Accounting for Social Risk Factors in Public Reporting on Unplanned Hospital Readmissions in Massachusetts: A Workgroup Report

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Summary

Recent national research provides evidence that social risk factors should be accounted for in the measurement of hospital performance.

- **Objective:** To determine if, and how, CHIA should account for social risk factors in their public reporting of all-payer, unplanned hospital readmissions.
- **Solution**: With expert recommendations of a statewide workgroup, CHIA adopted a conceptual framework for social risk factors and expanded its existing risk-adjustment model to incorporate patient- and community-level social risk factors. Data from CHIA's Hospital Inpatient Discharge Database and the US Census were used to identify social risk factors.
- **Next Steps:** CHIA plans to update the enhanced risk-adjustment model by refining the data elements used and linking to additional data sources, including the Massachusetts All Payer Claims Database.

In service of its mission to objectively report reliable and meaningful information about the quality, affordability, utilization, access, and outcomes of the Massachusetts health care system, the Massachusetts Center for Health Information and Analysis (CHIA) produces annual analyses of hospital-wide readmissions.

Readmissions within 30 days of discharge are a measure of health system performance. In 2012, the Massachusetts Statewide Quality Advisory Committee adopted the Yale/CMS hospital-wide all-cause unplanned 30-day readmission measure. CHIA adapted the Yale/CMS measure, originally developed for use with the Medicare fee-for-service population, for use with an all-payer adult population (Yale New Haven Health Services Corporation - Center for Outcomes Research & Evaluation (YNHHSC/CORE), 2018). To date, CHIA has produced six annual reports detailing overall trends in statewide all-payer readmissions, readmissions examined by characteristics of patients and hospitalizations, and observed and risk-standardized readmission rates for individual and groups of acute care hospitals in Massachusetts.

Since the inception of the CMS "readmission penalty" program, there have been debates about whether social risk factors should be accounted for in calculating penalties assessed in the CMS Hospital Readmission Reduction Program (Medicare Payment Advisory Commission (MEDPAC), 2013). In recent years, there has been a growing body of evidence that social risk factors influence access, utilization, and quality of health care (Office of the Assistant Secretary for Planning and Evaluation, 2016). Hospitals and hospital associations have raised concerns that inter-hospital comparisons of readmission rates based on adjustments of case mix and clinical severity fail to account for the additional impact of social risk factors. Accounting for social risk factors may serve to more accurately compare hospital performance in this domain.

To respond to these developments in the field, CHIA convened a multi-stakeholder workgroup to consider whether CHIA should account for social risk factors in its analysis of readmissions, and if so, to provide recommendations for doing so given the available data sources and methods.

Problem Statement

Should CHIA account for social risk factors to improve its public reporting of hospital performance on readmissions? The Yale/CMS hospital-wide all-cause unplanned 30-day readmission measure was developed for the Medicare fee-for-service patient population aged 65 and over. Currently, the Yale/CMS measure adjusts hospital readmission rates by patient age, patient case mix, and hospital service mix. However, recent national research provides evidence that social risk factors should be accounted for in the measurement of hospital performance.

Process

In the spring of 2018, a workgroup was formed in order to gather expert counsel and scientific research on how to incorporate social risk factors in CHIA's readmission work. The workgroup was comprised of representatives from state agencies, hospitals and health systems, provider and payer organizations, and method and content experts. The workgroup was expected to meet and offer expert advice and recommendations to CHIA within members' areas of experience and expertise.

The purpose of the workgroup was to advise CHIA in the following areas:

1. How might social risk factors be conceptualized and defined?
2. What data is necessary and/or available to adequately measure these factors?
3. To what extent do social risk factors explain the variation in risk for readmission?
4. How should these factors be accounted for in CHIA's public reporting on hospital readmissions and revisits?

