All-Cause Admissions and Readmissions Measures Follow-Up Web Meeting
January 26, 2015 [2-3:30 pm ET]

Table of Contents of Developer Responses

Measure Number 2375: PointRight® Pro 30™
AHCA Response on Trial Period
1-20-15

1. Describe the conceptual relationship between your outcome measure and possible SDS risk factors. Specifically, provide support from the literature or other empirical data on whether a conceptual relationship exists between at least one (1) specific SDS risk factor and the outcome being measured. Describe the possible risk factor(s) that exhibits the strongest relationship to admissions/readmissions. Possible SDS risk factors for examination may include income, level of education, homelessness status, English language proficiency, health insurance status, occupation, employment status, literacy, health literacy, or neighborhood-level data that can be used as a proxy for individual data such as median neighborhood income, education, or local funding availability for safety net providers.

   Information on many of the SDS risk factors is not available on skilled nursing facility (SNF) admissions. In addition, our measure looks at readmissions during the SNF stay not after discharge from the SNF back to the community. Also, our measure principally captures individuals over the age of 65. Thus, a number of the SDS variables would not be postulated to have an impact on readmission rates such as occupation, employment status, homelessness, etc. which impact a person's ability to receive care in the community but would not significantly impact either care delivery or decision making in the SNF. SDS risk factors such as ethnicity, English language proficiency or marital status may have a relationship with a SNF admission being sent back to a hospital. These may impact the communication with healthcare team about one's condition as well as decisions about the preferences of rehospitalization or not.

   The literature on ethnic disparities in care in SNFs is scarce overall, with only two articles focusing on ethnic differences in rehospitalization rates. A Medline search of racial disparities and SNFs only yields 37 articles of which a fifth address issues related to ethnic disparities in access to SNF services. Of the remaining articles most address disparities in long term care but not for residents receiving short post-acute care services. Two articles focus on ethnic disparities related to hospitalizations (Li, 2011; Grunier, 2008).

   In the first study using national MDS data from 2008, the authors found that the 30 day rehospitalization rates were 14.3% for white patients (n = 865,993) and 18.6% for black patients (n = 94,651). Both patient and admitting facility characteristics accounted for a considerable portion of overall racial disparities, but disparities persisted after multivariable adjustments overall and in patient subgroup (Li, 2011). However, this study did not compare within- facility and between-facility disparities. Within-facility disparities are those where disparities exist between Blacks and Whites in the same facilities and between-facility disparities are those where disparities exist between facilities with different racial composition (i.e. facilities with higher minority populations have poorer care quality than facilities with mostly white populations). Based on previous research related to racial disparities in SNFs, it is expected that disparities in rehospitalization would exist between facilities.

   In the second article, hospitalization rates for long stay residents on Medicaid were examined (short stay residents were not included) (Grunier, 2008). In this study, using MDS data to look at long stay residents, 18.5% of white and 24.1% of black residents were hospitalized. Residents in nursing homes with high concentrations of blacks had 20% higher odds (95 percent confidence interval [CI]=1.15-1.25) of hospitalization than residents in nursing homes with no blacks. Ten-dollar increments in Medicaid rates reduced the odds of hospitalization by 4 percent (95 percent CI=0.93-1.00) for white residents and 22 percent (95 percent CI=0.69-0.87) for black residents.

   Multiple studies in the past twenty years have examined racial disparities in the care of SNF residents and have consistently found poorer care in facilities with high minority populations (Fennell et al., 2000; Mor et al., 2004; Smith et al., 2007). Work on disparities in quality of care between elderly white and black residents within SNFs has shown clearly that nursing homes remain relatively segregated, and that nursing home care can be described as a tiered system in which blacks are concentrated in marginal-quality homes (Mor et al., 2004). Such homes tend to have serious deficiencies in staffing ratios, performance, and are more financially vulnerable (Smith et al, 2007; Chisholm et al., 2013). Based on a review of the SNF disparities literature, Konetzka and Werner (2009) concluded that disparities in care are likely related to racial and socioeconomic segregation as opposed to within-provider discrimination. This conclusion is supported, for example, by

Grunier and colleagues who found that as the proportion of black residents in the nursing home increased the risk of hospitalization among all residents, regardless of race, also increased (Grunier et al., 2008). Rehospitalization risk likely also increases as the proportion of black residents increases, indicating that the best measure of racial disparities in rates of rehospitalization is one that measures rehospitalization at the facility level.

2. Describe the relationship between the SDS risk factor(s) and the measured unit (hospital, SNF, etc.) to indicate the variation in the risk factor across the measured unit. Information from the literature is sufficient to indicate potential variation; however, empirical data for the measure as specified (e.g., via bivariate frequency distributions) would be needed to demonstrate that variation **does not** exist and therefore adjustment is not appropriate.

   The measure reflects the entire population of individuals admitted to a SNF followings hospitalization. It includes all ethnicities regardless of payer status. Nationally, three-quarters of all nursing home residents are classified as Caucasian. Stratifying the measure by ethnicity would result in most providers having inadequate sample size to report a rehospitalization rate. Also, the measure is an all cause readmission measure, intended to capture the overall performance of each SNF. Thus, we have not calculated the measure stratified by ethnicity as the volume on average is so low in each SNF to have a significant impact on an individual SNF's results. However, certain ethnicities do cluster in SNFs, particularly inner city poor quality SNFs raising the question as to whether ethnicity should be risk adjusted or will it adjust for poor quality providers who happen to more likely care for individuals with particular SDS risk factors.

   Only Medicaid and Medicare status are available. We do currently adjust for Medicare as the primary payor. Data on specific insurance status is not available on MDS. Thus, we have not calculated the measure stratified by payer status.

   Data on other potential SDS such as English language proficiency or marital status is not included in our risk adjustment model.

3. In your view, should the measure enter the trial period? Note: Final decision will be made by the standing committee.

   While there appears to be differences in rehospitalization rates by ethnicity in the literature, these differences appear to be related to differences in the quality of SNFs and the clustering of different ethnicities with poor quality SNFs. Thus, risk adjusting for ethnicity may have the unintended effect of adjusting for poor quality providers. However, this finding has not been extensively tested. In addition, other ethnicities have not been evaluated in the literature. Other SDS variables are not available for the SNF population. The prevalence for many of these SDS variables are very low and do not cluster in SNFs. Thus, it is not clear if risk adjustment at a provider level will have any impact. That all said, given the paucity of empiric data, we believe our measure should enter the trial period with empiric testing for including SDS in the risk adjustment model.

Relationship Between Pediatric Hospital Readmissions and Sociodemographic Status

Question 1. *Describe the conceptual relationship between your outcome measure and possible SDS risk factors. Specifically, provide support from the literature or other empirical data on whether a conceptual relationship exists between at least one (1) specific SDS risk factor and the outcome being measured. Describe the possible risk factor(s) that exhibits the strongest relationship to admissions/readmissions. Possible SDS risk factors for examination may include income, level of education, homelessness status, English language proficiency, health insurance status, occupation, employment status, literacy, health literacy, or neighborhood-level data that can be used as a proxy for individual data such as median neighborhood income, education, or local funding availability for safety net providers.*

Multiple factors within and outside of health systems contribute to a patient's health status after hospital discharge and thus influence the risk of readmission.[1–3] An important set of factors consists of patients' and families' social and economic conditions, which comprise both individual resources and community resources such as access to transportation and paid family leave.[3–8] Sociodemographic status (SDS) can affect health directly, as well as indirectly by having an impact on self-management, adherence to recommendations, and access to care.[9–11] Nearly 21% of children live in poverty—a rate almost double that for adults—making effects of SDS on health especially relevant to pediatrics.[12]

To examine the impact of SDS on pediatric all-condition hospital readmissions, we evaluated the relationship between readmission risk and insurance status.

Evidence in the Literature

We chose to focus on insurance status because multiple studies in the literature have demonstrated that public insurance is associated with higher pediatric readmission rates.[13–18] For example, an analysis of community (non-children's) hospitals in the 2007 AHRQ Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases for Arizona, Nebraska, and South Carolina found that the unadjusted 30-day all-condition readmission rate for pediatric Medicaid beneficiaries (ages 0 to 20 years old, including newborns but excluding obstetric patients) was 3.1%, compared with 2.0% for privately insured children ($p < 0.05$).[17] Within the full sample of Medicaid-insured adult and pediatric patients, readmission rates were higher than for privately insured patients except for the subcategory of 13- to 20-year-old females admitted for obstetric care.[17]

Readmissions at children's hospitals are likewise more frequent in publicly insured children than in patients with other insurance statuses. A study of recurrent all-condition readmissions at 37 freestanding children's hospitals found that as a patient's annual readmission frequency increased from 0 to ≥ 4 readmissions, the rate at which patients were publicly insured correspondingly increased from 40.9% (0 readmissions) to 56.3% (≥ 4 readmissions) ($p < .001$).[16] Public (versus commercial) insurance remained significantly associated with readmission risk in multivariate analysis (odds ratio (OR) 1.36, 95% CI 1.33-1.40).[16] Similarly, in an analysis of all-condition readmissions at 72 freestanding and non-freestanding children's hospitals, the unadjusted readmission rate was highest for publicly insured patients (6.9%), followed by those who had other insurance (6.2%), private insurance (5.9%), and no insurance (4.5%) ($p < .001$).[19] Public (versus private) insurance was a significant risk factor for readmission in multivariate analysis (OR 1.12, 95% CI 1.09-1.15).[19]

Given their higher risk of readmission, publicly insured children are a vulnerable population for whom targeted interventions to reduce readmissions are critical. The percentage of pediatric hospitalizations for which Medicaid is the primary payer is substantial and increasing: Medicaid is the single largest payer for hospitalized children and accounted for 44% of pediatric admissions in 2007, up from 36% in 2000.[20,21]

Interventions that reduce hospital readmissions by improving hospital discharge, transition and post-discharge care as well as disease management should be beneficial to all patients, including those insured by Medicaid. Interventions that specifically address the complex needs of Medicaid-insured patients, such as limited resources for healthcare and barriers to accessing care, may be particularly effective in reducing readmission rates in this group. Successful interventions to prevent readmissions in Medicaid-insured patients are described in the literature.

The Care Transitions Innovation (C-TraIn) is a low-cost, multi-component transitional care intervention that has decreased readmission rates in uninsured and Medicaid-insured adult populations.[22] The intervention helps remove financial barriers to care by providing inpatient pharmacy consultation, a 30-day supply of medications for use after discharge, payment for medical homes for uninsured patients who lack access to outpatient care, and access to a transitional care nurse to bridge care between the inpatient and outpatient settings. This low-cost intervention illustrates how investing a relatively small amount of resources upfront could potentially avert the much greater cost of hospital readmission.

North Carolina has demonstrated that interventions implemented via a Medicaid program can be highly effective in reducing readmissions. Its state-wide initiative focused on comprehensive transitional care for Medicaid beneficiaries of any age with complex chronic medical conditions, with the intensity of the intervention tailored to patients' readmission risk.[23] Patients who received the intervention were 20% less likely to experience a readmission during the subsequent year than clinically similar patients who received routine care. Additionally, patients who received the transitional care were less likely than routine-care patients to experience multiple readmissions. These findings suggest that transitional care interventions targeted to address the particular needs of Medicaid-insured patients can reduce hospital readmissions among this high-risk population. The Pediatric All-Condition Readmission Measure could be used to track the impact of similar interventions in Medicaid-insured children.

Empirical Data

We assessed disparities in readmission risk associated with insurance status using our Pediatric All-Condition Readmission Measure. We performed this analysis for community and children's hospitals in 2005-2009 AHRQ HCUP State Inpatient Databases with Revisit Data for New York and Nebraska. We found that compared with Medicaid-insured patients, the odds of readmission were significantly lower for those who had private insurance, other types of insurance (such as Medicare or other government-sponsored insurance), or self-pay status ($p < 0.001$ for each comparison). Medicaid insurance was a risk factor independent of patient age, gender, and chronic conditions and of index admission hospital.

Multivariate Analysis of Disparities in Readmission Risk Based on Insurance Status

Insurance Status	**Odds Ratio [95% Confidence Interval][a]**
Medicaid	Reference
Private insurance	0.76 [0.75 - 0.78]
Self-pay	0.73 [0.69 - 0.78]
Other (e.g., Medicare or other government-sponsored insurance)	0.85 [0.78 - 0.92]

[a]Multivariate model adjusted for patient age, gender, and chronic conditions and for index admission hospital.

Relationship Between Pediatric Hospital Readmissions and Sociodemographic Status

Using the same data, we also evaluated whether a given hospital's readmission performance tends to correlate among patients with different insurance statuses. We fitted the measure case-mix model, adding a random slope indicator variable for Medicaid, private insurance, and self-pay statuses (we were unable to include an indicator variable for other types of insurance because the model would not converge, perhaps due to low numbers of observations in this category at some hospitals). We found that the regression coefficients were highly correlated among different insurance statuses. Correlations were 0.84 for Medicaid and self-pay, 0.92 for Medicaid and private insurance, and 0.90 for private insurance and self-pay. This finding indicates that readmission rates tend to vary in parallel for all insurance categories, which suggests that a hospital's adjusted readmission rate is a valid measure of performance (relative to other hospitals) for children with all insurance statuses.

Question 2. *Describe the relationship between the SDS risk factor(s) and the measured unit (hospital, SNF, etc.) to indicate the variation in the risk factor across the measured unit. Information from the literature is sufficient to indicate potential variation; however, empirical data for the measure as specified (e.g., via bivariate frequency distributions) would be needed to demonstrate that variation* ***does not*** *exist and therefore adjustment is not appropriate.*

The percentage of admissions that are for Medicaid-insured patients varies across hospitals and is substantially greater in some hospitals than others.[24] We found in 2005-2009 AHRQ HCUP State Inpatient Databases with Revisit Data for New York and Nebraska that the overall percentage of pediatric all-condition index hospitalizations at community and children's hospitals for which Medicaid was the primary payer was 47.7%. Because hospitals with very low pediatric volume might be outliers, we did not rely on observed sample hospital-level percentages to assess variation across hospitals. We instead estimated a random effects logistic regression to model the distribution of Medicaid rates at the hospital level. We found that the mean percentage of Medicaid hospitalizations was 41.8%; the percentage was 59.6% for hospitals 1 standard deviation above the mean and 26.0% for hospitals 1 standard deviation below the mean.

