



Cost and Resource Use Standing Committee Ad Hoc Review: Conceptual & Empirical Analysis of SDS Variables and Payment Outcomes

The Cost and Resource Use Standing Committee met over two webinars in May and October 2015 to evaluate three risk-standardized payment measures under the NQF Sociodemographic Status (SDS) Adjustment Trial Period guidance. This report summarizes the Committee's review and recommendations.

Measures under Review

- #2431: Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) (CMS/Yale)
- #2436: Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Heart Failure (HF) (CMS/Yale)
- #2579: Hospital-level, risk-standardized payment associated with a 30-day episode of care pneumonia (CMS/Yale)

Overview of the Sociodemographic Status (SDS) Adjustment Trial Period

The NQF Board of Directors approved SDS trial period is designated as a 2-year period of time during which SDS factors should be considered as potential factors in the risk-adjustment approach of measures submitted to NQF if there is a conceptual reason for doing so. If there is a conceptual relationship between potential SDS risk factors and the outcome of interest, the developer should conduct empirical analyses to determine whether such factors improve the risk-adjustment model and/or result in meaningful difference in performance rates. Based on those analyses, measure developers decide whether to include SDS in their risk-adjustment approach. The trial period began January 2015.

Prior to this SDS trial period, NQF criteria and policy prohibited the inclusion of SDS factors in the risk adjustment approach and only allowed for the inclusion of a patient's clinical factors present at the start of care. Rather than including SDS factors related to the outcome in statistical risk models, NQF guidance indicated that measure results should be stratified by these variables.

Reviewing the Cost Measures during the SDS Trial Period

The evaluation of the aforementioned measures began and ended prior to the inception of the SDS trial period, and therefore the Committee did not consider SDS factors as part of the risk-adjustment approach during their initial evaluation. When the NQF Board of Directors (BoD) Executive Committee ratified the Consensus Standards Approval Committee's (CSAC) approval to endorse the measures, it did so with conditions in recognition of the potential impact of SDS on cost and payment outcomes and the impending start of the SDS trial period. The conditions for endorsement included:

- Consideration of the measures to enter the SDS trial period; and
- A one-year look-back assessment of unintended consequences.

Following the NQF Board of Directors Executive Committee decision to endorse the cost measures with the condition that they be considered under the trial period guidance, NQF, in collaboration with the CMS/Yale measure development team, agreed to divide the assessment of the impact of SDS variables into two stages (and webinars).

[Stage 1/Webinar #1 \(May 21, 2015\): Conceptual Analyses Review](#)

- Review the conceptual analysis of the relationship between SDS factors and the hospital-level, risk-standardized payment associated with a 30-day episode-of-care for the three conditions (pneumonia, HF, and AMI)
- Determine whether further empirical analysis is warranted
- Identify the variables to be pursued in empirical analysis
- Provide input on the plan or approach to empirical analysis of the selected variables

[Stage 2/Webinar #2 \(October 27, 2015\): Empirical Analyses Review](#)

- Review empirical analysis of the impact of SDS risk factors in the risk model and measure score
- Make a recommendation on endorsement status

Webinar 1: Conceptual Analyses Review

A conceptual relationship refers to a logical theory or rationale that explains the association between a SDS factor(s) and the outcome of interest. The conceptual basis may be informed by prior research and/or healthcare experience related to the outcome of interest, but does not require a direct causal relationship (i.e., it could be a direct cause, an indirect cause, or serve as a surrogate for a cause for which data are lacking). An assessment of a conceptual relationship between a SDS factor and an outcome of interest includes a consideration of whether the effect of the SDS is primarily mediated by the quality of care delivered (i.e., does the SDS factor lead to the delivery of inferior care processes, which in turn affects the outcome?).