The workgroup was co-chaired by the Massachusetts Health & Hospital Association (MHA) and CHIA, and met for a series of five meetings from May 2018 to June 2019. The meeting series covered:

1. Purpose and scope of the workgroup
2. Current work related to social risk factors and readmissions
3. Current and potentially available data to measure social risk factors

4. Development of a preliminary analytic approach
5. Review of preliminary results and revision of the approach
6. Proposal of a set of recommendations for CHIA

Solution

With the workgroup's expert advisement and recommendations, CHIA made the decision to expand their current risk-adjustment model for their public reporting of readmissions. The key decision points were regarding:

1. A conceptual framework for social risk factors, and
2. An analytic approach to account for social risk factors

Adopting a social risk factor conceptual framework

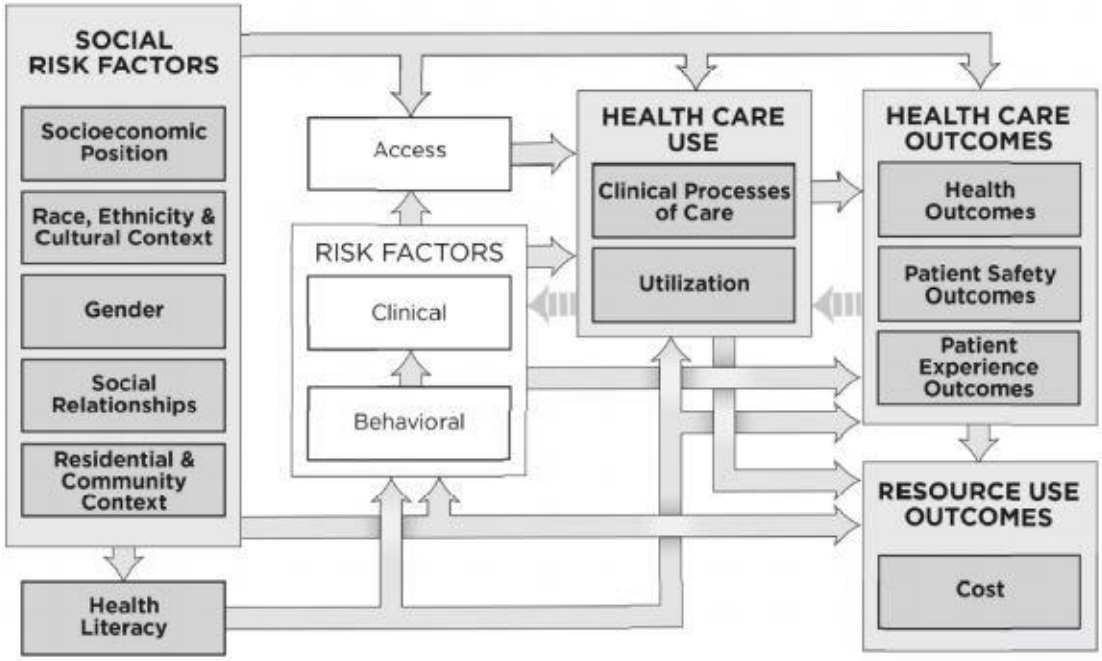
Based on discussion and review of the literature, the workgroup determined that the conceptual framework used in the 2016 report, "Accounting for Social Risk Factors in Medicare Payment – Identifying Social Risk Factors," presented by the National Academies of Sciences, Engineering and Medicine (NASEM)[1] would be appropriate for CHIA to conceptualize and examine factors most related to health outcomes and readmission risk. The conceptual framework examined social risk factors in the context of health use, outcomes, and cost (National Academies of Sciences Engineering and Medicine, 2017). The report defined social risk factors as a "set of constructs that capture the key ways in which social processes and social relationships could influence key health-related outcomes." The five social risk factor domains included socioeconomic position (SEP); race, ethnicity, and cultural context; gender; social relationships; and residential and community context (see Figure 1).[2]

[1] The Office of the Assistant Secretary for Planning and Evaluation (ASPE), the Department of Health and Human Services (DHHS) contracted with the National Academies of Sciences, Engineering and Medicine (NASEM) to convene a committee to determine how to account for social risk factors in Medicare payment. The committee's tasks included identifying criteria for selecting social risk factors, identifying specific social risk factors for Medicare, and determining methods to account for social risk factors.

[2] Though not a social risk factor, NASEM included health literacy in their conceptual framework because it is affected by social risk factors and the literature supports its role in health care outcomes and quality measures. For the purposes of examining social risk factors and readmissions, CHIA did not include health literacy.

Figure 1

Figure 2.1. National Academies of Sciences, Engineering, and Medicine's Conceptual Framework of Social Risk Factors for Healthcare Use, Outcomes, and Cost



Source: National Academies of Sciences, Engineering, and Medicine. Accounting for Social Risk Factors in Medicare Payment: Identifying Social Risk Factors. Washington, DC: National Academies of Sciences, Engineering, and Medicine; 2016.