Question 3. *In your view, should the measure enter the trial period? Note: Final decision will be made by the standing committee.*

Yes, based on the relationship between insurance status and pediatric hospital readmissions and the variation in insurance status across hospitals, the Pediatric All-Condition Readmission Measure should enter the trial period.

References

1. Nakamura MM, Toomey SL, Zaslavsky AM, Berry JG, Lorch SA, Jha AK, Bryant MC, Geanacopoulos AT, Loren SS, Pain D, Schuster MA. Measuring pediatric hospital readmission rates to drive quality improvement. *Acad. Pediatr.* 2014;14(5):S39-S46. doi:10.1016/j.acap.2014.06.012.

2. Ashton CM, Wray NP. A conceptual framework for the study of early readmission as an indicator of quality of care. *Soc. Sci. Med. 1982* 1996;43(11):1533-1541.

3. Kangovi S, Grande D. Hospital readmissions--not just a measure of quality. *JAMA J. Am. Med. Assoc.* 2011;306(16):1796-1797. doi:10.1001/jama.2011.1562.

4. McCarthy D, Johnson M, Audet A. Recasting readmissions by placing the hospital role in community context. *JAMA* 2013;309(4):351-352. doi:10.1001/jama.2013.1.

5. Srivastava R, Keren R. Pediatric readmissions as a hospital quality measure. *JAMA* 2013;309(4):396-398. doi:10.1001/jama.2012.217006.

6. Chung PJ, Lui CK, Cowgill BO, Hoffman G, Elijah J, Schuster MA. Employment, family leave, and parents of newborns or seriously ill children. *Acad. Pediatr.* 2012;12(3):181-188. doi:10.1016/j.acap.2012.02.001.

7. Schuster MA, Chung PJ, Elliott MN, Garfield CF, Vestal KD, Klein DJ. Awareness and use of California's Paid Family Leave Insurance among parents of chronically ill children. *JAMA J. Am. Med. Assoc.* 2008;300(9):1047-1055. doi:10.1001/jama.300.9.1047.

8. Riese J, McCulloh RJ, Koehn KL, Alverson BK. Demographic factors associated with bronchiolitis readmission. *Hosp. Pediatr.* 2014;4(3):147-152. doi:10.1542/hpeds.2013-0078.

9. Weissman JS, Stern RS, Epstein AM. The impact of patient socioeconomic status and other social factors on readmission: a prospective study in four Massachusetts hospitals. *Inq. J. Med. Care Organ. Provis. Financ.* 1994;31(2):163-172.

10. Kangovi S, Barg FK, Carter T, Long JA, Shannon R, Grande D. Understanding why patients of low socioeconomic status prefer hospitals over ambulatory care. *Health Aff. (Millwood)* 2013;32(7):1196-1203. doi:10.1377/hlthaff.2012.0825.

11. Colvin JD, Zaniletti I, Fieldston ES, Gottlieb LM, Raphael JL, Hall M, Cowden JD, Shah SS. Socioeconomic status and in-hospital pediatric mortality. *Pediatrics* 2013;131(1):e182-e190. doi:10.1542/peds.2012-1215.

12. Betson DM, Michael RT. Why so many children are poor. *Future Child. Cent. Future Child. David Lucile Packard Found.* 1997;7(2):25-39.

13. Brousseau DC, Owens PL, Mosso AL, Panepinto JA, Steiner CA. Acute care utilization and rehospitalizations for sickle cell disease. *JAMA* 2010;303(13):1288-1294. doi:10.1001/jama.2010.378.

14. Rice-Townsend S, Hall M, Barnes JN, Lipsitz S, Rangel SJ. Variation in risk-adjusted hospital readmission after treatment of appendicitis at 38 children's hospitals: an opportunity for collaborative quality improvement. *Ann. Surg.* 2013;257(4):758-765. doi:10.1097/SLA.0b013e318268a663.

15. Liu SY, Pearlman DN. Hospital readmissions for childhood asthma: the role of individual and neighborhood factors. *Public Health Rep.* 2009;124(1):65-78.

16. Berry JG, Hall DE, Kuo DZ, Cohen E, Agrawal R, Feudtner C, Hall M, Kueser J, Kaplan W, Neff J. Hospital utilization and characteristics of patients experiencing recurrent readmissions within children's hospitals. *JAMA* 2011;305(7):682-690. doi:10.1001/jama.2011.122.

17. Jiang HJ, Wier LM. All-cause hospital readmissions among non-elderly Medicaid patients, 2007: statistical brief #89. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Health Care Policy and Research (US); 2010. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb89.jsp. Accessed October 23, 2013.

18. Gay JC, Hain PD, Grantham JA, Saville BR. Epidemiology of 15-day readmissions to a children's hospital. *Pediatrics* 2011;127(6):e1505-1512. doi:10.1542/peds.2010-1737.

19. Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, Feng JY, Shulman S, Chiang VK, Kaplan W, Hall M, Schuster MA. Pediatric readmission prevalence and variability across hospitals. *JAMA* 2013;309(4):372-380. doi:10.1001/jama.2012.188351.

20. Smith RB, Dynan L, Fairbrother G, Chabi G, Simpson L. Medicaid, hospital financial stress, and the incidence of adverse medical events for children. *Health Serv. Res.* 2012;47(4):1621-1641. doi:10.1111/j.1475-6773.2012.01385.x.

21. Friedman B, Berdahl T, Simpson LA, McCormick MC, Owens PL, Andrews R, Romano PS. Annual Report on Health Care for Children and Youth in the United States: Focus on Trends in Hospital Use and Quality. *Acad. Pediatr.* 2011;11(4):263-279. doi:10.1016/j.acap.2011.04.002.

22. Englander H, Kansagara D. Planning and designing the care transitions innovation (C-Train) for uninsured and Medicaid patients. *J. Hosp. Med.* 2012;7(7):524-529. doi:10.1002/jhm.1926.

23. Jackson CT, Trygstad TK, Dewalt DA, Dubard CA. Transitional care cut hospital readmissions for North Carolina Medicaid patients with complex chronic conditions. *Health Aff. (Millwood)* 2013;32(8):1407-1415. doi:10.1377/hlthaff.2013.0047.

24. Dynan L, Goudie A, Smith RB, Fairbrother G, Simpson LA. Differences in quality of care among non-safety-net, safety-net, and children's hospitals. *Pediatrics* 2013;131(2):304-311. doi:10.1542/peds.2012-1089.

Relationship Between Pediatric Hospital Readmissions and Sociodemographic Status

Question 1. *Describe the conceptual relationship between your outcome measure and possible SDS risk factors. Specifically, provide support from the literature or other empirical data on whether a conceptual relationship exists between at least one (1) specific SDS risk factor and the outcome being measured. Describe the possible risk factor(s) that exhibits the strongest relationship to admissions/readmissions. Possible SDS risk factors for examination may include income, level of education, homelessness status, English language proficiency, health insurance status, occupation, employment status, literacy, health literacy, or neighborhood-level data that can be used as a proxy for individual data such as median neighborhood income, education, or local funding availability for safety net providers.*

Multiple factors within and outside of health systems contribute to a patient's health status after hospital discharge and thus influence the risk of readmission.[1–3] An important set of factors consists of patients' and families' social and economic conditions, which comprise both individual resources and community resources such as access to transportation and paid family leave.[3–8] Sociodemographic status (SDS) can affect health directly, as well as indirectly by having an impact on self-management, adherence to recommendations, and access to care.[9–11] Nearly 21% of children live in poverty—a rate almost double that for adults—making effects of SDS on health especially relevant to pediatrics.[12]

To examine the impact of SDS on pediatric lower respiratory infection hospital readmissions, we evaluated the relationship between readmission risk and insurance status.

Evidence in the Literature

We chose to focus on insurance status because multiple studies in the literature have demonstrated that public insurance is associated with higher pediatric readmission rates.[13–18] For example, an analysis of community (non-children's) hospitals in the 2007 AHRQ Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases for Arizona, Nebraska, and South Carolina found that the unadjusted 30-day all-condition readmission rate for pediatric Medicaid beneficiaries (ages 0 to 20 years old, including newborns but excluding obstetric patients) was 3.1%, compared with 2.0% for privately insured children ($p < 0.05$).[17] Within the full sample of Medicaid-insured adult and pediatric patients, readmission rates were higher than for privately insured patients except for the subcategory of 13- to 20-year-old females admitted for obstetric care.[17]

Readmissions at children's hospitals are likewise more frequent in publicly insured children than in patients with other insurance statuses. A study of recurrent all-condition readmissions at 37 freestanding children's hospitals found that as a patient's annual readmission frequency increased from 0 to ≥ 4 readmissions, the rate at which patients were publicly insured correspondingly increased from 40.9% (0 readmissions) to 56.3% (≥ 4 readmissions) ($p < .001$).[16] Public (versus commercial) insurance remained significantly associated with readmission risk in multivariate analysis (odds ratio (OR) 1.36, 95% CI 1.33-1.40).[16] Similarly, in an analysis of all-condition readmissions at 72 freestanding and non-freestanding children's hospitals, the unadjusted readmission rate was highest for publicly insured patients (6.9%), followed by those who had other insurance (6.2%), private insurance (5.9%), and no insurance (4.5%) ($p < .001$).[19] Public (versus private) insurance was a significant risk factor for readmission in multivariate analysis (OR 1.12, 95% CI 1.09-1.15).[19]

Studies assessing the relationship between readmission risk and insurance status that focus specifically on lower respiratory hospitalizations are still relatively few. An analysis of readmissions after hospitalization for pneumonia at 43 freestanding children's hospitals found no relationship between readmission risk and insurance status.[20] In contrast, a study using 2008-2010 HCUP State Inpatient Databases for 6 states to examine readmissions in children

with respiratory illnesses (defined as asthma, pneumonia, and bronchiolitis) determined that readmission risk was associated with insurance status ($p < .001$).[21]

Given their higher risk of readmission, publicly insured children are a vulnerable population for whom targeted interventions to reduce readmissions are critical. The percentage of pediatric hospitalizations for which Medicaid is the primary payer is substantial and increasing: Medicaid is the single largest payer for hospitalized children and accounted for 44% of pediatric admissions in 2007, up from 36% in 2000.[22,23]

Interventions that reduce hospital readmissions by improving hospital discharge, transition and post-discharge care as well as disease management should be beneficial to all patients, including those insured by Medicaid. Interventions that specifically address the complex needs of Medicaid-insured patients, such as limited resources for healthcare and barriers to accessing care, may be particularly effective in reducing readmission rates in this group. Successful interventions to prevent readmissions in Medicaid-insured patients are described in the literature.

The Care Transitions Innovation (C-TraIn) is a low-cost, multi-component transitional care intervention that has decreased readmission rates in uninsured and Medicaid-insured adult populations.[24] The intervention helps remove financial barriers to care by providing inpatient pharmacy consultation, a 30-day supply of medications for use after discharge, payment for medical homes for uninsured patients who lack access to outpatient care, and access to a transitional care nurse to bridge care between the inpatient and outpatient settings. This low-cost intervention illustrates how investing a relatively small amount of resources upfront could potentially avert the much greater cost of hospital readmission.

North Carolina has demonstrated that interventions implemented via a Medicaid program can be highly effective in reducing readmissions. Its state-wide initiative focused on comprehensive transitional care for Medicaid beneficiaries of any age with complex chronic medical conditions, with the intensity of the intervention tailored to patients' readmission risk.[25] Patients who received the intervention were 20% less likely to experience a readmission during the subsequent year than clinically similar patients who received routine care. Additionally, patients who received the transitional care were less likely than routine-care patients to experience multiple readmissions. These findings suggest that transitional care interventions targeted to address the particular needs of Medicaid-insured patients can reduce hospital readmissions among this high-risk population. The Pediatric Lower Respiratory Infection Readmission Measure could be used to track the impact of similar interventions in Medicaid-insured children.

Empirical Data

We assessed disparities in readmission risk associated with insurance status using our Pediatric Lower Respiratory Infection Readmission Measure. We performed this analysis for community and children's hospitals in 2005-2009 AHRQ HCUP State Inpatient Databases with Revisit Data for New York and Nebraska. We found that compared with Medicaid-insured patients, the odds of readmission were significantly lower for those who had private insurance, other types of insurance (such as Medicare or other government-sponsored insurance), or self-pay status ($p < 0.001$ for each comparison). Medicaid insurance was a risk factor independent of patient age, gender, and chronic conditions and of index admission hospital.

Multivariate Analysis of Disparities in Readmission Risk Based on Insurance Status

Insurance Status	Odds Ratio [95% Confidence Interval][a]
Medicaid	Reference
Private insurance	0.79 [0.73 - 0.85]

Self-pay	0.75 [0.64 - 0.88]
Other (e.g., Medicare or other government-sponsored insurance)	0.71 [0.53 - 0.94]

[a]Multivariate model adjusted for patient age, gender, and chronic conditions and for index admission hospital.

Using the same data, we also evaluated whether a given hospital's readmission performance tends to correlate among patients with different insurance statuses. We fitted the measure case-mix model, adding a random slope indicator variable for each insurance status. We found that the regression coefficients were highly correlated for Medicaid and private insurance (correlation = 0.91) and for Medicaid and other insurance types (correlation = 0.85); for self-pay and private insurance (correlation = 0.82) and for self-pay and other insurance types (correlation = 0.88); and for private insurance and other insurance types (correlation = 0.99). However, the regression coefficients were only moderately correlated for Medicaid and self-pay (correlation = 0.51), suggesting that readmission performance for patients with these 2 insurance statuses tends not to be parallel within hospitals.

Question 2. *Describe the relationship between the SDS risk factor(s) and the measured unit (hospital, SNF, etc.) to indicate the variation in the risk factor across the measured unit. Information from the literature is sufficient to indicate potential variation; however, empirical data for the measure as specified (e.g., via bivariate frequency distributions) would be needed to demonstrate that variation* ***does not*** *exist and therefore adjustment is not appropriate.*

The percentage of admissions that are for Medicaid-insured patients varies across hospitals and is substantially greater in some hospitals than others.[26] We found in 2005-2009 AHRQ HCUP State Inpatient Databases with Revisit Data for New York and Nebraska that the overall percentage of pediatric lower respiratory infection index hospitalizations at community and children's hospitals for which Medicaid was the primary payer was 55.1%. Because hospitals with very low pediatric volume might be outliers, we did not rely on observed sample hospital-level percentages to assess variation across hospitals. We instead estimated a random effects logistic regression to model the distribution of Medicaid rates at the hospital level. We found that the mean percentage of Medicaid hospitalizations was 51.7%; the percentage was 69.5% for hospitals 1 standard deviation above the mean and 33.5% for hospitals 1 standard deviation below the mean

Question 3. *In your view, should the measure enter the trial period? Note: Final decision will be made by the standing committee.*

Yes, based on the relationship between insurance status and pediatric hospital readmissions and the variation in insurance status across hospitals, the Pediatric Lower Respiratory Infection Readmission Measure should enter the trial period.