The CMS/Yale Core development team [submitted a memo](#) and [conceptual model diagram](#) illustrating the potential relationships of various factors during the episode of care captured by the measures (i.e., hospital admission through 30 days post-discharge). Of the factors identified in their conceptual analysis, they selected three variables that have also been noted in the literature to have a conceptual relationship to utilization and payment and that can be represented by data to which they have access. They also identified the relevant data that are currently available to them for potential empirical testing.

SDS factors with conceptual relationship to utilization and payment selected by Yale Core	Variables and data source
Educational Attainment	Educational attainment obtained from Census data linked to patient's 5-digit ZIP Code
Income	Income level obtained from Census data linked to patient's 5-digit ZIP Code Medicaid (Dual Eligibility) Status as a proxy for low income, obtained from Medicare enrollment data
Insurance coverage	Medicaid (Dual Eligibility) Status as a proxy, obtained from Medicare enrollment data
Race	Operationalized as black or white race, obtained from Medicare enrollment data

In their overview of the conceptual model, the CMS/Yale team noted the following regarding the appropriateness of adjusting on these variables:

- The association of low socioeconomic status and hospital cost is uncertain and exerts itself at multiple points in episode of care. The impact of SDS may be intrinsic to the patient or extrinsic and it is unclear whether hospitals should be held responsible and whether these factors should be included in the adjustment.
- During hospitalization, the hospital has control of a patient's care and therefore any differences in care influenced by SDS should not be adjusted for. Once a patient is discharged, the hospital only has partial control over the patient's care and environmental, community, and patient factors play a larger role.
- The risk standardized payments captured by the measures are based on DRGs (which do not account for length of stay, translational services, or the cost of care coordination). The risk-standardized payments captured by the measures are only linked to procedures, complications of care, and, sometimes, comorbidities.

Committee Discussion

The Committee discussed the conceptual model as well as the literature review summary submitted by the developer. The Committee expressed concerns about some elements of the conceptual model and offered suggestions on how to make it and the literature review broader and more comprehensive.

1. **Broaden the conceptual model.** The Committee was concerned that the conceptual model seemed too medically-oriented and should be broadened to account for more public health variables. For example, the model did not address community, environmental, or patient factors (e.g., social supports, lack of money to buy medication, no refrigerator). The conceptual model should reflect resources available for care within individual hospitals. While these should not be included in the risk-adjustment approach, because differential resources can impact quality of care, they should be noted in the conceptual model.

2. **Additional literature review.** The Committee believed that further literature review was needed to determine the within and between effects of race on hospital performance. Some members strongly suggested that between and within hospital differences should be a lens through which this information should be analyzed. Members also suggested that the developers do a broader search of literature to include readmissions and impact of SDS on health.
3. **Conceptual Relationships.** Based on the research performed by the developers, the Committee agreed there is a conceptual relationship between the selected variables and cost/payment outcomes.

NQF guidance for the evaluation of SDS factors states that if the Committee believes a conceptual relationship exists between the sociodemographic factor(s) and the outcome (i.e, resource utilization or cost), developers should conduct empirical analyses to confirm that relationship. The Committee determined there is conceptual relationship between the proposed variables and the three payment outcomes. Their discussion yielded the following recommendations regarding the examination and consideration of these variables in empirical analyses:

- **Race:** The Committee recommended that the CMS/Yale team review the data and consider including other race variables beyond black.
- **Income and educational attainment:** The Committee was not in favor of the developers beginning empirical analysis using data linked on the basis of 5-digit ZIP Code. The Committee preferred the developers to use their resources analyzing the 9-digit ZIP Code data once it is available to them.
- **Medicaid/dual eligibility status:** The Committee was in support of empirical analysis on this (Medicaid status) variable, but only in combination with the Low Income Subsidy (LIS) data as proxy for insurance status and income.

