration of speech, physical, and occupational therapy received in a week (at least 120 minutes combined). Because of inconsistencies between plans in the values for therapy minutes recorded on the MDS-HC 2.0, we calculated the amount of therapy minutes received from encounters and claims for an average 7-day period. Specifically, we identified claims with physical, occupational, and speech therapy procedure codes and multiplied the units from the claim by the number of minutes associated with each code. These minutes were summarized by week, and then an average was taken using only the weeks where any therapy minutes were present during the year.</p> <p>Abbreviations: Long-term services and supports (LTSS); resource utilization groups home care (RUGs-HC);</p>	

eAppendix Table 2. Predictors and R²s for Models to Predict Community LTSS^a Costs among SCO Enrollees during 2016-2017

Predictor	SDH		RUGS-III-HC		ADL/IADL		Cognitive		Full		MA-SCO	
	Coeff	Z	Coeff	Z	Coeff	Z	Coeff	Z	Coeff	Z	Coeff	Z
Men 64-69 years	9898		3665		5175		9533		-310		-1073	
Men 70-74 years	10360		4180		5435		9825		51		-753	
Men 75-79 years	11321		5043		5812		10683		438		-444	
Men 80-84 years	12908		6463		6974		12026		1539		617	
Men 85+ years	15467		8774		7963		13670		2310		1452	
Women 64-69 years	10903		4631		6802		10831		1116		482	
Women 70-74 years	11781		5358		6975		11352		1396		620	
Women 75-79 years	13295		6721		7798		12555		2183		1409	
Women 80-84 years	14468		7810		8033		13295		2385		1604	
Women 85+ years	17681		10807		8920		15191		3129		2488	
DxCG RRS ^b	51	6.1							-32	-4.2		
Disability	241	1.3							463	2.8		
Housing Problems ^c	1887	5.3							1668	5.2	1531	5.7
Housing Problems X DxCG RRS	-13	-0.4							-33	-1.0		
NSS ^{+d}	878	7.1							1009	9.1	990	8.9
RUGS-III-HC ^e												
Special Rehabilitation			7166	25.8					4665	18.0	4972	19.1
Extensive Services			6724	17.1					4354	12.0	4589	12.6
Special Care			12186	25.9					2886	6.4	3003	6.6
Clinically Complex			8780	30.5					4786	17.7	4942	18.2
Impaired Cognition			9352	25.9					6011	17.4	7578	22.1
Reduced Physical Function			8026	34.3					6877	31.4	7330	33.3
Behavior Problems (ref)												
ADL Score ^f					-102	-1.7			239	4.0	237	3.3
IADL Score ^g					2162	26.9			2573	29.2	2486	28.2
ADL Score squared					141	23.1			91	13.9	168	17.6
CPS ^h							-1467	-12.8	-2201	-18.9	24	0.4
CPS squared							974	35.7	636	23.2		

R-squared	3.5%	7.0%	18.4%	10.4%	22.9%	21.6%
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^aCommunity LTSS includes Community Services covered by the MassHealth Office of Long-term Services and Supports with the exception of durable medical equipment, prosthetics, orthotics, and oxygen. Broadly, this includes personal care attendant, adult foster care, adult day habilitation, home health, nursing, and therapy services. Annual costs are tabulated for Nursing Home Certifiable SCO members in 2016 and 2017.

^bThe DxCG v4.2 concurrent Medicaid relative risk score (RRS) uses age, sex, and diagnoses recorded from clinician encounters to predict health care costs. It was normalized to have mean = 1 in the MassHealth managed care eligible population.

^cHousing problems = 3 or more addresses or an ICD-10 code for homelessness.

^dThe Neighborhood Stress Score (NSS) was normalized to a mean of 0 and standard deviation of 1 in the MassHealth managed care eligible population. $NSS+ = \max(0, NSS)$.

^eThe RUGS-III-HC grouper was modified so that the duration of therapies utilized in the special rehabilitation step was estimated from encounters rather than from the MDS recorded values. The RUGS-III-HC categories were operationalized using 6 indicator variables.

^fThe ADL score ranges from 0 to 16 with higher scores indicating greater limitations. The range of scores in the modeling population was 4-15. Scores of 4-6 were rescaled to 0 and scores of 7-15 were rescaled to 1-9 for modeling.

^gThe IADL score ranges from 0 to 3 with higher scores indicating greater limitation.

^hThe Cognitive Performance Score ranges from 0 to 6 with higher scores indicating greater cognitive impairment.