References

1. Nakamura MM, Toomey SL, Zaslavsky AM, Berry JG, Lorch SA, Jha AK, Bryant MC, Geanacopoulos AT, Loren SS, Pain D, Schuster MA. Measuring pediatric hospital readmission rates to drive quality improvement. *Acad. Pediatr.* 2014;14(5):S39-S46. doi:10.1016/j.acap.2014.06.012.

2. Ashton CM, Wray NP. A conceptual framework for the study of early readmission as an indicator of quality of care. *Soc. Sci. Med. 1982* 1996;43(11):1533-1541.

3. Kangovi S, Grande D. Hospital readmissions--not just a measure of quality. *JAMA J. Am. Med. Assoc.* 2011;306(16):1796-1797. doi:10.1001/jama.2011.1562.

4. McCarthy D, Johnson M, Audet A. Recasting readmissions by placing the hospital role in community context. *JAMA* 2013;309(4):351-352. doi:10.1001/jama.2013.1.

5. Srivastava R, Keren R. Pediatric readmissions as a hospital quality measure. *JAMA* 2013;309(4):396-398. doi:10.1001/jama.2012.217006.

6. Chung PJ, Lui CK, Cowgill BO, Hoffman G, Elijah J, Schuster MA. Employment, family leave, and parents of newborns or seriously ill children. *Acad. Pediatr.* 2012;12(3):181-188. doi:10.1016/j.acap.2012.02.001.

7. Schuster MA, Chung PJ, Elliott MN, Garfield CF, Vestal KD, Klein DJ. Awareness and use of California's Paid Family Leave Insurance among parents of chronically ill children. *JAMA J. Am. Med. Assoc.* 2008;300(9):1047-1055. doi:10.1001/jama.300.9.1047.

8. Riese J, McCulloh RJ, Koehn KL, Alverson BK. Demographic factors associated with bronchiolitis readmission. *Hosp. Pediatr.* 2014;4(3):147-152. doi:10.1542/hpeds.2013-0078.

9. Weissman JS, Stern RS, Epstein AM. The impact of patient socioeconomic status and other social factors on readmission: a prospective study in four Massachusetts hospitals. *Inq. J. Med. Care Organ. Provis. Financ.* 1994;31(2):163-172.

10. Kangovi S, Barg FK, Carter T, Long JA, Shannon R, Grande D. Understanding why patients of low socioeconomic status prefer hospitals over ambulatory care. *Health Aff. (Millwood)* 2013;32(7):1196-1203. doi:10.1377/hlthaff.2012.0825.

11. Colvin JD, Zaniletti I, Fieldston ES, Gottlieb LM, Raphael JL, Hall M, Cowden JD, Shah SS. Socioeconomic status and in-hospital pediatric mortality. *Pediatrics* 2013;131(1):e182-e190. doi:10.1542/peds.2012-1215.

12. Betson DM, Michael RT. Why so many children are poor. *Future Child. Cent. Future Child. David Lucile Packard Found.* 1997;7(2):25-39.

13. Brousseau DC, Owens PL, Mosso AL, Panepinto JA, Steiner CA. Acute care utilization and rehospitalizations for sickle cell disease. *JAMA* 2010;303(13):1288-1294. doi:10.1001/jama.2010.378.

14. Rice-Townsend S, Hall M, Barnes JN, Lipsitz S, Rangel SJ. Variation in risk-adjusted hospital readmission after treatment of appendicitis at 38 children's hospitals: an opportunity for collaborative quality improvement. *Ann. Surg.* 2013;257(4):758-765. doi:10.1097/SLA.0b013e318268a663.

15. Liu SY, Pearlman DN. Hospital readmissions for childhood asthma: the role of individual and neighborhood factors. *Public Health Rep.* 2009;124(1):65-78.

16. Berry JG, Hall DE, Kuo DZ, Cohen E, Agrawal R, Feudtner C, Hall M, Kueser J, Kaplan W, Neff J. Hospital utilization and characteristics of patients experiencing recurrent readmissions within children's hospitals. *JAMA* 2011;305(7):682-690. doi:10.1001/jama.2011.122.

17. Jiang HJ, Wier LM. All-cause hospital readmissions among non-elderly Medicaid patients, 2007: statistical brief #89. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Health Care Policy and Research (US); 2010. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb89.jsp. Accessed October 23, 2013.

18. Gay JC, Hain PD, Grantham JA, Saville BR. Epidemiology of 15-day readmissions to a children's hospital. *Pediatrics* 2011;127(6):e1505-1512. doi:10.1542/peds.2010-1737.

19. Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, Feng JY, Shulman S, Chiang VK, Kaplan W, Hall M, Schuster MA. Pediatric readmission prevalence and variability across hospitals. *JAMA* 2013;309(4):372-380. doi:10.1001/jama.2012.188351.

20. Neuman MI, Hall M, Gay JC, Blaschke AJ, Williams DJ, Parikh K, Hersh AL, Brogan TV, Gerber JS, Grijalva CG, Shah SS. Readmissions among children hospitalized with pneumonia. 2014.

21. Bardach NS, Vittinghoff E, Berry JG, Asteria-Penaloza R, Dudley RA. Is there meaningful hospital performance variation in readmissions or revisits for children with respiratory illnesses? 2014. Available at: http://www.abstracts2view.com/pas/view.php?nu=PAS14L1_1440.7. Accessed June 26, 2014.

22. Smith RB, Dynan L, Fairbrother G, Chabi G, Simpson L. Medicaid, hospital financial stress, and the incidence of adverse medical events for children. *Health Serv. Res.* 2012;47(4):1621-1641. doi:10.1111/j.1475-6773.2012.01385.x.

23. Friedman B, Berdahl T, Simpson LA, McCormick MC, Owens PL, Andrews R, Romano PS. Annual Report on Health Care for Children and Youth in the United States: Focus on Trends in Hospital Use and Quality. *Acad. Pediatr.* 2011;11(4):263-279. doi:10.1016/j.acap.2011.04.002.

24. Englander H, Kansagara D. Planning and designing the care transitions innovation (C-Train) for uninsured and Medicaid patients. *J. Hosp. Med.* 2012;7(7):524-529. doi:10.1002/jhm.1926.

25. Jackson CT, Trygstad TK, Dewalt DA, Dubard CA. Transitional care cut hospital readmissions for North Carolina Medicaid patients with complex chronic conditions. *Health Aff. (Millwood)* 2013;32(8):1407-1415. doi:10.1377/hlthaff.2013.0047.

26. Dynan L, Goudie A, Smith RB, Fairbrother G, Simpson LA. Differences in quality of care among non-safety-net, safety-net, and children's hospitals. *Pediatrics* 2013;131(2):304-311. doi:10.1542/peds.2012-1089.

Examining the Relationship between Socio-demographic Status (SDS) and Standardized Readmission Ratio (SRR)

Introduction

Standardized Readmission Ratio, as a systematic measure of the rate of unplanned readmissions at dialysis facilities, can help to improve coordinated care and provide cost-effective health care for the end stage renal patients. There has been increasing interest in exploring the relation of hospital readmissions for dialysis patients with patient characteristics such as income, education, insurance status, race and employment status. However, many existing studies of this set of relationships were conducted in other health care situations, such as in nursing homes and hospitals. In addition, much of the work on socio-demographic (SDS) factors and readmissions has been done at the geographic level, as opposed to the individual patient level.

For example, Philbin et al. (2001) found substantially higher risks of readmission for persons residing in low income ZIP codes. These results held after controlling for comorbidities, location of care, and a fairly full set of other SDS characteristics, including age, sex, race and insurance, as measured at the ZIP code level. All SDS characteristics in the model were also associated with odds of readmission.

Foster et al. (2014) applied the Community Need Index (CNI) developed by Truven Health Analytics to analyze variation in all-cause hospital readmission, with and without adjustment for socioeconomic (SES) characteristics and race. The CNI is calculated at the ZIP code level and reflects potential barriers to effective health care, including income, ethnicity, education, insurance and housing quality. The results show that standardizing for SES characteristics and race reduces the variation in readmission across hospitals, potentially resulting in a fairer comparison of readmission rates.

Singh has developed the Area Deprivation Index (ADI) with colleagues at the University of Wisconsin. Like the CNI, the ADI reflects a full set of SES and demographic characteristics, measured at the ZIP code level. Singh (2003) has applied the index in a variety of contexts, including analysis of county-level mortality rates. He found area differences in mortality associated with low SDS. Over the period studied, mortality differences widened because of slower mortality reductions in more deprived areas. Very recently, the ADI has been applied to the calculation of risk-adjusted rates of hospital readmission.

All the aforementioned studies have provided evidence that, at least at a conceptual level, patient SDS characteristics may affect the likelihood of hospital readmission among dialysis patients. To further explore such hypothesis, we have conducted some preliminary analyses of the relationships between some SDS characteristics and the Standardized Readmission Ratio (SRR) for dialysis facilities, leveraging the national ESRD database with more than 600,000 patients from 6,000+ facilities.

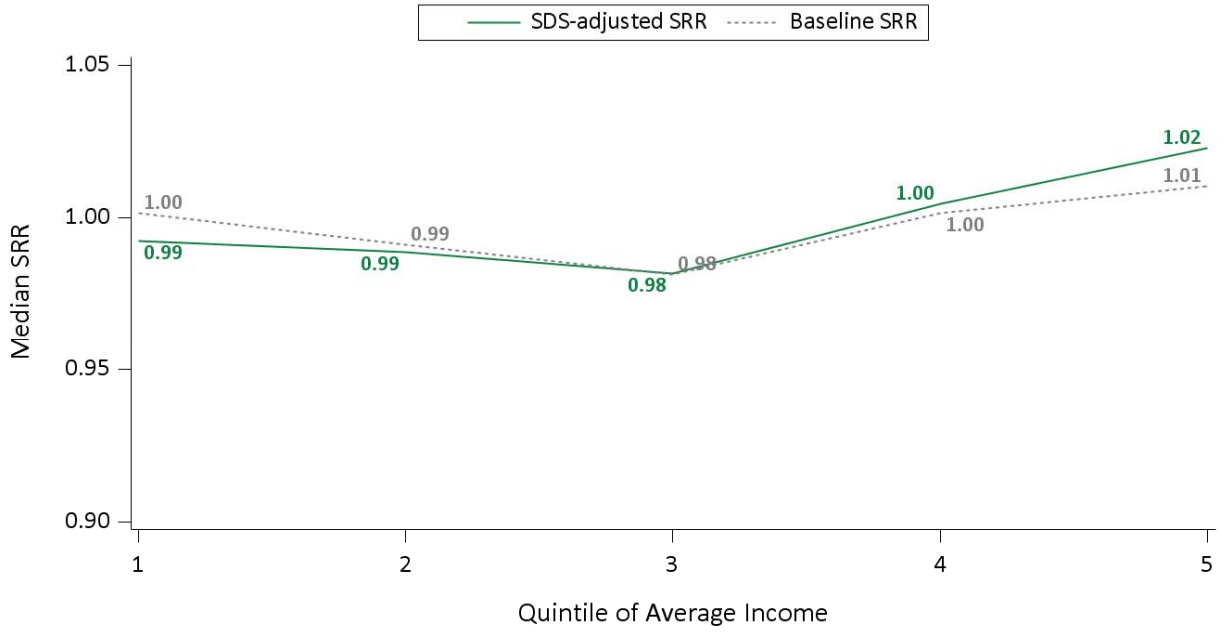
Relationship between patients' estimated income and SRR

As a proxy for patients' estimated income, we used the median income for each discharged patient's ZIP code of residence on the discharge date. In the model, income was categorized by quartiles. The estimated odds ratio of readmission was found to decrease slightly but steadily as the estimated income level increases. Compared with the first quartile (i.e., the lowest income level), the odds ratios were 0.995 ($p>>0.05$), 0.975 ($p<0.01$) and 0.95 ($p<0.001$) for quartiles 2, 3 and 4, respectively. Thus, there is

some indication that patients who come from ZIP codes with higher incomes have somewhat lower readmission rates than those with lower incomes, although the effect is fairly modest.

In Figure 1, we compare the SRRs computed with and without adjustment of patients SDS and also plot the observed median SRR (with and without SDS-adjustment) for facilities divided into quintiles according to the facility average income of hospitalized patients in the facility. First, we note the SDS-adjusted and non-SDS-adjusted SRRs are very comparable. Second, there does not seem to exist a systematic change of SRRs over the range of average incomes in the population, suggesting that there is no clear evidence that patients with lower economic status would tend to go to facilities with poorer (or better) readmission rates.

Figure 1: Facility SRR, by Average Income, 2012



Source: American Community Survey 5-year file.