Socioeconomic position is a broad dimension that captures an individual's access to resources, and includes indicators such as income, education, and dual eligibility for Medicaid and Medicare. Race and ethnicity is related to how resources, risks, and rewards are distributed in society, examples of which include nativity, language, documentation status, and race/ethnicity. Gender is defined as a social concept, broader than biological sex, which includes indicators related to gender identity and sexual orientation. Social relationships refers to access to social networks including marital/partner status, living alone, and emotional social support. Residential and community context broadly captures characteristics of residential environments including housing, neighborhood deprivation, and urbanization.

Analytic approach to account for social risk factors

The workgroup examined the NASEM report "Accounting for Social Risk Factors in Medicare Payment – Criteria, Factors, and Methods," which proposed four policy options that could be applied across Medicare payment programs to account for social risk factors. The options were:

1. Stratified public reporting,
2. Adjustment of performance measure scores,

3. Direct adjustment of payment, and
4. Restructuring payment incentive design

The workgroup focused on the first two methods—stratification and adjustment—for CHIA to consider for their public reporting, as the latter two methods focus on payment, which was out of scope.

Stratification vs. Risk-Adjustment

Using stratification to account for social risk factors would involve dividing hospitals into subgroups based on shared characteristics (e.g., hospitals serving a similar share of patients with social risk factors) and reporting performance within those strata. The benchmark for hospital performance would be specific to each subgroup. Adjustment of performance measure scores aims to statistically minimize the effect of factors being adjusted for; these factors may influence performance independent of a provider's control. Adjustment allows for comparison across all hospitals, as opposed to within subgroups.

Beginning in federal fiscal year 2019, CMS assesses hospital performance under HRRP using stratification. Hospitals are stratified into five peer groups, or quintiles, by proportion of dual-eligible patients served. A hospital's dual proportion is the proportion of Medicare fee-for-service (FFS) and managed care stays where the patient was dually eligible for Medicare and full-benefit Medicaid, and the median peer group performance on each measure is used as the threshold (Centers for Medicare & Medicaid Services, 2017). By contrast, the CMS Center for Medicaid and CHIP Services stratifies their Medicaid all-cause readmission measure using groups of patient utilization—beneficiaries with 1-3 hospital stays compared to beneficiaries with four or more hospital stays (Centers for Medicare & Medicaid Services, 2018).

Though the workgroup agreed that a mixture of both approaches would be ideal, given the small number of acute care hospitals in Massachusetts, stratification by patient dual-eligible status as described above would not be appropriate or feasible. Additionally, risk-adjustment would allow for comparison across all acute care hospitals in Massachusetts, as opposed to within subsets.

Model Enhancement

After determining that stratification was not a feasible option, workgroup members determined that the best approach to incorporate social risk factors would be to expand the existing risk-adjustment model by adding patient- and community-level social risk factors. The current Yale/CMS all-cause readmission measure that CHIA adapted for an all-payer population already adjusts for patient age, clinical comorbidities, and hospital service mix (Center for Health Information and Analysis, 2018). Workgroup members and CHIA staff looked into CHIA's hospital inpatient discharge database (HIDD)[3] for available patient-level social risk factors, as well as publicly available community-level data, to determine which data were available and feasible for inclusion.[4]

At the patient-level, factors available to be included were patient sex, race and ethnicity, homeless status, and insurance type. Patient sex and patient race and ethnicity were taken as coded on the discharge record. Race and

[3] CHIA's all-payer readmission analysis uses the hospital inpatient discharge database (HIDD) that includes discharge information from all of the acute care hospitals in Massachusetts.

[4] In the NASEM report, "Accounting for Social Risk Factors in Medicare Payment – Data," the American Community Survey is recommended as a useful source of community-level social risk factor data that can be used as a proxy when individual-level social risk data is unavailable.

ethnicity was cleaned and aggregated to classify patients into one of five categories: non-Hispanic white, non-Hispanic black, non-Hispanic Asian, Hispanic, and other. Homeless status was created using the homeless indicator as submitted on the discharge record or having a homeless diagnosis on the discharge (i.e., V600 for ICD-9 or Z590 for ICD-10). Insurance type in the HIDD includes the primary expected payer source for a patient. For the risk-adjustment, patients were categorized as having one of the following insurance types: Medicare only, Medicaid only, private insurance only, self-pay or other only, and dual-eligible. A proxy for dual-eligibility was created and defined as patients aged 18-64 years on Medicare. This proxy was created based on the available information in the HIDD, and a final indicator of dual-eligibility will be created when the HIDD is linked to CHIA's All Payer Claims Database (APCD).

