USING NEIGHBORHOOD RISK AND OTHER SDH FACTORS TO MANAGE HEALTH CARE

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A bit about me …

- Math PhD, Health Services Researcher since 1984
- Professor and QHS Division Chief at the University of Massachusetts Medical School since 2009
  http://www.umassmed.edu/QHS
- I predict *population-based* outcomes ("per person-year") from medical and social risk factors
  - E.g., *cost* and *utilization* (ED visits, hospitalizations, …)
- Models are used to make fair
  - Payments to health plans
  - Judgments about quality

MassHealth

- MassHealth (MH) covers ~*1.8 million people*, over 25% of Massachusetts residents, 40% of all children
  - Of people in MH, about 1/3 are children, 9% "disabled"
- Ongoing, 5-year, *$1.8 billion delivery system reform*
  - Systems pushed/helped to organize as Accountable Care Organizations (ACOs)
  - Medical + Behavioral Health (BH) + Long-Term Services and Supports (LTSS) + some housing & food assistance
- Members accept assignment to ACO plans that receive risk adjusted (capitated) payments to care for them
- MH also monitors and modifies payment based on ~*20 quality measures*

Accountable Care Organizations (ACOs)

- ACO: a network of clinicians and hospitals that share financial and medical responsibility for providing coordinated care to groups of patients
- ACOs connect patients with not-strictly-medical services and supports
- ACOs are incentivized to *spend less* AND *provide quality care*
- Most MH members belong to 1 of 17 ACO plans
    - Some ACOs members are "riskier" (more difficult) than others

How Can We Measure Risk?

- Variables must be available in health system records
- ICD-10 diagnoses (D_xs) on "encounter records" *mainly* capture medical risk
- Some ICD-10 D_xs refer to social risk (e.g., homeless)
- Eligibility, enrollment records reveal additional risks
  - Frequent address changes
  - Program entitlement due to disability
  - "Tough" neighborhood
  - Client of the Department of Mental Health
  - "Nursing home certifiable"
    - Relies on "minimum data set" (MDS) questions, thus they are not known for everybody

Predicting *Cost*

- Using measures of medical and social risk
  - Age-sex (20 categories)
  - Medical relative risk score (RRS) from DxCG-HCCs
  - Unstable housing, disability, serious mental illness, and substance use disorder
  - Neighborhood Stress Score (NSS), a summary measure from census data (standardized to have mean = 0; SD = 1)

- Version 2.0 (uses CY2015 data), adds an "interaction": (Housing Problem) x RRS

- Next:
  - Use (MDS) functional assessments to predict LTSS cost

How the model is used (simplified)

- Each person gets a relative risk score (RRS)
  - RRS = 1 → member is expected to have average costs
  - 2 → twice average cost, etc.

- MassHealth *separately* determines how much to pay on average: e.g., M = $5000

- The ACO receives RRS*M for each enrollee

- If an ACO's enrollees have average RRS = 1.1, then it receives 1.1*M = $5,500 per enrollee

Neighborhood Stress Score (NSS)

- Measure of "economic stress" summarizing 7 census variables identified in a principal components analysis
    - % of families with incomes < 100% of FPL
    - % < 200% of FPL
    - % of adults who are unemployed
    - % of households receiving public assistance
    - % of households with no car
    - % of households with children and a single parent
    - % of people age 25 or older who have no HS degree

- NSS is standardized (Mean = 0; SD = 1)

SDH Payment Model (CY13)

	% of MCO members in this group	Model coefficient, as compared to 1.00 average risk	Dollar *increment* for members in cohort	Mean overall dollars predicted
All Managed Care	100.0			$ 5,000
NSS, per SD unit		0.01	$ 50	-
DxCG RRS, per unit		0.66	$ 3,300	-
Risk Group				
DMH client	0.4	2.73	13,650	29,700
Not DMH, but DDS	1.1	0.51	2,550	11,450
All other disabled	10.7	0.28	1,400	13,650
Homeless, by ICD code	0.02	0.11	550	29,050
3+ addresses in a year	11.5	0.11	550	7,400
Serious mental illness	10.2	0.45	2,250	16,900
Substance use disorder	6.2	0.40	2,000	15,300

SDH Payment Model Summary

- MassHealth started using its SDH model for payment in October 2016. The model used
  - A medical risk score (RRS), age and sex
  - Unstable housing/homelessness
  - Disability status
  - A summary measure of "neighborhood stress" (NSS)
  - Serious mental illness and substance use disorders
- MassHealth's current (v 2.0) model is similar, but based on more recent data
  - SMI and SUD are no longer separately "called out"
  - It uses an interaction: NSS * RRS

We apply the same ideas to measuring quality

As an example, we will focus on risk adjustment for one quality goal: Having fewer ED visits in a complex population

Predicting ED visits

- Goal: Reward plans for care that leads to fewer Emergency Department (ED) visits for people with SMI or SUD

- Quality measures often aren't risk adjusted
  - This could penalize a plan with a tough "case-mix"

- MassHealth's primary questions:
  - Is risk adjustment needed for a fair measure?
  - Will "only a little risk adjustment serve"? E.g., are both medical and SDH factors needed?