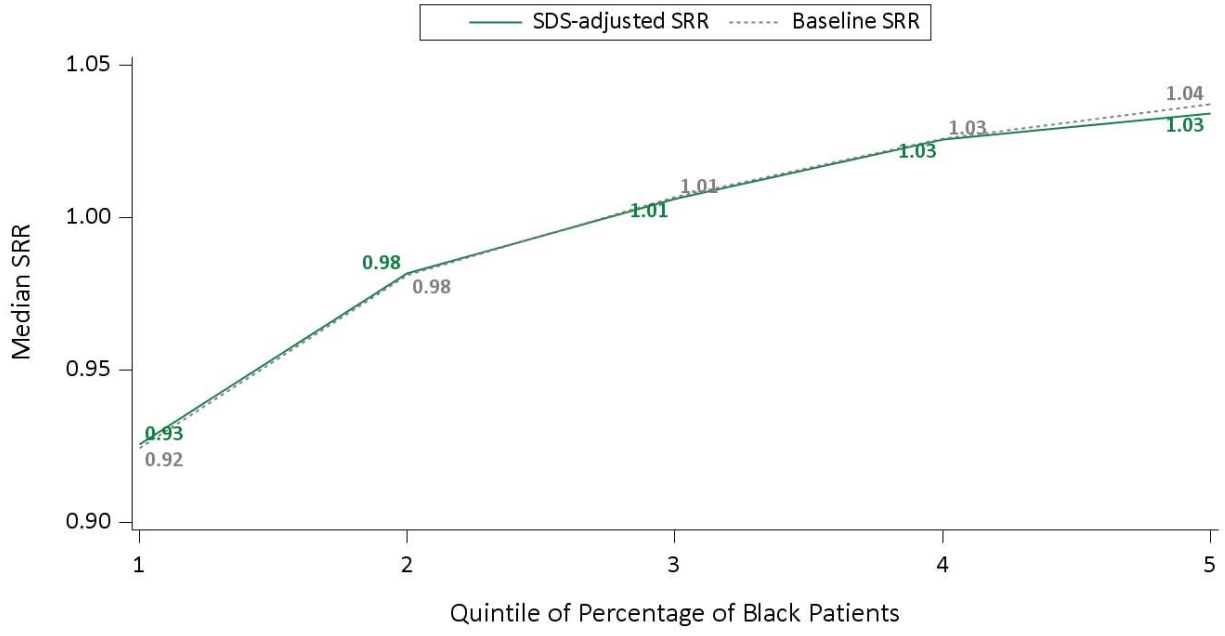
Relationship between race and ethnicity and SRR

We first studied the within-facility effects of race and ethnicity on readmission by including race and ethnicity as risk-adjusters in a mixed effects logistic regression model for readmission. We found that, within the same facilities, black patients have an odds ratio of 0.9993 for readmission compared to the non-black patients. Similarly, within the facilities, Hispanic patients have an odds ratio of 0.98 for readmission compared to those who are identified as non-Hispanic. Both results suggest that race and ethnicity not have strong impact on readmission within the same facility.

We next studied how the facility-level racial and ethnicity composition would impact SRR. Specifically, we examined the median SRR by facilities grouped in quintiles by their percentage of black patients and

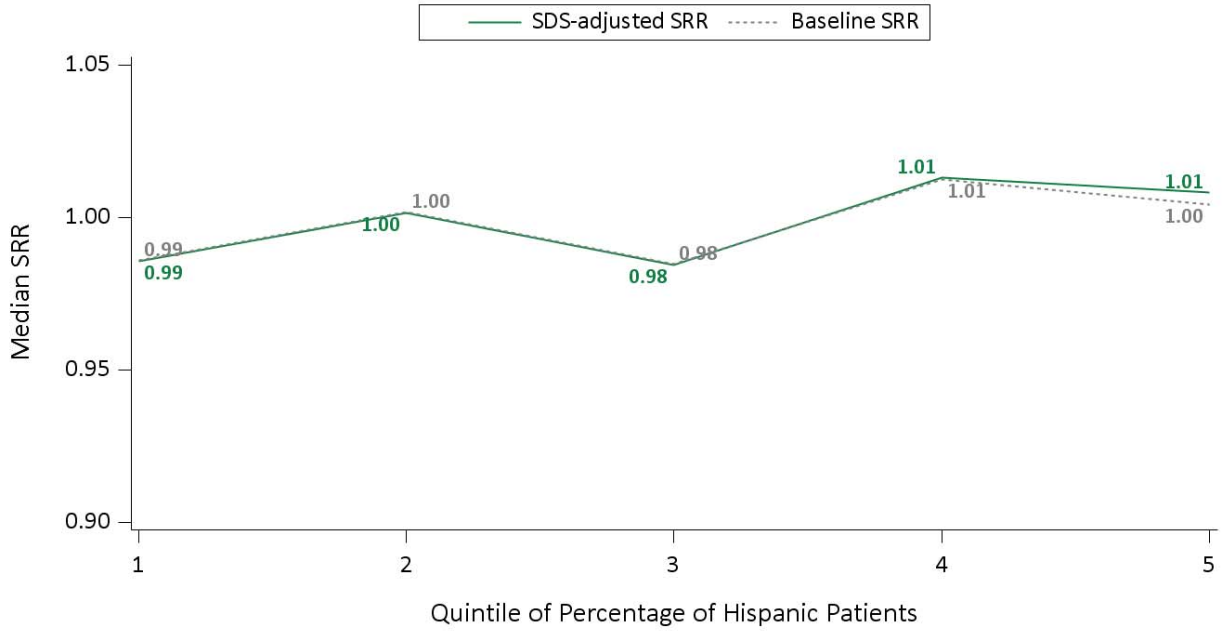
also by their percentage of Hispanic patients. These are presented in Figures 2 and 3. First, there are no systematic differences between the SRRs for facilities with varying percentages of Hispanic patients. On the other hand, there is an obvious upward trend in the SRR among facilities with increasing proportions of black patients. This indicates that, even having accounted for the within-facility differences in readmissions between black and non-black patients, facilities with higher proportions of black patients have higher readmission rates than those with lower proportion of black patients. We plan to explore these race relationships to SRR further.

Figure 2: Facilty SRR by Percentage of Black Patients, 2012



All races included in the model (reference group is whites).

Figure 3: Facility SRR, by Percentage of Hispanic Patients, 2012



Future Studies

Because of the high level of interest in considering risk-adjustment for SDS in the SRR for dialysis facilities, we are developing a plan of work to look into the question further. We plan to evaluate area-level measures of SDS, including both indices such as the CNI and the ADI, as well as individual measures of SD, such as income, insurance, race, education, etc. In addition, we plan to evaluate the feasibility and utility of patient level measures of SDS.

We have volunteered the SRR to enter the trial period for consideration of SDS adjustment.

References

Philbin EF, Dec WG, Jenkins PL, DiSalvo TG. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. The American Journal of Cardiology, Volume 87, Issue 12, 15 June 2001, Pages 1367–1371.

Foster D, Young J, Heller S. Community Need Associated with 30-Day Readmission. Truven Health Analytics (SDS Truven 20121514.pdf).

Singh, GK. Area deprivation and widening inequalities in US mortality, 1969-1998. Am J Public Health. 2003 Jul 93(7):1137-43.

Kind AJH, Jencks S, Brock J, et al. Neighborhood socioeconomic disadvantage and 30-day rehospitalizations: an analysis of Medicare data. Ann Intern Med (in press)

Re: Next steps for Admissions/Readmissions Measures Endorsed with Conditions

2504: 30-day Rehospitalizations per 1000 Medicare fee-for-service (FFS) Beneficiaries

1. Describe the conceptual relationship between your outcome measure and possible SDS risk factors.

The readmissions/1000 measure describes the readmission experience of a population of fee-for-service (FFS) Medicare beneficiaries; members of the population are defined by the geography of where they live. The measure is intended to track change in readmissions over time for a geographic region, and the SDS composition of a region's population are unlikely to change quickly, therefore we are using this measure without adjusting for the SDS of individual members. The readmissions/1000 measure probably reflects the influence of neighborhood contextual factors however, many of which are likely to be strongly correlated with socio-demographic (SD) determinants, or with personal SD factors that are often grouped into neighborhoods. What is unclear, and should be tested further, is whether or not neighborhoods of concentrated deprivation have more or less capacity to change, as many improvement initiatives focus efforts on such neighborhoods.

Published research has associated neighborhood of residence with health behaviors,[1] access to food[2,3] and safety,[4] and outcomes such as mortality,[1,5,6,7,8,9] birthweight[10] and rehospitalization risk for heart failure.[11] In addition, there is evidence that health indicators improve with moving persons to areas of less concentrated poverty.[12,13] Previous studies of child health and mental health outcomes have established that neighborhood disadvantage is a separate

[1] Lantz PM, House JS, Lepkowski JM, Williams DR, Mero RP, Chen J. Socioeconomic factors, health behaviors, and mortality: results from a nationally representative prospective study of U.S. adults. JAMA. 1998;279:1703-8. [PMID: 9624022]

[2] Moore LV, Diez Roux AV. Associations of neighborhood characteristics with the location and type of food stores. Am J Public Health. 2006;96:325-31. [PMID: 16380567]

[3] Franco M, Diez Roux AV, Glass TA, Caballero B, Brancati FL. Neighborhood characteristics and availability of healthy foods in Baltimore. Am J Prev Med. 2008;35:561-7. [PMID: 18842389] doi:10.1016/j.amepre.2008.07.003

[4] Hsieh CC, Pugh MD. Poverty, income inequality, and violent crime: a meta-analysis of recent aggregate data studies. Criminal Justice Review. 1993;18: 182-202.

[5] Robert SA. Socioeconomic position and health: the independent contribution of community socioeconomic context. Annual Review of Sociology. 1999: 489-516.

[6] House JS, Lepkowski JM, Kinney AM, Mero RP, Kessler RC, Herzog AR. The social stratification of aging and health. J Health Soc Behav. 1994;35:21334. [PMID: 7983335]

[7] Joynt KE, Orav EJ, Jha AK. Thirty-day readmission rates for Medicare beneficiaries by race and site of care. JAMA. 2011;305:675-81. [PMID: 21325183] doi:10.1001/jama.2011.123

[8] Joynt KE, Jha AK. Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. JAMA. 2013;309:342-3. [PMID: 23340629] doi:10.1001/jama.2012.94856

[9] Rau J. Hospitals treating the poor hardest hit by readmissions penalties. Kaiser Health News. 13 August 2012. Accessed at www.kaiserhealthnews.org /stories/2012/august/13/hospitals-treating-poor-hardest-hit-readmissions -penalties.aspx on 2 October 2014.

[10] Blumenshine P, Egerter S, Barclay CJ, Cubbin C, Braveman PA. Socioeconomic disparities in adverse birth outcomes: a systematic review. Am J Prev Med. 2010;39:263-72. [PMID: 20709259] doi:10.1016/j.amepre.2010.05.012

[11] Foraker RE, Rose KM, Suchindran CM, Chang PP, McNeill AM, Rosamond WD. Socioeconomic status, Medicaid coverage, clinical comorbidity, and rehospitalization or death after an incident heart failure hospitalization: Atherosclerosis Risk in Communities cohort (1987 to 2004). Circ Heart Fail. 2011;4: 308-16. [PMID: 21430286]doi:10.1161/ CIRCHEARTFAILURE.110.959031

[12] Ludwig J, Duncan GJ, Gennetian LA, Katz LF, Kessler RC, Kling JR, et al. Neighborhoodeffectsonthelong-termwell-beingoflow-incomeadults.Science. 2012;337:1505-10. [PMID: 22997331]

[13] Ludwig J, Sanbonmatsu L, Gennetian L, Adam E, Duncan GJ, Katz LF, et al. Neighborhoods, obesity, and diabetes—a randomized social experiment. N Engl J Med. 2011;365:1509-19. [PMID: 22010917] doi:10.1056 /NEJMsa1103216

risk factor beyond individual personal disadvantage, with worse health and social outcomes for persons who live in both poor families and poor neighborhoods than for persons living in poor families in less poor neighborhoods.[12,14]

We have recently demonstrated that a composite measure of neighborhood deprivation, based on 2000 Census data, was associated with 30-day readmission risk after hospitalizations from 2004 - 2009 for heart failure, myocardial infarction or pneumonia, and remained so after adjustment for usual patient-level socioeconomic (SE) variables such as income and dual eligibility.[15]

We calculated the deprivation index from 17 US Census variables using methods developed by Gopal Singh, PhD, MS, MSc.[16] Census variables used to calculate the ADI include:

- Percent of the population aged 25 and older with less than 9 years of education
- Percent of the population aged 25 and older with at least a high school diploma
- Percent employed persons aged 16 and older in white-collar occupations
- Median family income in US dollars
- Income disparity
- Median home value in US dollars
- Median gross rent in US dollars
- Median monthly mortgage in US dollars
- Percent of owner-occupied housing units
- Percent of civilian labor force population aged 16 years and older who are unemployed
- Percent of families below federal poverty level
- Percent of the population below 150% of the federal poverty threshold
- Percent of single-parent households with children less than 18 years of age
- Percent of households without a motor vehicle
- Percent of households without a telephone
- Percent of occupied housing units without complete plumbing
- Percent of households with more than 1 person per room

Although neighborhood deprivation may be partially a proxy for personal SDS, we believe that it is an easier and therefore more practical approach to adjusting a regional population's readmission experience, without compromising validity.

Risk factors derived from Census data are unassociated with the effects of healthcare providers or the characteristics of the care provided. They measure slowly changing characteristics of the communities in which Medicare beneficiaries live and are present and stable from the beginning of a treatment episode and throughout that episode. They are also available in the public domain, freeing providers from having to capture these data themselves, and allowing them to fully engage in initiatives designed to address patterns of readmissions in their service areas.

2. Describe the relationship between the SDS risk factor(s) and the measured unit (hospital, SNF, etc.) to indicate the variation in the risk factor across the measured unit.

The geographic units at which both the outcome measure and the SDS adjustment factor are calculated can be set to any desired regional division. The US Census aggregates the variables used to calculate the ADI at the census

[14] Acevedo-Garcia D, Osypuk TL, McArdle N, Williams DR. Toward a policy-relevant analysis of geographic and racial/ethnic disparities in child health. Health Aff (Millwood). 2008;27:321-33. [PMID: 18332486] doi:10.1377 /hlthaff.27.2.321

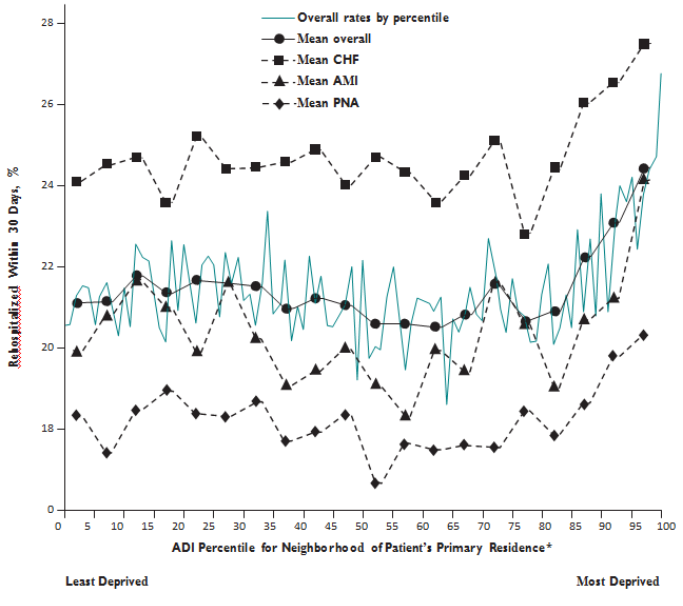
[15] Kind AJ, Jencks S, Brock J, Yu M, Bartels C, Ehlenbach W, et al. Neighborhood Socioeconomic Disadvantage and 30-Day Rehospitalization: A Retrospective Cohort Study. Ann Intern Med. 2014;161:765-774. doi:10.7326/M13-2946

[16] Singh GK. Area deprivation and widening inequalities in U.S. mortality, 1969-1998. Am J Public Health. 2003;93:1137-43. [PMID: 12835199]

tract level, and readmissions/1000 rates could be similarly assigned census tracts. Alternatively, ZIP+4 codes are the easiest method for aggregating admissions and readmissions rates, based on information from the Medicare enrollment file, and there are a number of publicly available software packages designed to translate ZIP+4 into census tracts which could be used to match census-derived ADI scores to ZIP+4 defined readmission rates.