Webinar 2: Empirical Analyses Review

Follow up on Conceptual Analysis

In response to the Committee's recommendations in May, the developer submitted a [second memo](#) that included a summary of their review of 14 additional articles and a revised conceptual model. These additional articles examined within and between hospital differences in outcomes related to SDS variables; the key findings from this review have been excerpted below:

- "Taken together these papers do not present a conclusive or consistent picture about the role of within hospital differences in treatment of patients based on SDS nor the subsequent impact on outcomes or cost. However they provide some evidence that in certain settings differential care by race could contribute to differences in costs and outcome."
- "Taken together, the body of literature reveals an inconsistent and complex association of low SDS and health outcomes. Most studies used race as their independent variable with less attention to income or other measures of poverty (e.g. Medicaid status). The literature demonstrates both within and between hospital differences in outcomes among racial/ethnic groups that can be partially explained by the use of lower quality hospitals by minorities."

The CMS/Yale Team also revised the conceptual model to broaden the scope of community-level factors that are considered. In doing so, they updated the pre-admission and post-discharge phases of the model to capture the many patient and community factors that reflect differential impact of SDS on episode of care payments. The developer also revised the model to reflect “patient factors” rather than “patient behaviors”. And finally, the model also was reoriented to capture the potential pathways by which low SDS may impact the care provided to patients.

Upon review of these modifications to the conceptual model and the literature review, the Committee and developers noted the significant gaps in the literature specific to the impact of SDS on cost, utilization or payment outcomes. One Committee member raised the issue of whether there is a relationship between the quality of the hospitals that low SDS patients are likely to be treated in and the resources available to those facilities, which may be hidden by the use of standardized payments based on diagnosis-related groups (DRGs). In particular, the Committee member questioned whether any of the literature identified by the developers addressed this issue, to which the developer confirmed their literature search did not find anything specific to this issue.

Another concern raised by one of the Committee members was in reference to summary of the literature review ([page 3, Yale Memo](#)), which indicated that the body of literature identified by CMS/Yale suggests an inconsistent and complex association of low SDS and health outcomes. The Committee member cautioned that this language could be taken to suggest that race or ethnicity could be used to proxy for high or low SES since their literature review predominantly focused on race/ethnicity as the dependent variable.

Review of Empirical Analyses

The importance of the SDS variables in the risk adjustment model should be evaluated by the size of the SDS coefficients in the risk adjustment model, the p-values associated with the SDS coefficients, and the impact of adjusting for the SDS variables on the measure results. Reasons for including the SDS variables in the risk-adjustment approach include (1) demonstration of the contribution of the SDS factor(s) to unique variation in the outcome that is not due to between-unit effects, (2) adjustment leads to substantial differences between measure scores (although this doesn't have to result in change in rankings), or (3) if needed for face validity of the approach.

Variables Used in the Empirical Analyses

1. Race: Categorized as Black and Non-Black
2. Medicaid enrollment/Dual Status (as proxy for low income): Categorized as Medicaid and Non-Medicaid.

The CMS/Yale Team explained that while the Committee recommended the use of the LIS variable in conjunction with the Medicated variable as a proxy for income, when they performed their analysis of the LIS data they chose not to use it as the patients captured with their current method to identify patients based on dual status alone sufficiently overlapped with those captured with the dual plus LIS variables.

Methods

For each measure/condition, the Yale team conducted the following analyses:

1. Determined the prevalence of the SDS variables for each condition across the measured entities.
2. Determined whether there is a bi-variate association between each of the SDS variables and the outcome.. [Bi-variate relationship]
3. Determined whether the inclusion of variables in the risk model improved the risk model's ability to account for variation in the data.
4. Determined whether the risk-standardized payment changed with the inclusion of the SDS variables (i.e., how much did the payment increase or decrease for the hospitals in the sample with the inclusion of the variables in the model?)
5. Determined whether and how much the ranking of hospitals shifted with the addition of the SDS variables.



Results

These measures estimate hospital-level, risk-standardized episode-of-care payment starting with inpatient admission to a short term acute-care facility and extending 30 days post-admission for Medicare fee-for-service (FFS) patients who are 65 years of age or older with a principal discharge diagnosis of AMI, HF or Pneumonia.