ED visit rates for members with SMI and/or SUD (2015 data)

- ~150,000 MH members, age 18 to 64, had SMI or SUD
  - ~150 visits per 1000 member-months
- Without risk adjustment we penalize plans when their rates exceed 150
- But some plans enroll more complex patients
- Risk adjustment
  - Can change which plans look better/worse than "expected"
  - Should matter for quality measures, when SDH and other risks differ across plans

ED visit rate per 1000 member-months for adult members with SMI or SUD

		Observed	
	Per cent	Rate	O: 148 Ratio
TOTAL (N = 144,981)	100%	**148**	1.00
SMI and SUD (dual)	25%	**262**	1.77
SMI w/o SUD	56%	**107**	0.72
SUD w/o SMI	19%	**118**	0.80
Client of DMH	3%	**252**	1.70
Client of DDS (not DMH)	2%	**150**	1.02
Other disabled	32%	**170**	1.15
Highest-stress (NSS) quintile	25%	**167**	1.13
Housing Problems	18%	**222**	1.50
Unstably housed (3+ addresses)	17%	**188**	1.28
Homeless by ICD Code	3%	**731**	4.95

Performance of SDH Model to Predict ED Visit Rates: Selected Subgroups (1)

| | Person Years | No Model | | Model | | | | | |
| | | Observed | | SMI + SUD only | | DxCG (medical risk only) | | SDH (medical and social risk) | |
		Rate	O:E Ratio *	Expected Rate	O:E Ratio	Expected Rate	O:E Ratio	Expected Rate	O:E Ratio
Total	144,249	148	1.00	148	1.00	148	1.00	148	1.00
White/Non-Hispanic	96,999	150	1.02	153	0.98	153	0.98	151	1.00
Black/Non-Hispanic	6,313	174	1.18	143	1.22	154	1.13	164	1.06
Hispanic	4,038	134	0.91	132	1.01	129	1.04	137	0.98
Other Non-Hispanic	1,415	76	0.52	124	0.61	101	0.75	101	0.75
Missing/unknown	35,483	140	0.95	137	1.02	135	1.04	140	1.00
Top 10% of SDH Model predicted	14,410	**492**	3.34	216	2.28	472	1.04	488	1.01
Bottom 10% of SDH Model predicted	14,420	**23**	0.16	115	0.20	25	0.91	24	0.94

Performance of SDH Model to Predict ED Visit Rates: Selected Subgroups (2)

		Observed		O:E ratio after risk adjustment
	Per cent	Rate	O: 148 Ratio	
TOTAL (N = 144,981)	100%	**148**	1.00	1.00
SMI and SUD (dual)	25%	**262**	1.77	1.00
SMI w/o SUD	56%	**107**	0.72	1.00
SUD w/o SMI	19%	**118**	0.80	1.00
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Plans *do* vary a lot

- Findings for selected plans:

O:E Ratios (none to full Risk Adjustment)			
Plan	Observed	After accounting for Medical only	After adding SDH
A	1.23	1.14	1.10
B	1.05	1.05	1.08
C	1.03	1.06	0.92
D	0.93	0.91	0.92
E	0.79	0.84	0.93

- A large part of observed differences among these plans is "explained" by the SDH model

Key Findings (ED visit example)

- Risk adjustment protects plans with high risk members
- Model with age/sex, DxCG, and SMI/SUD/both indicators has high predictive power, but *under-predicts* for:
  - Clients of DMH
  - Those with housing problems
  - Black non-Hispanics
- Adding SDH variables gets the "expected" for almost all groups examined pretty much right
- The 10% of members with highest (lowest) SDH model predictions use 492 (23) ED visits per 1000!
- People with "housing problems" (especially homelessness) are at high risk. ED visit rates are:
  - 1.3 times average, for those with 3+ addresses
  - 5.0 times average, for those with ICD-coded homelessness

Summary: SDH Risk Adjustment

- *Enables fair benchmarking of any outcome*
- Paying ~$50 per unit increase in "neighborhood stress" gives providers with 2,000 patients in a distressed neighborhood ≥ $100,000/year to address social complexity
- ~$600 for coded homelessness is less than needed, but:
  - Supports useful services now
  - Encourages the more comprehensive coding needed to understand the effect of homelessness in the future
- SDH modeling protects "safety net" providers
  - It suggests the value of socially-focused interventions
  - It *could* encourage health care system/community partnerships and cooperation across state agencies

THANK YOU

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