The variation in readmissions/discharges among patients hospitalized with heart failure, myocardial infarction and pneumonia varied from 21% to 27% in the published paper, with a sharp increase, or threshold, starting with the 15th percentile of most deprived neighborhoods. Geographically defined measures of readmission could be adjusted by the ADI metric as a binomial variable (significant neighborhood deprivation vs. no significant deprivation).

Figure 1. Unadjusted relationship between ADI percentile of a Medicare patient's neighborhood and 30-day rehospitalization.



ADI = area deprivation index; AMI = acute myocardial infarction; CHF = congestive heart failure; PNA = pneumonia.
* On the ADI percentile range shown, 0 is the least socioeconomically disadvantaged group of neighborhoods ranging sequentially by equally sized neighborhood groupings up to 100 as the most disadvantaged group of neighborhoods. Mean lines represent the mean relationship over each ADI percentile.

3. In your view, should the measure enter the trial period?

We are actively working on updating the ADI calculation for 2010 Census data elements, and assessing its value as an adjuster for all-cause readmissions.

2503 Hospitalizations per 1000 Medicare fee-for-service (FFS) Beneficiaries

Although we have not yet tested the relationship of ADI to admission rates, we believe it would be of interest to test adjustment of hospitalizations per 1000 Medicare beneficiaries also. If variation in admission rates is influenced by neighborhood characteristics as described above, then adjustment by neighborhood deprivation would also be logical and feasible. Additionally, in deprived neighborhoods 27% of discharge for tested conditions result in readmissions, which suggests that admission rates are likely to be significantly influenced by readmissions, which have been demonstrated to be sensitive to ADI.

RTI INTERNATIONAL | Memorandum

TO: All Cause Admissions and Readmissions Standing Committee, National Quality Forum

FROM: RTI International

DATE: January 20, 2015

SUBJECT: Measure Developer Response to the Inclusion of SDS Factors for NQF #2502 All-Cause Unplanned Readmission Measure for 30 Days Post Discharge from Inpatient Rehabilitation Facilities (IRFs)

1. Conceptual Relationship between Readmissions Post-IRF Discharge & SDS Risk Factors

The potential relationship between SDS risk factors and the outcome of readmissions post-discharge from Inpatient Rehabilitation Facilities (IRFs) is plausible; however, the literature on such relationships specific to this setting is limited.

Readmission rates among patients recovering specifically from stroke were most frequently examined, and the evidence on disparities was mixed. Some studies showed no differences. For example, separately developed hierarchical models have shown that neither sex nor race is a significant predictor for either three-month (Ottenbacher et al., 2012) or six-month (Dossa, Glickman, & Berlowitz, 2011) acute rehospitalization from inpatient rehabilitation facilities. However, the former study, Ottenbacher et al. (2012), found that an interaction term between minority and depressive symptoms was significant in predicting hospital readmissions. One study of readmissions among stroke patients found differences by ethnicity suggesting certain ethnic patient populations had better readmission outcomes. In developing classification models assessing 80-180 day risk of hospital readmission post-IRF discharge for stroke patients, Hispanic men and Asian men had the lowest risk of rehospitalization compared to non-Hispanic white and African-American men (Ottenbacher et al., 2001). This finding was also identified in a study looking at 6-month hospital readmissions among older adults receiving inpatient rehabilitation after hip fracture (Ottenbacher et al., 2003). This hip fracture study found that 18.1 percent of non-Hispanic white males and 16.8 percent of African American males were rehospitalized compared to 10.1 percent of Hispanic males (Ottenbacher, et al., 2003).

Finally, a national study analyzing Medicare claims data from 2006-2011 for post-acute patients discharged from IRFs to the community for selected impairment categories found that readmission rates were highest among men and non-Hispanic blacks (Ottenbacher et al., 2014). This study also found higher readmission rates for dual eligible beneficiaries, suggesting a

disparity by socio-economic status. The literature suggests that race and socio-economic status are possible patient-level risk factors that should be tested.

Next, we summarize the results of our testing of these risk factors, as included in section 1b.4 of our Measure Submission Form. Our testing was limited by the availability of these variables in our data sources (Medicare claims and administrative data). As such, we tested race (White, Black, Other which includes the following codes: unknown, other, Asian, Hispanic, and North American native) and a proxy for low-income status (Medicaid Buy-In) in our readmission models.

About 10 percent of our sample was Black and we found that the unadjusted, unplanned readmission rate for this group was highest (15.5%). Eighty-five percent of the IRF sample included in the 2010/2011 model was White, and the unadjusted, unplanned readmission rate for this group was 13.4 percent. The remaining five percent of the sample included beneficiaries with race included in the Other category; the unadjusted, unplanned readmission rate for Other was similar to that of Whites (13.7%). Less than 19 percent of the IRF sample had the indicator for state (Medicaid) Buy-In of Medicare Part B, though the unadjusted, unplanned readmission rate was slightly higher among that group (16.0%).

In our risk-adjustment models, however, the odds of readmission for Black beneficiaries did not differ from White beneficiaries; however, there were reduced odds of readmissions for the Other race category relative to White beneficiaries. There was a significant increase in odds of readmission among beneficiaries with the Buy-In indicator—about 14 percent higher—relative to beneficiaries with no Buy-In indicator. Please refer to **Appendix Tables 1-2** at the end of this memo for the results described above.

2. Relationship between SDS Risk Factors & IRFs

In addition to analyzing the effect of including race and SES in the readmission models at the patient level, we also conducted analyses to assess the potential impact on facilities' scores based on the proportion of patients that were Non-White or had the Buy-In indicator. Results of these analyses are summarized below and included in **Appendix Tables 3-4** at the end of this memo, as reported in section 1.b.4 of our Measure Submission Form. Analyses of the distribution of IRF patients by race shows that Non-White populations are not evenly distributed across facilities. However, there were no differences in comparing IRFs' RSRRs based on facility percentages of Non-White patients. The mean RSRRs were similar, and there were only very small differences in the median RSRRs as IRFs' percentages of Non-White patients increased. Next, for IRF patients with the Buy-In indicator, a proxy for low-income status or SES, the results were similar. There were no differences in the RSRRs for facilities based on the proportion of patients with Buy-In. Note the RSRRs estimated for these analyses are based on risk-adjustment models

that did not include either race or Buy-In. In both cases it is not clear whether quality of care is a factor or some underlying factor not measured.

3. Developer Recommendation on Trial Period

We did not include race and socioeconomic status (SES) in our proposed IRF post-discharge readmission measures. This decision was based on NQF guidance as well as the goal to harmonize with the HWR measure (NQF #1789). Despite the fact that there is a plausible relationship between SDS factors and readmissions, both the literature and our analyses are mixed. For example, though race is a significant risk-adjuster in the patient-level models, the only differences were among the Other race category (reduced odds of readmissions) relative to White. Even though we found that non-White beneficiaries were not evenly distributed among IRFs, there appeared to be no difference in facilities' RSRRs based on the proportion of Non-White beneficiaries.

The evidence for an SES proxy, the Buy-In indicator, was somewhat stronger and suggested that the odds of readmission for beneficiaries with the Buy-In indicator were about 14 percent higher relative to beneficiaries with no Buy-In indicator. However, there were no differences in the RSRRs for facilities based on the proportion of patients with Buy-In.

We have not tested the many environmental/ecological factors that could affect the probability of a readmission in the post-discharge period. There are health services supply factors that could have an effect. Factors like a patient's compliance and personal living circumstances are difficult to measure. Proxy measures for an individual's own situation are rough. However, our model contains variables that are summary indicators of both ecological and personal characteristics affecting readmission probabilities. These variables are the categorical variables for counts of readmissions in the year prior to the episode in the measure. Counts are a marker unrelated to the current IRF stay that control for a pattern of service use driven by many potential causal factors. The coefficients behave as expected, increasing with hospitalization count. The conceptual correlation between this factor and the Buy-In variable may explain why there is no net effect of the Buy-In when the variable is included in the model; the prior admission counter effect is reduced when the Buy-In is introduced. Adding the SDS variables and finding significance does not mean that there will be a net change in the scores of the facilities.

In summary, our findings and the limited literature on the relationships between SDS factors and post-discharge readmission rates for IRF patients suggest that NQF #2502 should be entered into the trial period for further testing.

References:

Dossa A, Glickman ME, Berlowitz D. Association between mental health conditions and rehospitalization, mortality, and functional outcomes in patients with stroke following inpatient rehabilitation. BMC Health Serv Res 11:311, 2011.

Ottenbacher, K. J., Karmarkar, A., Graham, J. E., et al. "Thirty-Day Hospital Readmission following Discharge from Postacute Rehabilitation in Fee-for-Service Medicare Patients." JAMA 311(6):604-14, 2014.

Ottenbacher KJ, Graham JE, Ottenbacher AJ, et al. Hospital readmission in persons with stroke following postacute inpatient rehabilitation. J Gerontol A Biol Sci Med Sci 67(8): 875-881, 2012.

Ottenbacher, K. J., P. M. Smith, et al. (2003). "Hospital readmission of persons with hip fracture following medical rehabilitation."Arch Gerontol Geriatr 36(1): 15-22.

Ottenbacher, K. J., P. M. Smith, et al. (2001). "Comparison of logistic regression and neural networks to predict rehospitalization in patients with stroke." J Clin Epidemiol 54(11): 1159-1165.

Appendix Tables

Table A-1
Sample Descriptives for Race and SES Risk-Adjusters

	IRF Post-Discharge 2010/2011 Readmission Model Sample Unadjusted Rates (n=590,120)	
Risk-Adjuster	**% sample with covariate**	**% with unplanned readmission**
White	85.2	13.4
Black	10.2	15.5
Other	4.6	13.7
Medicaid Buy-In	18.7	16.0

SOURCE: RTI International analysis of Medicare claims data, 2007-2012. (RTI program reference: lc35)

Table A-2
Odds Ratios for Race and SES Risk-Adjusters

	IRF Post-Discharge 2010/2011 Readmission Model	
Risk-Adjuster	**Odds Ratio**	**95% Confidence Interval**
White	REF	REF
Black	0.99	0.96-1.01
Other	0.91	0.88-0.95
Medicaid Buy-In Indicator	1.14	1.11-1.16

NOTE: Full set of risk-adjusters not shown.

SOURCE: RTI International analysis of Medicare claims data, 2007-2012. (RTI program reference: lc35)

Table A-3
Race: Distribution of Risk-Standardized Readmission Rate (%) by Facility Proportion Non-White Patients, 2010/2011

% of Facility Patients that are Non-White	N Obs (IRFs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <5%	313	13.4	11.7	13.0	13.4	13.9	16.1
5 to <10%	271	13.4	11.2	13.0	13.4	13.8	15.5
10 to <20%	285	13.6	11.1	13.1	13.5	14.1	15.7
20% or more	302	13.5	11.8	13.1	13.6	13.9	15.6
Total IRFs	1,171	13.5	11.1	13.0	13.5	13.9	16.1

NOTE: The Risk-Standardized Readmission Rates reported are based on models that do not include race or Buy-In. IRF=Inpatient rehabilitation facility; Obs=Observations; Pctl=Percentile.

SOURCE: RTI analysis of Medicare claims data, 2007-2012. (RTI program references: lc38)

Table A-4
SES: Distribution of Risk-Standardized Readmission Rate (%) by Facility Proportion of Patients with Buy-In, 2010/2011

% of Facility Patients with State Buy-In during 2010/2011	N Obs (IRFs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <12%	288	13.4	11.5	13.0	13.4	13.8	15.5
12 to <17%	305	13.4	11.2	12.9	13.3	13.8	15.7
17 to <24%	291	13.5	11.1	13.1	13.5	14.0	16.1
24% or more	287	13.6	11.8	13.2	13.6	14.0	15.5
Total IRFs	1,171	13.5	11.1	13.0	13.5	13.9	16.1

NOTE: The Risk-Standardized Readmission Rates reported are based on models that do not include race or Buy-In. IRF=Inpatient rehabilitation facility; Obs=Observations; Pctl=Percentile.

SOURCE: RTI analysis of Medicare claims data, 2007-2012. (RTI program references: lc38)

RTI INTERNATIONAL | Memorandum

TO: All Cause Admissions and Readmissions Standing Committee, National Quality Forum

FROM: RTI International

DATE: January 20, 2015

SUBJECT: Measure Developer Response to the Inclusion of SDS Factors for NQF #2510 Skilled Nursing Facility 30-Day All-Cause Readmission Measure (SNFRM)

1. Conceptual Relationship between SNF Readmissions & SDS Risk Factors

The potential relationship between SDS risk factors and the outcome of hospital readmissions for Skilled Nursing Facility (SNF) patients is plausible; however, the literature on such relationships specific to this setting is not extensive.

Research has found that racial and socio-demographic disparities exist both in the quality of nursing facilities as well as in hospital readmission rates. Any discussion of disparities in hospitalization or hospital readmission rates should acknowledge the potential influence of differences in preferences for intensity of intervention by patient subgroups. Additionally, previous studies suggest that these disparities arise from vulnerable populations being admitted disproportionately into poorer quality homes, rather than patients or residents receiving care at different levels of quality by race within the same facility (Mor et al., 2004; Cai, Mukamel, Temkin-Greener 2010). Studies have suggested that a contributing factor to systematically poorer quality care among facilities providing services to disproportionately more low socio-demographic residents or patients is the lack of resources to dedicate to quality improvement (Mor et al., 2004).