Level of Analysis: Facility **Costing Method:** Standardized pricing **Target Population:** Senior Care **Data Source:** Administrative Claims

	#2431: AMI	#2436: HF	#2579: Pneumonia
SUMMARY OF EMPIRICAL ANALYSIS & RESULTS:			
<i>Was there sufficient variation of the SDS variables within the sample to warrant additional analysis?</i>	Yes	Yes	Yes
<i>Was there bivariate association between the SDS variables and payment outcomes?</i>	Yes	Yes	Yes
<i>Was there a statistically significant relationship between the variables and payment outcomes after accounting for other clinical variables?</i>	Yes	Yes	Yes
<i>Did the risk model's ability to account for variation in payment improve with the addition of the variables?</i>	Minimal	Minimal	No
<i>Was there a change in the hospital payment with the inclusion of the variables?</i>	Black: Slightly lower payment Medicaid: Slightly lower payment	Black: Slightly lower payment Medicaid: Slightly higher payment	Black: Higher payment +\$287 Medicaid: Higher payment, +\$496

	#2431: AMI	#2436: HF	#2579: Pneumonia
<i>Did the ranking of hospital payments change with the inclusion of the variables in the risk model?</i>	No	No	No
DEVELOPER DECISION TO INCLUDE FACTORS IN THE MODEL:	Based on the results of the empirical analysis, the developers chose NOT to include the variables in the model. The developers cited the nominal impact of the SDS variables on the risk model performance and payment outcomes as their rationale not to change the measure.		
COMMITTEE RECOMMENDATIONS:	Validity: H-4; M-9; L-0; I-0 Recommendation for continued endorsement: Yes- 13; No-0	Validity: H-4; M-7; L-1; I-0 Recommendation for continued endorsement: Yes- 12; No-0	Validity: H-4; M-8; L-0; I-0 Recommendation for continued endorsement: Yes- 12; No-0



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Committee Discussion

Ultimately the Committee voted to continue endorsement of the measures without inclusion of SDS factors in the risk-adjustment approach. The empirical results do not suggest that accounting for black versus non-black race and Medicaid dual-eligibility status is needed when estimating facility-level episode-of-care payments for AMI, heart failure, or pneumonia.

The Committee discussed the minimal impact of the SDS variables on the payment outcomes. The episode of care captured by the measures extends 30 days after discharge for each of the conditions, capturing payments for any readmissions, admissions to skilled nursing facilities, and other post-acute activities within that timeframe. It is this post-acute timeframe that has been shown to have the most variation for these measures and is the time within the episode where patient-level SDS and community-level factors presumably exert the most influence on outcomes. Through dialogue with the developers, the Committee spent much of their discussion on these measures trying to understand why the results of the empirical analysis did not align with their expectations. In doing so, the Committee members and developers identified several important points for clarification in understanding the measures and what they capture, as well as some possible considerations for why the analysis yielded the results it did. These points are discussed below.

Measuring Hospital Payments

Diagnosis-related groups (DRGs) are a classification system used for grouping similar patients into groups based on several factors including diagnosis, procedures, age, sex, and comorbidities (e.g., AMI patients with X severity level are grouped into a DRG). These groups are then used to determine the amount Medicare pays a hospital based on estimates of the amount of resources that would be used to care for the patients within the group. Understanding the concept of DRGs is important to understanding what these payment measures are measuring, as they are based on standardized DRG hospital payments and therefore do not capture itemized costs for procedures or interventions during the hospital portion of the episode. In fact, these measures do not capture cost at all, as only payments are being measured. The Committee acknowledged that although there are differences between hospitals and in the resources available to them to manage patients and invest in quality improvement, the payments captured in the measure are standardized and are not necessarily a reflection of the resources that are available or utilized within a hospital to care for the patients. Further, even though these measures may be in use for public reporting and potentially other programs, risk adjustment for the examined SDS factors would only potentially address the “mismeasurement” issue and would not address the problem of uneven distribution of resources among hospitals in order to reduce disparities. This, as the Committee pointed out, is a payment policy issue, not a measurement issue.