In addition to the patient-level indicators that were previously unaccounted for, the workgroup identified an opportunity to significantly expand the behavioral health-related clinical comorbidities in the existing model. The existing model included severe substance use and mental health disorders as comorbidities, which workgroup members thought insufficiently covered the wide array of behavioral health conditions that increase a patient's clinical and social risk for readmission. CHIA staff then reviewed and expanded the list of behavioral health-related codes included in the risk-adjustment.

In order to incorporate community-level social risk factors, data was pulled from the 2010 US Census and the 2017 five-year estimates from the American Community Survey (ACS). Through review of the literature, and the expert counsel of workgroup members, the following community-level factors outlined in Table 1 were selected for inclusion.

Table 1

DOMAIN	INDICATOR
Poverty	Median family income; percent of single parent (with dependents under age 18) households in population
Food Insecurity	Percent of population on food stamps/SNAP
Housing	Median home value; percent of population who lived in the same house for the past 12 months
Education	Percent of population ages 25+ with at least a high school education
Employment	Percent of employed persons ages 16+ in white collar occupations; percent of unemployed people 16+ in civilian labor force

Community-level data were linked to the hospital inpatient discharge data using zip code tabulation areas (ZCTAs). Currently, community-level data were only pulled for Massachusetts residents, and therefore all risk-adjustment analyses were limited to MA residents.

Preliminary results

The new risk-standardized hospital readmission rates ranged from a low of 14.4% to a high of 19.2%, a range of 4.8 percentage points. The previous risk-standardized rates from the original Yale/CMS model ranged from 14.3 to 18.9%, a range of 4.6 percentage points. The difference in risk-standardized rates between the original model and the new model varied by hospital (see Figure 2), with no particular trends for hospitals of the same type (i.e., Academic Medical Centers, teaching hospitals, community hospitals, community-High Public Payer hospitals[5]). In the extremes, the new model changed the risk-standardized readmission rates by about one percentage point in either direction, but most hospital's readmission rates changed by less than half a percentage point in either direction.