Multiple studies have found that nursing facilities with higher proportions of minority and low socio-economic status residents tend to have poorer results on quality of care indicators, and that African-Americans have higher rates of hospital readmission (Howard et al., 2002; Mor et al., 2004; Grabowski 2004; Silverstein et al., 2008; Jencks, Williams, and Coleman 2009). Prior research has shown that racial disparities exist in care provided to nursing home residents with respect to occurrence of pressure sores (Li, Yue, et al., 2011a) and provision of influenza and pneumococcal vaccination (Li, Yue, Mukamel, 2010), and data indicate that these racial disparities persist for hospital readmissions.

Using data from a large health maintenance organization and fee-for-service Medicare claims for patients with a stroke occurring in the 2-year period 1998-2000, African-American race was a significant predictor of experiencing at least one complicated transition defined as moving from

a less to a more intense care setting after hospital discharge. Patients who had had multiple complicated transitions were 38 percent more likely to be African-American (Kind et al., 2008). Another study analyzing hospital readmission rates using Medicare claims data from 2003-2004 found that African-Americans had a nearly 6 percent higher risk of rehospitalization within 30 days of hospital discharge than those of other races (Jencks, Williams & Coleman, 2009).

Among studies specifically of hospital readmissions for patients in SNFs, one national study using MDS data found that the unadjusted 30-day readmission rate was 18.6 percent for African-American patients and 14.3 percent for White patients, resulting in an odds ratio of 1.37 (Li et al., 2011b). These differences were more marked when analyzing the 90-day readmission rate: the readmission rate for African-American patients was 29.5 percent compared to 22.1 percent for White patients, with an odds ratio of 1.48.

2. Relationship between SDS Risk Factors & SNFs

The literature suggests that race and socio-economic status are possible patient-level risk factors that should be tested. Next, we summarize the results of our testing of these risk factors, as included in section 1b.4 of our Measure Submission Form. Our testing was limited by the availability of these variables in our data sources (Medicare claims and administrative data). As such, we tested race (White, Black, and Other which includes the following codes: unknown, other, Asian, Hispanic, and North American native) and a proxy for low-income status (the dual eligibility indicator, a variable indicating that the patient is enrolled in both Medicare and Medicaid) in our readmission models. We conducted analyses to assess the potential impact on facilities based on their proportion of patients that were Non-White or had the dual eligibility indicator. Results of these analyses are summarized below and included in **Appendix Tables 1-2** at the end of this memo.

Analyses of the distribution of patients by race shows that non-White populations are not evenly distributed across facilities. When the total number of SNFs is broken down by the percentage of patients who are non-White, there are a large proportion of facilities that have non-White populations smaller than the national average (16.5% of US population 60 and older). Under 30 percent (27.1%) of facilities have more than 16.5 percent of their patients who are non-White. 10 percent of facilities have over 40 percent non-White patients. Approximately7 percent of facilities have a majority non-White patients.[1]

When examining whether facilities with higher percentages of non-White patients have systematically different performance scores for the SNFRM, the data suggest that the RSRR

[1] SOURCE: RTI analyses of 2011 MedPAR files (N=16,656). (output: readmit138_HLMFinal_Disparity02_Freq_NWhite_SNF_11.xls)

increases slightly as the percentage of non-White patients increases (see **Appendix Table 1**).[2] This is consistent with prior literature showing that hospitals deemed as "minority serving" (defined as over 30% of patient served are minority) had higher readmission rates (25.5% readmitted within 30 days) than those that were "non-minority serving" (22.0% readmitted within 30 days) (Joynt 2011). Our data showed results that are less pronounced, with patients in facilities with over 30 percent non-White patients having readmission rates of 23.2 percent, versus facilities with less than 30 percent non-White patients having rates between 21.7-22.6 percent. The clustering of patients by race in facilities makes it difficult to argue for taking steps like reporting stratified measures because many facilities have very small minority populations. Prior literature examining other health outcomes has suggested that disparities in outcomes are due to differential access to quality care facilities, rather than differences in care being received by residents of different races in the same facility (Li, Yue, et al. 2011a; Li, Yue, Mukamel, 2010).

For dual eligible patients, the results were similar, in that the RSRR was higher for facilities with larger percentages of Medicaid enrollees. However, differences were small (ranging from 20.8% for facilities with the lowest percentage of dual eligible patients, to 21.6% for facilities with the highest percentage).[3] The results are presented in **Appendix Table 2**.

3. Developer Recommendation on Trial Period

We did not include race and socioeconomic status (SES) in our SNF readmission measure. This decision was based on NQF guidance as well as the goal to harmonize with the HWR measure (NQF #1789). There were very small differences in the RSRRs for facilities that had a high percentage of Medicaid enrollees as compared to those with a low percentage of Medicaid enrollees. We did find that non-White beneficiaries were not evenly distributed among SNFs suggesting that some facilities could have a disproportionate effect on their performance if there were systematic differences in risk by race and socio-demographic status. Facilities with higher proportions of vulnerable populations had RSRRs that were slightly higher, but the magnitude of this difference was not large.

We have not tested the many environmental/ecological factors that could affect the probability of a readmission in the case of SNFs. However, health services supply factors that could have an effect on readmissions should be more in control of SNFs given this is largely a within-stay measure and patients should have access to appropriate caregivers in the facility. Factors like a patient's compliance are difficult to measure, but again a SNF should have more influence on compliance and so may be less appropriate to include as a risk-adjuster. Additionally, facilities should have control over the quality of the physical environment the patient lives in. Our model

[2] SOURCE: RTI analyses of 2011 MedPAR files (N=16,656). (output: readmit138_HLMFinal_Disparity03.xls .xls)
[3] SOURCE: RTI analyses of 2011 MedPAR files (N=16,656). (output: readmit138_HLMFinal_Disparity03.xls)

does contain variables that are summary indicators of both ecological and personal characteristics affecting readmission probabilities. These variables are the categorical variables for counts of acute hospitalizations in the year prior to the episode in the measure. Counts are a marker that should be unrelated to the current SNF stay, for most patients, which controls for a pattern of service use driven by many potential causal factors. Research suggests that in the Medicare population, the number of previous hospitalizations, combined with length of stay and the reason for the hospitalization, had more impact on the risk of readmission than any other patient characteristic (Jencks et al., 2009).

In summary, while our analyses suggest only a weak relationship between race, socio-demographic status and readmissions, our findings from the data and review of the literature suggest that NQF #2510 Skilled Nursing Facility 30-Day All-Cause Readmission Measure (SNFRM) should be entered into the trial period for SDS.

References:

1. Cai S, Mukamel DB, Temkin-Greener H. Pressure ulcer prevalence among black and white nursing home residents in New York state: evidence of racial disparity? Med Care. Mar 2010;48(3):233-239.
2. Dombrowski, Wen et al. "Factors Predicting Rehospitalization of Elderly Patients in a Postacute Skilled Nursing Facility Rehabilitation Program." Archives of Physical Medicine and Rehabilitation, October 2012. 93 pp. 1808-1813.
3. Grabowski DC. The admission of blacks to high-deficiency nursing homes. Medical Care. May 2004;42(5):456-464.
4. Howard DL, Sloane PD, Zimmerman S, et al. Distribution of African Americans in residential care/assisted living and nursing homes: more evidence of racial disparity? American Journal of Public Health. Aug 2002;92(8):1272-1277.
5. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. The New England Journal of Medicine. Apr 2 2009;360(14):1418-1428.
6. Kind, AJH, et al. "Bouncing Back: Patterns and Predictors of Complicated Transitions 30 Days after Hospitalization for Acute Ischemic Stroke." Journal of the American Geriatric Society, 2007 March, 55(3): 365-373.
7. Li Y, et al. "Association of Race and Sites of Care with Pressure Ulcers in High-Risk Nursing Home Residents." Journal of the American Medical Association, July 13, 2011(a). 306:2, pp 179-186.
8. Li Y, Mukamel DB. "Racial disparities in receipt of influenza and pneumococcus vaccinations among US nursing-home residents." American Journal of Public Health. 2010; 100(supp 1) 256-262.
9. Li Y, Glance LG, Yin J, and Mukamel DB. Racial disparities in rehospitalization among Medicare patients in skilled nursing facilities. American Journal of Public Health: May 2011; 101(5):875-882.
10. Mor V, Zinn J, Angelelli J, Teno JM, Miller SC. Driven to tiers: socioeconomic and racial disparities in the quality of nursing home care. The Milbank Quarterly. 2004;82(2):227-256.
11. Silverstein MD, Qin H, Mercer SQ, Fong J, Haydar Z. Risk factors for 30-day hospital readmission in patients >/=65 years of age. Proc (Bayl Univ Med Cent). Oct 2008;21(4):363-372.

Appendix Tables

Table A-1
Race: distribution of risk-standardized readmission rate (%) by facility proportion non-white patients, 2011

% of the Facility Patients that are Non-White	N Obs (SNFs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <2%	5088	20.69	13.43	19.30	20.55	21.89	33.80
2 to <10%	5080	20.95	11.88	19.14	20.70	22.51	34.20
10 to <30%	3873	21.48	12.71	19.72	21.22	22.98	34.12
30% or more	2615	22.03	13.89	20.27	21.71	23.59	41.58

SOURCE: RTI analyses of 2011 MedPAR files (N=16,656). (output: readmit138_HLMFinal_Disparity03.xls .xls)

Table A-2
SES: distribution of risk-standardized readmission rate (%) by facility proportion dual eligible patients, 2011

% State buy-in for the month of the indexed SNF admission	N Obs (SNFs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <15%	**3890**	20.77	12.71	19.15	20.62	22.13	33.9
15 to <30%	**4500**	21.03	11.88	19.28	20.77	22.51	33.43
30 to <50%	**4507**	21.28	13.31	19.53	21.04	22.79	34.2
50% or more	**3759**	21.58	14.25	19.96	21.23	22.93	41.58

SOURCE: RTI analyses of 2011 MedPAR files (N=16,712). (output: readmit138_HLMFinal_Disparity03.xls)

RTI INTERNATIONAL | Memorandum

TO: All Cause Admissions and Readmissions Standing Committee, National Quality Forum

FROM: RTI International

DATE: January 20, 2015

SUBJECT: Measure Developer Response to the Inclusion of SDS Factors for NQF #2512 All-Cause Unplanned Readmission Measure for 30 Days Post Discharge from Long-Term Care Hospitals (LTCHs)

1. Conceptual Relationship between Readmissions Post-LTCH Discharge & SDS Risk Factors

The potential relationship between SDS risk factors and the outcome of readmissions post-discharge from Long-Term Care Hospitals (LTCHs) is plausible; however, there is a lack of literature on this topic specific to this setting. Evidence from readmission rates following acute-care discharge have shown disparities by race with Black beneficiaries having the highest 30-day readmission rates for acute myocardial infarction, heart failure, and pneumonia (Joynt, Orav, and Jha, 2011). Though this evidence is not specific to LTCHs, it suggests that race is one possible patient-level risk factor relevant to post-discharge readmissions that should be tested.

We included results of our testing of two SDS risk factors in section 1b.4 of our Measure Submission Form and summarize those results here. Our testing was limited by the availability of SDS variables in our data sources (Medicare claims and administrative data). As such, we tested race (White, Black, and Other which includes the following codes: unknown, other, Asian, Hispanic, and North American native) and a proxy for low-income status (Medicaid Buy-In) in our readmission models. The Buy-In variable is an indicator that a state is paying Part B premiums and/or cost sharing for beneficiaries because of low income. Buy-In policies vary by state, so although not perfect it is a reasonable measure for the effect of low-income.

Seventy-three percent of the LTCH sample was White, and the unadjusted, unplanned readmission rate was lowest for this group (22.6%) compared to the 20 percent of the sample in the Black race category which had the highest readmission rate (26.0%). Beneficiaries coded as Other for race—7.1 percent of the sample—had a higher readmission rate (24.6%) than White, but lower than Black beneficiaries. There is a high proportion of the LTCH sample with the Buy-In indicator code (41.1%), and the unadjusted, unplanned readmission rate was slightly higher than the national average.

Next, odds ratios were estimated from the logistic regression model including both race and Buy-In as risk-adjusters. In our risk-adjustment models, Black beneficiaries had about 6 percent higher odds of readmission relative to White beneficiaries, but there was no significant difference between beneficiaries in the Other race group compared to Whites. The odds of readmission for LTCH beneficiaries with the Buy-In indicator were 12 percent higher relative to those with no Buy-In indicator for an unplanned readmission. Please refer to **Appendix Tables 1-2** at the end of this memo for the results described above.

2. Relationship between SDS Risk Factors & LTCHs

In addition to analyzing the effect of including race and SES in the readmission models at the patient level, we also conducted analyses to assess the potential impact on LTCHs' readmissions rates based on their percentage of patients that were Non-White or had the Buy-In indicator. Results of these analyses are summarized below and included in **Appendix Tables 3-4** at the end of this memo, as reported in section 1.b.4 of our Measure Submission Form.

Analyses of the distribution of LTCH patients by race show that Non-White populations are not evenly distributed across facilities. There were small differences in comparing LTCHs' performance on the RSRR based on facility percentages of Non-White patients. For example, LTCHs with 0 to 12 percent Non-White patients had a mean RSRR of 23.5 percent and a median of 23.5 percent compared to LTCHs with 35 percent or more Non-White patients in which the mean and median RSRRs were higher, 25.2 and 24.8 percent, respectively. These results suggest that facilities' RSRRs increase slightly as the percentage of Non-White LTCH patients increases.

For LTCH patients with the Buy-In indicator, the results were similar. There were slight increases in the RSRRs as the percentage of LTCH patients with Buy-In increased within LTCHs. For example, based on models that did not adjust for race or Buy-In, LTCHs with 0 to 30 percent Buy-In patients had a mean RSRR of 23.4 percent and a median of 23.3 percent compared to LTCHs with 47 percent or more Buy-In patients in which the mean and median RSRRs were higher, 25.1 and 24.9 percent, respectively. In both cases it is not clear whether quality of care is a factor or some underlying factor not measured.

3. Developer Recommendation on Trial Period

We did not include race and socioeconomic status (SES) in our proposed LTCH post-discharge readmission measure. This decision was based on NQF guidance as well as the goal to harmonize with the HWR measure (NQF #1789). However, both the literature and our analyses support the need for further testing. Even though Black race is a statistically significant risk-adjuster in the patient-level models, the odds ratio predicting readmission was small for Black race relative to White. Non-White beneficiaries were not evenly distributed among LTCHs, suggesting the potential for some facilities' readmission rates could be affected disproportionate

effect on their performance if there were differences by race. LTCHs' RSRRs were slightly different based on the proportion of Non-White beneficiaries. The evidence for an SES proxy, the Buy-In indicator, was somewhat stronger and suggested increased odds of readmission for beneficiaries with the Buy-In indicator relative to beneficiaries with no Buy-In indicator. There were also increases in the RSRRs for facilities with a higher proportion of patients with Buy-In.