The Committee also discussed how the distribution of payments across the episode might relate to the impact of the SDS variables on the payment outcomes. For example, in the AMI population, the CMS/Yale developers indicated that approximately 70 percent of the payment is

allocated for inpatient hospital charges (i.e., DRG-based payment). The remaining 30 percent of the payment covers the post-acute care phase of the episode, during which SDS factors are presumably most likely to exert an impact. Given the small proportion of the payment that is potentially impacted by SDS in the episode, the Committee acknowledged that this might be one reason for why any empirical differences might have been minimal. The proportion of the payment allocated for inpatient and post-acute segments of the episode varies among the three measures. In response to this concern, the developers explained that they had not performed analyses of the post-acute portion of the payment to determine whether the SDS factors had a greater impact; they focused their analysis on the entire episode rather than segments of the episode. The Committee noted that conducting this analysis might shed additional light on whether adjustment for the SDS factors during the post-acute phase would be more impactful.

Differences in the Empirical Results among the Measures

The CMS/Yale developers also offered some possible causes for the minimal impact on the empirical results. Initial analyses indicated variation in the number of procedures received by certain subpopulations with AMI, potentially reflecting poor quality care. For example, these analyses suggested that both Blacks and Medicaid patients received fewer procedures than non-Blacks and non-Medicaid patients, which could result in lower DRG payments. While this might explain why the payments were lower in the AMI measure for these variables, it might not explain those differences for the other two measures. Given that the literature indicated inconsistent relationships in utilization within certain populations, the developer also suggested that perhaps that both high and low payments for patients within these groups washes out any significant differences in the end. For the heart failure and pneumonia measures, the developer suggested that because these conditions are predominantly treated medically (with medications rather than surgery or major procedures) during the hospitalization, there is less variation in the DRG payments.

Relationship to Clinical Risk-Adjustment

When discussing the clinical risk-adjustment model, the developers pointed out that due to the homogeneity of the samples used for analysis, the effect of the clinical risk adjustment is less impactful. This was a major topic of discussion among the Committee members during their initial review of the measures, as the risk model predicted very little variation ($R^2 = 0.07$). The risk strategy was ultimately accepted by the Committee with further explanation from the developers on the composition of the sample and their approach. For this analysis of the impact of SDS, the SDS variables were added into a model that has already been extensively clinically adjusted for conditions present on admission. The CMS/Yale developers suggested that conditions present on admission might in fact be occurring due to differences in SDS that have impacted a patient's health. Thus the impact of SDS might indirectly be adjusted for in the clinical adjustment. This might also explain why the SDS variables had minimal impact.

Community-Level Adjustment

The Committee had an extensive discussion about the inclusion of community-level factors into the risk-adjustment model given the inclusion of a 30-day post discharge period in the episode. They acknowledged that for some of the post-hospitalization services, the community context is a critical variable. For example, if high quality nursing home care is available, or primary care physician services are available in the community, it makes a difference in outcomes and these

factors may or may not be fully captured by the patient-level SDS adjustment. In communities where a high proportion of the post-acute population is in need of these services, there may be less capacity to adequately care for them, suggesting that the neighborhood a hospital is in may also have an impact on payment outcomes. The developers expressed interest in potentially considering these factors in the model, but sought Committee input and recommendations on how to approach this.

Next Steps

Based on the NQF ad hoc review process, the results of this review will be posted for public and NQF member commenting, followed by review by the Consensus Standards Approval Committee (CSAC), review by the Board of Directors, and an appeals period. The initial review by CSAC will take place during their in person meeting on November 17-18, 2015. Once comments from the commenting period have been compiled, they will be submitted to CSAC for a final review during their January 12, 2016 call. The results and learnings of this project will also be shared with the Disparities Committee for discussion during their January meeting and as needed with other Standing Committee that are considering measures for SDS adjustment.