Figure 2

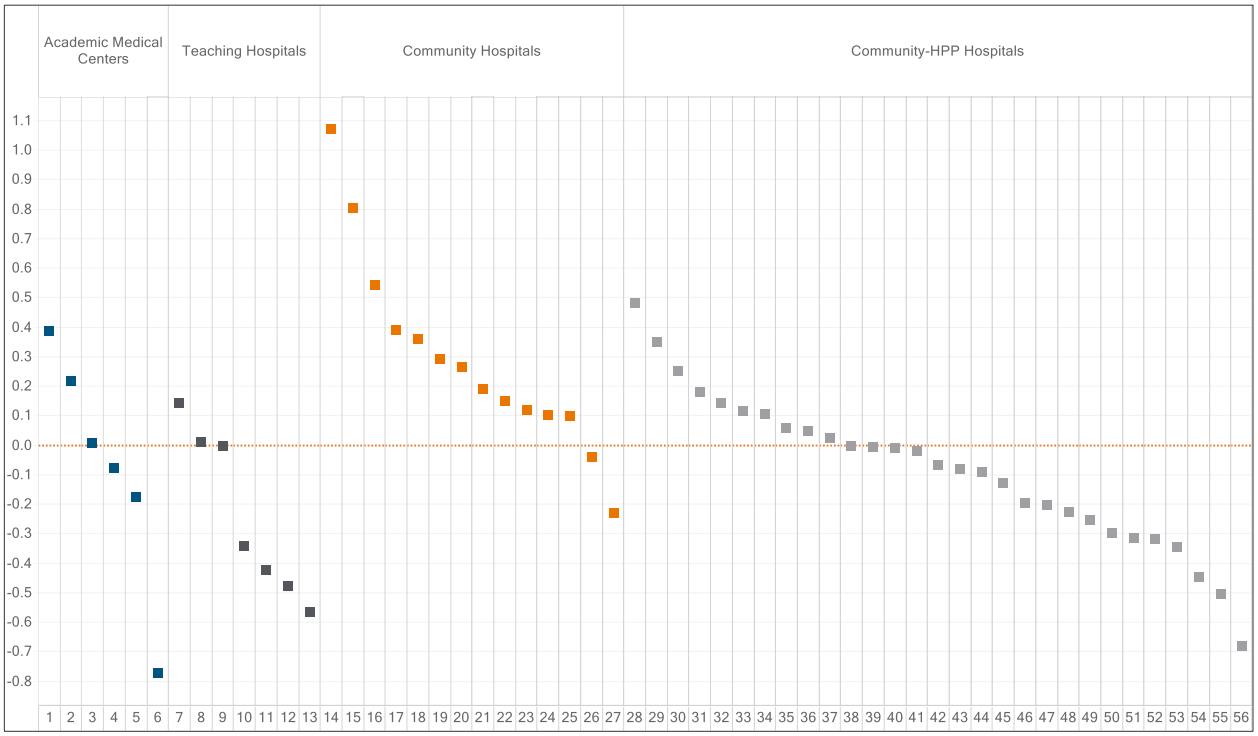
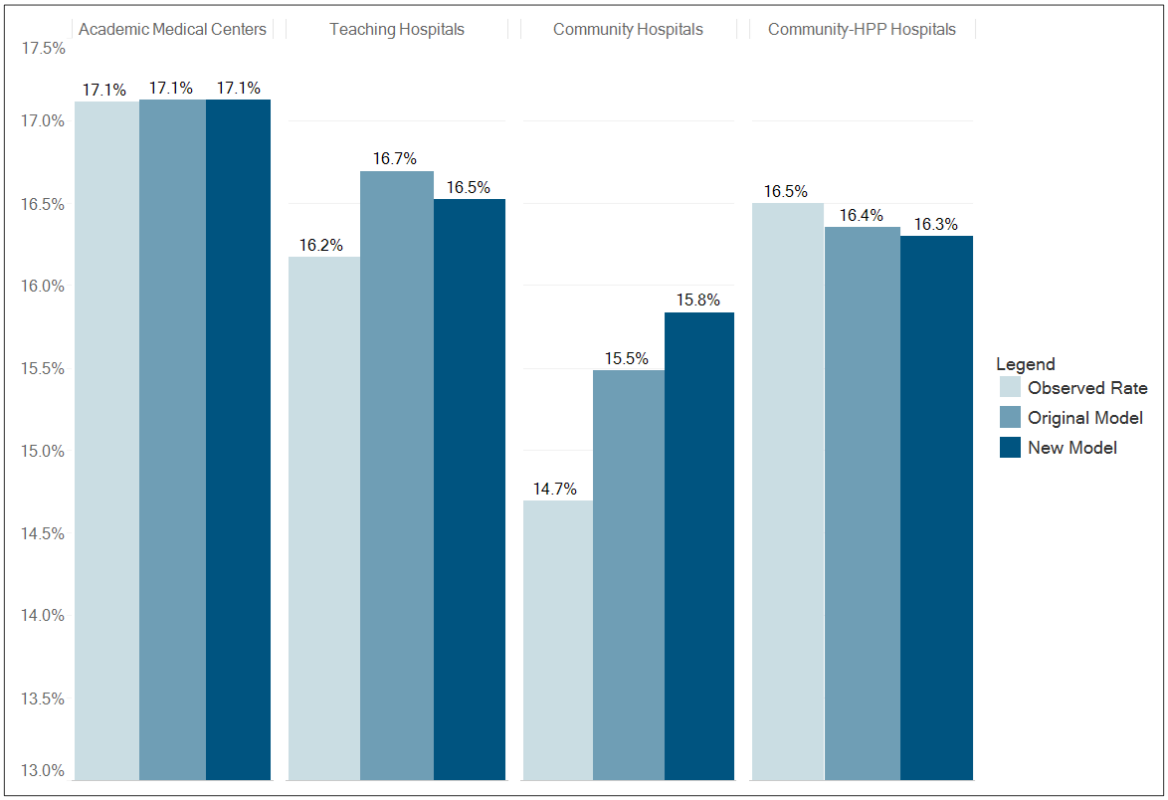


Figure 3 presents the volume-weighted risk-standardized readmission rates by hospital type. For Academic Medical Centers, the difference in the risk-standardized rate between models was barely detectable. The rate for teaching hospitals increased by 0.3 percentage points in the new model compared to their unadjusted rate, but the increase was slightly less than that with the original model (0.5 percentage points). For community-High Public Payer hospitals, their readmission rate fell slightly compared to their unadjusted rate with the new adjustments for social risk factors, while the new model increased the readmission rate for community hospitals by one percentage point.