We have not tested the many environmental/ecological factors that could affect the probability of a readmission in the post-discharge period. There are health services supply factors that could have an effect. Factors like a patient's compliance and personal living circumstances are difficult to measure. Proxy measures for an individual's own situation are rough. However, our model contains variables that are summary indicators of both ecological and personal characteristics affecting readmission probabilities. These variables are the categorical variables for counts of hospitalizations in the year prior to the episode in the measure. Counts are a marker unrelated to the current LTCH stay that control for a pattern of service use driven by many potential causal factors. The coefficients behave as expected, increasing with hospitalization count. However, even with the conceptual correlation between this factor and the Buy-In variable, there is still an effect of Buy-In when the variable is included in the model. Adding the SDS variables and finding significance does not mean that there will be a net change in the scores of the facilities.

In summary, our findings and the limited literature on the relationships between SDS factors and post-discharge readmission rates for LTCH patients suggest that NQF #2512 should be entered into the trial period for further testing.

References:

Joynt, K. E., E. J. Orav, et al. (2011). "Thirty-day readmission rates for Medicare beneficiaries by race and site of care." JAMA 305 (7): 675-681.

Appendix Tables

Table A-1
Sample Descriptives for Race and SES Risk-Adjusters

	LTCH Post Discharge 2010/2011 Readmission Model (n=212,018)	
Risk-Adjuster	**% sample with covariate**	**% with unplanned readmission**
White	72.9	22.6
Black	20.0	26.0
Other	7.1	24.6
Medicaid Buy-In	41.1	25.6

Source: RTI International analysis of Medicare claims data, 2007-2012. (RTI program reference: lc35)

Table A-2
Odds Ratios for Race and SES Risk-Adjusters

	LTCH Post-Discharge 2010/2011 Readmission Model	
Risk-Adjuster	**Odds Ratio**	**95% Confidence Interval**
White	REF	REF
Black	1.06	1.03-1.09
Other	0.98	0.94-1.02
Medicaid Buy-In Indicator	1.12	1.09-1.14

Note: Full set of risk-adjusters not shown.
Source: RTI International analysis of Medicare claims data, 2007-2012. (RTI program reference: lc35)

Table A-3
Race: Distribution of Risk-Standardized Readmission Rate (%) by Facility Proportion Non-White Patients, 2010/2011

% of Facility Patients that are Non-White	N Obs (LTCHs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <12%	116	23.5	18.1	21.8	23.5	25.1	30.6
12 to <22%	105	24.2	18.9	23.0	24.1	25.4	29.0
22 to <35%	115	24.3	17.9	23.0	24.3	25.8	28.5
35% or more	111	25.2	20.2	23.6	24.8	26.8	30.8
Total LTCHs	447	24.3	17.9	22.9	24.2	25.8	30.8

Note: The Risk-Standardized Readmission Rates reported are based on models that do not include race or Buy-In. LTCH=Long-Term Care Hospital; Obs=Observations; Pctl=Percentile.
Source: RTI analysis of Medicare claims data, 2007-2012. (RTI program references: lc38)

Table A-4
SES: Distribution of Risk-Standardized Readmission Rate (%) by Facility Proportion of Patients with Buy-In, 2010/2011

% of Facility Patients with State Buy-In during 2010/2011	N Obs (LTCHs)	Mean	Minimum	25th Pctl	Median	75th Pctl	Maximum
0 to <30%	106	23.4	17.9	21.6	23.3	24.9	29.9
30 to <38%	121	24.3	19.5	23.0	24.1	25.4	30.1
38 to <47%	110	24.4	18.4	23.0	24.1	25.7	30.6
47% or more	110	25.1	21.2	23.9	24.9	26.4	30.8
Total LTCHs	447	24.3	17.9	22.9	24.2	25.8	30.8

Note: The Risk-Standardized Readmission Rates reported are based on models that do not include race or Buy-In. LTCH=Long-Term Care Hospital; Obs=Observations; Pctl=Percentile.
Source: RTI analysis of Medicare claims data, 2007-2012. (RTI program references: lc38)

CENTER FOR OUTCOMES RESEARCH AND EVALUATION

MEMORANDUM

TO: Admissions and Readmissions Standing Committee
FROM: Elizabeth Drye and Susannah Bernheim, Yale New Haven Health Services Corporation - Center for Outcome Research and Evaluation (CORE)
THROUGH: Lein Han and Vinitha Meyyur, CMS
DATE: Wednesday, January 21, 2015
SUBJECT: Evaluation of whether to enter measures from the NQF Admission and Readmission committee in the trial period for consideration of socio-demographic adjustment (SDS)

CORE developed four measures on behalf of the Centers for Medicare and Medicaid Services that the NQF Admission and Readmission Committee evaluated over the last year:

- NQF #0505: Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
- NQF #2513: Hospital 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) following Vascular Procedures
- NQF #2515: Hospital 30-day, all-cause, unplanned, risk-standardized readmission rate (RSRR) following coronary artery bypass graft (CABG) surgery
- NQF #2539: Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy

In December 2014, the NQF board ratified the endorsement of these measures with the condition that they be brought back within a year for evaluation of unintended consequences and that they be considered for inclusion in the NQF trial period for consideration of socio-demographic status (SDS) adjustment. On January 6, 2015, NQF requested we provide information for the committee to use in their determination of which measures should enter the trial.

Below we respond to the questions posed by NQF in the January 6th request. In general, as evidenced by the national debate around SDS-adjustment, the question of the relationship between SDS and admissions/hospital days/readmissions is complex and not well understood. Given the time frame of this request we have provided a brief discussion of the possible pathways underlying these relationships and have directed the committee to the empiric information that we had previously produced for these measures. Further analytic work will take substantial resources and cannot be done in the timeframe requested.

Question 1. Describe the conceptual relationship between your outcome measure and possible SDS risk factors. Specifically, provide support from the literature or other empirical data on whether a conceptual relationship exists between at least one (1) specific SDS risk factor and the outcome being measured. Describe the possible risk

factor(s) that exhibits the strongest relationship to admissions/readmissions. Possible SDS risk factors for examination may include income, level of education, homelessness status, English language proficiency, health insurance status, occupation, employment status, literacy, health literacy, or neighborhood-level data that can be used as a proxy for individual data such as median neighborhood income, education, or local funding availability for safety net providers.

Question 1 Response

Pathways potentially mediating the relationship between SDS and the measure scores.

A variety of SDS factors may influence readmission risk following a hospital visit for AMI, CABG or a vascular procedure as well as the risk of returning to the hospital in the days following colonoscopy. These outcomes may be influenced by traditional socioeconomic status variables such as income/wealth, education level and occupational status, as well as literacy, English language proficiency, health literacy, housing, and race. In addition, a wide range of related factors and markers of community SDS may also influence outcomes. It is not clear that any particular one SDS factor is predominant in increased risk of returning to the hospital. Moreover the pathways by which these variables likely influence outcomes are similar. Therefore our response addresses common pathways by which individual SDS variables may affect risk of the return to the hospital.

The pathways by which these factors influence the risk of return to the hospital following an acute illness or major surgery, like the factors themselves, are varied and complex. There are at least 4 potential pathways that are important to consider. We briefly describe them here and comment on their implications for the four hospital readmission measures.

1. Relationship of SDS to health at admission. Socioeconomic disadvantage often leads to worse general health status and therefore patients who have lower income/education/literacy and tenuous housing may present for their hospitalization or procedure with a greater severity of underlying illness. These factors may also contribute to worse health status at admission due to patients failing to respond to early symptoms and presenting later in their disease process.

Race, per se, may not directly affect health status at presentation but is associated with worse health, likely through its association with other socioeconomic factors.

2. Relationship of SDS to the use of low-quality hospitals. SDS factors may be associated with lack of access to health care providers because of the distribution of providers and prohibitive costs. In particular, SDS factors can influence the likelihood that patients access high quality care. That is to say, patients of low income, lower education or tenuous housing may not have access to high quality facilities because such facilities are less likely to be found in low SDS geographic areas. There is evidence that poor and minority patients are more likely to be seen in lower quality hospitals and this can contribute to the likelihood that they will return to the hospital. [1,2,3]

[1] Jha AK, Orav EJ, Epstein AM. Low-quality, high-cost hospitals, mainly in South, care for sharply higher shares of elderly black, Hispanic, and medicaid patients. Health affairs (Project Hope). Oct 2011;30(10):1904-1911.
[2] Reames BN, Birkmeyer NJ, Dimick JB, Ghaferi AA. Socioeconomic disparities in mortality after cancer surgery: failure to rescue. JAMA surgery. May 2014;149(5):475-481.
[3] Skinner J, Chandra A, Staiger D, Lee J, McClellan M. Mortality After Acute Myocardial Infarction in Hospitals That Disproportionately Treat Black Patients. Circulation. 2005;112(17):2634-2641.

3. Relationship of SDS to differential care within a hospital. The third major pathway by which SDS factors could contribute to risk is that patients may not receive equivalent care within a facility. For example, patients of low income or minority race may experience differential, lower quality, or discriminatory care within a given facility.[4] Alternatively, patients with SDS risk factors may require differentiated care – e.g. provision of lower literacy information – that they do not receive. That is to say, hospitals may provide the same care for all populations (e.g. the same discharge instructions) and this may represent substandard care for patients for whom the standard approach is not effective (e.g. due to low literacy). By failing to actively address the unique needs of patients of low SDS, institutions may be, in essence, providing lower quality care to SDS patients.

4. Influence of SDS on readmission risk outside of care quality and health status. Some SDS factors, such as income/wealth may affect the likelihood of readmission without directly affecting health status on admission or the quality of care received during the hospital stay. For instance, while a hospital may make appropriate care decisions and provide tailored care and education, a lower-income patient may elect not to follow prescribed care (e.g. refill a prescription or keep a follow-up visit with a primary care provider) because limited resources create competing priorities for the patient.

Implications for the Readmission Measures

Each of the pathways described above have different implications for the treatment of SDS variables within the model. For example, to the extent SDS influences risk by affecting admission health status, this may already be accounted for in the clinical risk-adjustment of the measures and further adjustment may not be warranted. In other scenarios (e.g. #2 and #3) the means by which SDS influences the likelihood of return to the hospital is enmeshed with the quality of care a patient receives – in which case adjustment should be approached with more caution. All of these pathways may be implicated, but the relative influence of each has been little studied to date. Moreover, we have limited ability to access many key SDS variables for linking to national Medicare population. (At this time the most feasible markers of low SDS are Medicaid status and census data.) Determining the best approach to handling SDS factors will inevitably be complex for these measures.

Implications for the Colonoscopy Measure

The likelihood that SDS factors mediate the relationship between the measured quality and the outcome is unique to each measure. In our view, it is unlikely that SDS is related to the outcome of our colonoscopy measure in ways we are not adequately adjusting for (i.e. clinical risk factors and procedural risk). Clinically, patients in the measures are all well enough to undergo the procedure in the outpatient setting, and most are undergoing the procedure for screening only. The most common causes of hospital visits within 7 days (e.g. urinary retention, nausea/vomiting, bleeding) are unlikely to be mitigated by SDS through non-clinical pathways unrelated to quality. Our literature review for this measure examined risk factors for complications and hospital visits following outpatient colonoscopy; in the 27 studies we reviewed, SDS was not identified as a risk factor. Moreover, in our consultations with a diverse national expert panel of stakeholders and in a national public comment period on the measure, SDS was not raised as a potential confounder.

> **Question 2.** Describe the relationship between the SDS risk factor(s) and the measured unit (hospital, SNF, etc.) to indicate the variation in the risk factor across the measured

[4] Trivedi AN, Nsa W, Hausmann LRM, et al. Quality and Equity of Care in U.S. Hospitals. New England Journal of Medicine. 2014;371(24):2298-2308.

unit. Information from the literature is sufficient to indicate potential variation; however, empirical data for the measure as specified (e.g., via bivariate frequency distributions) would be needed to demonstrate that variation does not exist and therefore adjustment is not appropriate.

Question 2 Response

There is substantial variation in SDS risk factors across hospitals, as evidenced by the analyses included in our NQF applications and provided in the appendix. However, there is little literature to directly address the relationship of SDS variables and readmissions at the unit of hospital or outpatient hospital setting. Most literature in this area has focused on patient-level relationship. For the four readmission measures we have already completed empiric analyses as a part of our application (please see Section 1b.4. of the NQF submission form and appendix below). For each of these we divided hospitals into subgroups based on the proportion of patients who are low SES (as defined by being dually-eligible for Medicaid) or black patients cared for. In the case of all the measures we find that the hospitals with high proportions of low SES or black patients have similar results as those with fewer low SES or black patients.

For the colonoscopy measure we did not have the data available to do a similar analysis because we had only a limited number of patients per provider during measure development, so we could not generate measure scores for providers nationally. In our NQF application (please see Section 1b.2. of the NQF submission form) we do present the distribution of the **raw** unplanned hospital visits within 7 days across subgroups of hospitals and ambulatory surgery centers grouped by proportion of dual-eligible patients. Because we expect risk factors we adjust for in the measure to relate to SDS, the unadjusted data are not informative about whether there is a relationship between SDS and the risk-standardized measure score. We will have data to calculated national measure scores for providers in the late summer of 2015; however, further analysis of this issue is not currently budgeted.

Question 3. In your view, should the measure enter the trial period? Note: Final decision will be made by the standing committee.

Question 3 Response

We do not have a recommendation on whether the readmission measures should enter the trial period. In its overview of the issues and the analyses performed to date we hope this memo is helpful to the committee as it makes a decision on the measures. As noted, the decision about adjustment of these measures is inevitably complex. The differences among hospitals are relatively small and the potential explanatory pathways are complex to disentangle analytically. We suspect that conceptual and policy decisions will inevitably heavily influence final decisions regarding risk-adjustment.

We do not recommend a re-evaluation of the colonoscopy measure given the low likelihood SDS is related to the outcome in ways our risk adjustment does not already address, and data is not currently available to further investigate the relationship between the measure score and SDS.