Abbreviations: Cognitive Performance Score (CPS); long-term services and supports (LTSS); Department of Mental Health (DMH); Department of Developmental Services (DDS); resource utilization groups home care (RUGs-III-HC); activities of daily living (ADL); instrumental activities of daily living (IADL); coefficient (coeff); reference (ref); relative risk score (RRS); social determinants of health (SDH); Massachusetts (MA); Senior Care Options (SCO);

eAppendix Table 3. Predictive Ratios within Subgroups for Models to Predict Community LTSS^a Costs among SCO Enrollees during 2016-2017

Characteristic	Person Years	Mean LTSS ¹ Costs	No RA PR	SDH PR	RUGS -III- HC PR	ADL/ IADL PR	CPS PR	Full PR	MA- SCO PR
Total	32,941	\$14,071	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Characteristics in the MA-SCO model									
Men	9,835	\$12,870	0.91	1.00	1.00	1.00	1.00	1.00	1.00
Women	23,106	\$14,582	1.04	1.00	1.00	1.00	1.00	1.00	1.00
No Disability	26,449	\$14,230	1.01	1.00	0.99	0.99	1.00	1.00	0.99
Disability	6,492	\$13,420	0.95	1.00	1.03	1.03	1.02	1.00	1.02
Housing Problems ^b	1,880	\$15,664	1.11	1.00	1.12	1.11	1.11	1.00	1.00
NSS ^c lowest 20%	3,273	\$14,157	1.01	1.01	0.97	0.98	0.98	0.99	1.00
NSS ^c highest 20%	3,312	\$14,670	1.04	0.99	1.07	1.09	1.08	0.99	0.99
ADL Score ^d									
4 to 6	14,003	\$9,892	0.70	0.73	0.75	1.00	0.78	1.00	0.97
7 to 11	13,790	\$14,764	1.05	1.04	1.04	1.02	1.05	1.01	1.04
12 to 15	5,147	\$23,582	1.68	1.57	1.48	0.97	1.32	0.98	0.97
IADL Score ^e									
0	4,196	\$7,272	0.52	0.55	0.55	0.92	0.60	0.90	0.92
1 to 3	22,221	\$12,974	0.92	0.93	0.94	0.99	0.98	1.00	0.99
3	6,524	\$22,177	1.58	1.46	1.42	1.05	1.21	1.02	1.04
CPS ^f									
0 to 1	9,932	\$12,020	0.85	0.89	0.87	1.12	1.01	1.00	1.08
2 to 4	21,473	\$13,920	0.99	0.98	0.99	0.94	1.00	1.00	0.95
5 to 6	1,536	\$29,434	2.09	1.89	1.75	1.21	0.99	1.00	1.17
Characteristics not in the MA-SCO model									

White/Non-Hispanic	8,827	\$12,531	0.89	0.90	0.90	0.92	0.91	0.93	0.93
Black/Non-Hispanic	2,597	\$15,646	1.11	1.09	1.11	1.08	1.10	1.08	1.08
Hispanic	3,017	\$16,394	1.17	1.20	1.21	1.25	1.21	1.19	1.20
Other Non-Hispanic	3,548	\$12,986	0.92	0.93	0.92	0.96	0.94	0.97	0.97
Missing/unknown	14,953	\$14,495	1.03	1.02	1.02	0.99	1.01	1.00	0.99
DxCG RRS ^g lowest 20%	2,945	\$13,792	0.98	1.06	1.04	1.05	1.04	1.03	1.05
DxCG RRS ^g highest 20%	6,335	\$15,050	1.07	1.02	1.05	0.96	1.04	1.01	0.98
RUGS-III-HC Categories^h									
Special Rehabilitation	4,839	\$13,894	0.99	0.99	1.00	0.94	0.99	1.00	1.00
Extensive Services	1,380	\$13,067	0.93	0.95	1.00	0.93	0.93	1.00	1.00
Special Care	867	\$19,638	1.40	1.29	1.00	0.88	1.13	1.00	1.00
Clinically Complex	4,048	\$15,545	1.10	1.10	1.00	0.96	1.05	1.00	1.00
Impaired Cognition	1,789	\$16,581	1.18	1.14	1.00	1.14	0.90	1.00	1.00
Reduced Physical Function	16,719	\$14,780	1.05	1.05	1.00	1.12	1.10	1.00	1.00
Behavior Problems	3,298	\$6,522	0.46	0.47	1.00	0.54	0.51	1.00	1.00
MA-SCO Model Predictions									
Lowest 10% Predicted	3,262	\$5,162	0.37	0.41	0.61	0.57	0.44	0.98	0.98
Highest 10% Predicted	3,286	\$27,133	1.93	1.72	1.64	1.03	1.35	1.01	1.01

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