[5] Community-High Public Payer hospitals are community hospitals that have 63% or greater of Gross Patient Service Revenue (GPSR) attributable to Medicare, MassHealth, and other government payers, including the Health Safety Net. For more information on hospital types, see the **Readmissions technical appendix**.

Figure 3



Recommendations

Workgroup members were presented the preliminary results during the April and June 2019 meetings, and discussed a set of questions and recommendations for CHIA to consider moving forward.

How important is it to include social risk factors in CHIA's public reporting for readmissions?

There was a clear consensus among workgroup members that social risk factors should be included in CHIA's public reporting of readmissions. Some members noted concerns that the policy implications of this analysis should not be misinterpreted; the goal is still for hospitals to reduce readmissions, even for populations with more social risk factors. Nonetheless, it is important to understand the degree of challenge that hospitals and their patient populations face, and to learn from the hospitals that successfully reduce readmissions despite these challenges.

What, if any, are ways to improve or enhance the approach presented?

Workgroup members agreed that the current approach was a good starting point, and that further refinements should be explored as more and better quality data becomes available. One enhancement would be incorporating community-level data for non-MA residents, allowing CHIA to continue reporting on all eligible inpatient discharges regardless of place of residence. Also, community-level data linkage at a more granular level, like block group, would allow for more precise community estimates. In Massachusetts, several zip codes cover both high and low income residents, and data at the block group level would mitigate some of that obfuscation.

What are some suggestions for CHIA regarding the reporting of risk-adjusted rates from the original Yale/CMS model vs. the new model?

Workgroup members recommended that CHIA engage in pilot testing the updated method with select hospitals to field questions and obtain additional feedback prior to the public release of the new risk-standardized rates. The workgroup also recommended that in the initial release of the new risk-adjusted rates in the annual report, CHIA still report risk-standardized rates from the original model for hospitals to compare how their rates changed. Furthermore, workgroup members recommended that CHIA continue to report observed readmission rates as well as risk-standardized rates in their public reporting. Although risk-standardized rates accounting for social risk factors allow for more fair comparisons to be made between hospitals, observed rates will still be helpful for identifying opportunities for improvement and tracking performance over time within individual hospitals.

Next Steps

CHIA plans to undertake many of the workgroup member's recommendations regarding incorporating social risk factors in their public reporting of readmissions. As a first step to expanding community-level data beyond Massachusetts residents, CHIA staff will extract the appropriate Census data for neighboring states, including New York. Incorporating these data would account for about 99% of eligible inpatient discharges for the readmissions analysis. Additionally, CHIA plans to work with other state agencies to geocode the hospital inpatient discharge data to link community data at the census block group level.

Furthermore, CHIA's analyses of patient-level data is contingent upon the quality of data submitted by acute care hospitals. CHIA will continue to work with hospitals to ensure the accuracy and completeness of patient-level fields such as race, sex, homeless status, and expected payer type that will now be incorporated into readmission, and potentially other, analyses. This will be an especially important next step to help appropriately account for social risk factors in CHIA's public reporting and provide fair comparisons of hospital performance.

CHIA conducted and presented analyses on zip code information for discharges flagged as homeless, and found that 99.1% of discharges flagged as homeless had a valid zip code. However, CHIA staff were unable to ascertain from the data the accuracy of the zip codes on these discharges, which raised questions about what the zip code represented. CHIA plans to work with hospital stakeholders to potentially standardize what zip codes on homeless discharges represent, whether it is that of a family member, most recent address, nearest shelter, or even the hospital where the patient received care.

CHIA is also currently exploring a process by which the hospital inpatient discharge data can be linked with their All Payer Claims Database (APCD), which would aid in identifying those patients who are dual-eligible for both Medicaid and Medicare. A claims-based identification of dual eligibility will enhance that indicator in the risk-adjustment model.

Appendices

Appendix A: Model specifications

The risk-adjusted model incorporating social risk factors including the following changes (see **Readmissions technical appendix** for details about the original Yale/CMS model):

1. A three-year aggregate dataset including only discharges for Massachusetts residents was used for all analyses. Three years of data were combined to ensure model stability, and due to limited resources, community-level data was only included for Massachusetts zip codes.
2. Variables were defined and transformed in the following ways (complete list in Table A):
    a. Continuous age was grouped into eight categories
    b. Race and ethnicity was grouped into five categories
    c. Insurance type was grouped into five categories, including a proxy for dual eligibility (patients aged 18-64 on Medicare)
    d. Median family income was divided by a factor of ten thousand
    e. Median home value was divided by a factor of one hundred thousand
    f. Percent of single parent households in the population was multiplied by a factor of ten
    g. Percent of population ages 25 and over with at least a high school education was transformed into a binary variable, measuring whether or not that percentage was greater than 80%
    h. Percent of population ages 16 and over who are unemployed was divided by a factor of five
3. To reduce the number of parameters in the final model, standardized indices were created for the clinical comorbidities and the community-level factors. First, a logistic regression was run to output the linear score for each discharge. The linear score was then standardized by subtracting the mean and dividing by the standard deviation. This process was conducted once for the 31 clinical comorbidities to create a comorbidity score, and once for the 8 community-level factors to create a community index.
4. A hierarchical logistic regression model was then run with the existing model covariates, as well as the additional patient- and community-level factors. Model output is available upon request.

Table A: Model Variables

VARIABLE TYPE	DESCRIPTION	ORIGINAL MODEL	NEW MODEL
Variables in original model	Comorbidities*	X	X**
	Age	Age as continuous variable	Age groups for 18+
	Cohort-specific condition categories	X	X
Patient-level social risk factors	Sex		X
	Race		X
	Homeless status		X
	Insurance type (incl. dual-eligible proxy)		X
Community-level social risk factors	Median family income		X
	Median home value		X
	Percent of employed persons 16+ in white collar occupations		X
	Percent of single parent households with dependents under age 18		X
	Percent of population ages 25+ with at least a high school education		X
	Percent of population on food stamps/SNAP		X
	Percent of population who have lived in the same house in the past 12 months		X
	Percent of population ages 16+ who are unemployed		X

Notes:

* Comorbidities include: Severe Infection (CC1, 3-6), Septicemia, sepsis, systemic inflammatory response syndrome/shock (CC 2), Other infectious diseases and pneumonias (CC 7, 114 - 116), Metastatic cancer and acute leukemia (CC 8), Severe cancer (CC 9-10); Other cancers (CC 11-14), Diabetes mellitus (DM) or DM complications (CC 17-19, 122-123), Protein-calorie malnutrition (CC 21), Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23-24), End-stage liver disease; cirrhosis of liver (CC 27-28), Pancreatic disease; peptic ulcer; hemorrhage, other specified gastrointestinal disorders (CC 34, 36), Rheumatoid arthritis and inflammatory connective tissue disease (CC 40), Severe hematological disorders (CC 46), Coagulation defects and other specified hematological disorders (CC 48), Iron deficiency or other/unspecified anemias and blood disease (CC 49), Drug/alcohol psychosis and dependence (CC 54-55), Psychiatric comorbidity (CC 57-59, 61, 63), Hemiplegia, paraplegia, paralysis, functional disability (CC 70-74, 103-104, 189-190), Seizure disorders and convulsions (CC 79), Respirator dependence/tracheostomy status (CC 82), Cardio-respiratory failure and shock, Congestive heart failure (CC 85), Coronary atherosclerosis or angina, cerebrovascular disease (CC 86-89, 102, 105-109), Specified arrhythmias and other heart rhythm disorders (CC 96-97), Chronic obstructive pulmonary disease (COPD) (CC 111), Fibrosis or lung or other chronic lung disorders (CC 112), Transplants (CC 132, 186), Dialysis status (CC 134), Renal failure (CC 135-140), Decubitus ulcer or chronic skin ulcer (CC 157-161), Hip fracture/dislocation (CC 170).

** Entered as comorbidity index; expanded codes defining Drug/alcohol psychosis and dependence, and Psychiatric comorbidity

Appendix B: Workgroup Members

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