Appendix

A.1 Disparities Data for Measure NQF #0505: Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization

Table 1.1. Distribution of AMI RSRRs by Proportion of Medicaid Patients (Jun 2009 – Jun 2012)

Dates of Data: July 2009-June 2012
Data Source: Medicare FFS claims

Characteristic	Hospitals with a low proportion (≤8%) Medicaid patients	Hospitals with a high proportion (≥39%) Medicaid patients
# of hospitals	228	228
# of patients	51,198	38,809
Max	22.0	22.1
90%	19.7	20.3
Q3	19.0	19.5
Median	18.3	18.6
Q1	17.4	17.9
10%	16.8	17.3
Min	15.2	15.5

Table 1.2. Distribution of AMI RSRRs by Proportion of African-American Patients (Jun 2009 – Jun 2012)

Dates of Data: July 2009-June 2012
Data Source: Medicare FFS claims

Characteristic	Hospitals with a low Proportion (0%) African-American patients	Hospitals with a high Proportion (≥22%) African-American patients
# of hospitals	228	228
# of patients	29,066	41,400
Max	22.0	24.3
90%	19.2	20.7
Q3	18.4	19.8
Median	17.9	18.9
Q1	17.4	18.2
10%	16.6	17.6
Min	14.7	15.5

A.2 Disparities Data for Measure NQF #2513: Hospital 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) following Vascular Procedures

We conducted analyses to explore disparities by socioeconomic status (SES) and race at the hospital level. We used Medicaid eligibility status identified in the Medicare claims EDB as a proxy for SES. Hospitals were categorized into quintiles based on their proportion of dual eligible patients, with the lowest and highest quintile consisting of hospitals with lower and higher proportion of dual eligible patients, respectively. Analyses demonstrated that median RSRRs and the distributions of RSRRs were consistent across quintiles. This analysis suggests that that many hospitals with a high proportion of dual eligible patients can and do perform well on the measure.

Similar analyses were conducted for the proportion of African-American patients in hospitals that showed that the median RSRRs were consistent across quintiles of hospitals based on the hospital proportion of African-American patients. Similarly, the distributions were overlapping. This indicates that hospitals with high proportion of African-American patients can perform as well on the measure as hospitals with lower proportion of African-American patients.

Table 2.1. Distribution of Vascular RSRRs across quintiles by proportion of Medicaid patients over different time periods for hospitals with at least 25 index hospital stays in the study period (2010)

Year Dataset R: 2010

Quintile	1	2	3	4	5
# of hospitals	326	327	327	327	326
% Medicaid LL	0.1	11.6	16.4	19.7	24.2
% Medicaid UL	11.6	16.4	19.7	24.2	66.5
Max	17.1	17.0	16.6	17.6	17.9
90%	14.7	14.8	14.7	15.0	15.2
Q3	14.2	14.2	14.2	14.3	14.5
Median	13.6	13.5	13.5	13.7	13.9
Q1	13.0	13.0	13.0	13.2	13.3
10%	12.5	12.5	12.6	12.7	12.8
Min	10.9	11.2	11.0	10.8	11.3

Table 2.2. Distribution of Vascular RSRRs across quintiles by proportion of African-American (AA) patients over different time periods for hospitals with at least 25 index hospital stays in the study period (2010)

Year Dataset R: 2010

Quintile	1	2	3	4	5
# of hospitals	329	331	330	331	329
% AA patients LL0.0	0.0	0.6	2.9	6.9	14.6
% AA patients UL0.6	0.6	2.9	6.9	14.6	97.7
Max	16.2	17.6	17.6	17.4	17.9
90%	14.4	15.0	15.0	15.1	15.0
Q3	14.0	14.2	14.3	14.4	14.4
Median	13.4	13.6	13.7	13.8	13.9

Quintile	1	2	3	4	5
Q1	12.9	13.0	13.1	13.2	13.3
10%	12.5	12.6	12.5	12.6	12.7
Min	11.0	10.8	11.4	10.9	11.2

A.3 Disparities Data for Measure NQF #2515: Hospital 30-day, all-cause, unplanned, risk-standardized readmission rate (RSRR) following coronary artery bypass graft (CABG) surgery

Table 3.1. Distribution of CABG RSRRs by Proportion of Medicaid Patients

We determined a SES level for each hospital, by calculating the percentage of patients dually enrolled in both Medicare and Medicaid for each hospital, using all patients admitted to each hospital. We grouped hospital into deciles by percentage of Medicaid beneficiaries and examined hospital-level RSRRs across deciles (hospitals in the lowest decile had <3% Medicaid beneficiaries and those in the highest decile had >29% Medicaid beneficiaries). There were increases in median RSRRs across deciles (0.6% increase between lowest to highest). The median (range) weighted RSRR was 16.8% (13.3%-21.9%) for hospitals in the lowest (fewest Medicaid beneficiaries) and 17.4% (14.1%-21.1%) for the highest (most Medicaid beneficiaries) deciles. The distributions for the RSRRs overlapped and the distribution for th ose hospitals caring for the highest proportion of Medicaid beneficiaries was narrower than for those caring for the fewest Medicaid patients, with the worst hospital in the highest decile (most Medicaid beneficiaries) performing better on the measure than the worst hospital in the lowest decile (fewest Medicaid beneficiaries). Many hospitals in the highest decile performed well on the measure. On the CABG readmission measure, overall the hospitals with the most Medicaid beneficiaries perform slightly worse than hospitals with the fewest Medicaid beneficiaries, but the two groups show a similar range of performance, indicating that both groups can perform well on the measures.

Decile	Number of Hospitals	% Medicaid (Min)	% Medicaid (Max)	RSRR Median	RSRR Min	RSRR Max
.	1,197	0	100.0	16.85%	12.53%	22.36%
1	119	0	3.26	16.85%	13.30%	21.88%
2	119	3.27	5.15	16.40%	12.66%	21.10%
3	116	5.17	6.65	16.53%	13.48%	20.20%
4	125	6.67	7.86	16.85%	13.62%	21.93%
5	119	7.87	9.23	16.58%	13.34%	22.07%
6	121	9.26	11.1	16.75%	12.53%	21.68%
7	118	11.18	13.61	16.97%	13.81%	20.79%
8	121	13.64	18.55	17.37%	13.35%	22.36%
9	120	18.56	29.36	16.94%	12.76%	21.77%
10	119	29.41	100.0	17.44%	14.11%	21.11%

Table 3.2. Distribution of CABG RSRRs by Proportion of African-American Patients

We used the Medicare Provider Analysis and Review (MEDPAR) File for 2008-2010 to calculate the percentage of African-American patients at each hospital, using all patients admitted to each hospital. We examined hospital-level RSRRs across hospitals which were grouped by decile of percentage of African-American patients for whom they cared (hospitals in the lowest decile had <0.9% African-American patients and those in the highest decile had >14% African-American patients). There was an increase in median RSRRs by decile (0.5% increase between lowest to highest) as well as a broader range of RSRRs as the proportion of African-American patients increased. The distributions for the RSRRs overlapped, and many hospitals caring for the highest percentage of African-American patients performed well on the measure. The median (range) weighted RSRR for hospitals with the highest proportion of African-American patients was 17.3% (12.5%-22.4%) compared with 16.8% (12.7%-21.9%) for hospitals with the lowest proportion of African-American patients. On the CABG readmission measure, overall the hospitals with the most African-American patients perform slightly worse than hospitals with the fewest African-American patients, but the two groups show a similar range of performance, indicating that both groups can perform well on the measures.

Decile	Number of Hospitals	% African-American (Min)	% African-American (Max)	RSRR Median	RSRR Min	RSRR Max
.	1,197	0	100.0	16.85%	12.53%	22.36%
3	358	0	0.86	16.76%	12.66%	21.88%
4	121	0.86	1.67	16.71%	12.85%	21.09%
5	120	1.68	2.53	16.74%	13.30%	21.11%
6	119	2.53	3.72	17.21%	13.80%	21.53%
7	119	3.73	5.73	16.71%	14.11%	21.93%
8	121	5.75	8.74	16.93%	13.58%	22.07%
9	120	8.75	13.91	17.21%	14.04%	21.77%
10	119	13.96	100.0	17.34%	12.53%	22.36%

THE SOCIETY OF THORACIC SURGEONS

633 N Saint Clair St, Floor 23
Chicago, IL 60611-3658
(312) 202-5800
sts@sts.org
www.sts.org

January 22, 2015

Bruce Hall, MD, PhD, MBA, Co-Chair
Sherrie Kaplan, PhD, Co-Chair
NQF All-Cause Admissions and Readmissions Standing Committee
National Quality Forum
1030 15th Street NW
Suite 800
Washington DC 20005

RE: Developer Response Regarding Sociodemographic Status (SDS) Adjustment Trial Period

Dear Drs. Hall and Kaplan:

We are writing to offer our input to the NQF All-Cause Admissions and Readmissions Standing Committee regarding whether our measure, Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate (NQF# #2514), should enter the NQF trial period for sociodemographic status (SDS) adjustment. We understand that our response letter will be taken into consideration during the standing committee's deliberations on January 26, 2015.

Current NQF policy suggests that the conditions for inclusion of SDS factors exist under the following circumstances [1]:

> "**Recommendation 1**: When there is a conceptual relationship (i.e., logical rationale or theory) between sociodemographic factors and outcomes or processes of care and empirical evidence (e.g., statistical analysis) that sociodemographic factors affect an outcome or process of care reflected in a performance measure…those sociodemographic factors should be included in risk adjustment of the performance score (using accepted guidelines for selecting risk factors) unless there are conceptual reasons or empirical evidence indicating that adjustment is unnecessary or inappropriate…"

In the context of this NQF recommended policy, we believe that there is sufficient evidence regarding the association of SDS factors and readmission to justify the study of these factors in our Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate (NQF# #2514) measure. The following brief summary reviews the arguments and evidence.

<u>Readmission and SES factors—Arguments pro and con</u> [1-10]
Risk of mortality and other short-term clinical outcomes is mostly influenced by clinical factors present on admission, such as cardiogenic shock. By convention, given the plausible causal pathways leading to these outcomes, risk models used for mortality profiling have generally excluded non-

clinical patient factors or local environmental factors, as their inclusion might theoretically adjust out important inequities in care.

Historically, the same general approaches have been used for readmission models. However, compared with the risk of early clinical events such as mortality, readmission risk is associated with a broader and more complex range of predisposing factors, which vary in the degree to which they are under the control of the index hospital. There is broad consensus in the literature that non-clinical patient factors (e.g., race, ethnicity, socioeconomic status) and local environmental factors (e.g., availability and quality of post-discharge healthcare services) are associated with readmissions and probably to a greater extent than they are with early clinical outcomes such as mortality (See Appendix—Literature Review). Although these factors may all confound the apparent association between quality of care and readmission, by convention, they have not been included in profiling risk models, although they are perfectly acceptable and even desirable for use by hospitals in identifying patients for targeted interventions to reduce readmissions.

Recently, because of the disproportionate impact of such non-clinical variables on the risk of readmission compared with mortality, and because certain hospitals care for much higher proportions of vulnerable populations, many have questioned whether this policy should be reconsidered for readmission models. Under the Hospital Readmissions Reduction Program, hospitals are penalized for readmission rates that are higher than expected, and these rates are currently adjusted only for patient clinical comorbidities. This has resulted in disproportionate penalties to hospitals serving disadvantaged populations. Joynt and Jha [7] note that the proportion of hospitals receiving penalties and the magnitude of penalties are directly related to the percentage of their patients receiving Supplemental Security Income. Lipstein and Dunagan [4] report that in the St. Louis area, the four hospitals with the highest poverty index also had the highest readmission rates and in some cases the highest penalties, potentially jeopardizing their financial survival.

Hospitals caring for the most vulnerable populations argue for SDS adjustment in order to avoid penalties for excess readmissions which they believe are inevitable given their patient populations. If readmissions are thought to be strongly associated with non-clinical factors in the external environment (e.g., a lack of community resources, poor living environment), then it is a societal and health delivery system problem of a larger scale than could be addressed by most hospitals. Hospitals serving predominately vulnerable patients, those at highest risk for readmission, may simply not have the necessary resources to broadly implement readmission-mitigation interventions in a non-research setting. While summary *Hospital Compare Chartbook* data [11] suggest that some hospitals serving higher proportions of Medicaid or African American populations have readmission rates comparable to those serving wealthier non-minority populations (i.e., substantial overlap), the distributions of readmission rates for hospitals serving more vulnerable populations show higher rates at every quantile examined [11-13]. It seems unlikely that all such hospitals will be able to institute the interventions necessary to overcome major social and local environmental challenges. As pointed out by Lipstein and Dunagan [4], "Although some safety-net providers across the United States are able to keep readmission rates below national averages, policymakers should not assume that all safety-net providers are equally resourced at the local level so that the playing field is, indeed, level. It is not. Some of these hospitals receive substantial economic support from local taxing jurisdictions; others receive no local funding. The former may well have the necessary patient care infrastructure to manage discharged patients in an outpatient or home setting; the latter probably do not."

Reimbursement penalties for excess readmissions may thus "make the poor poorer", a potential unintended negative consequence. If some hospitals caring for the most disadvantaged populations are financially unable to positively impact the local outpatient environment, perhaps the most important

determinant of readmission for many conditions, then penalizing them will further reduce their effectiveness, and disparity gaps will widen. Such hospitals may also be increasingly reluctant to care for the neediest patients because they are the most likely to require readmission, a form of risk aversion that will reduce access to care for these patients.

On the other hand, some experts are concerned that inclusion of SDS adjustment to readmission measures would make poor outcomes in disadvantaged patients "expected", in the same way we expect worse outcomes in patients who have multiple comorbidities, and that this would essentially adjust away disparities in care (importantly, as pointed out in the NQF policy report [1], "expected" in this sense does not refer to ethical or moral acceptability but rather to the statistical output of a risk algorithm). These experts argue that if such patients were appropriately identified by hospitals before discharge, targeted interventions (e.g., more intensive follow-up phone calls) might reduce the subsequent need for readmission. Those holding this view argue that knowledge of the external environment and home living situation of patients is within the purview of hospitals, which then have a responsibility to focus additional post-discharge resources on patients from such environments.

Strategies for dealing with the effect of SDS factors

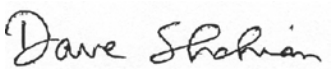
The preceding considerations have stimulated debate regarding ways in which the legitimate goal of reducing readmissions may be incentivized, while at the same time limiting the potential for unintended negative consequences. Many alternative or adjunctive strategies have been recommended [1-10]. These include the investigation of readmission profiling models with and without SDS variables, and comparison with stratified results (as in the NQF recommendation); comparison of safety-net hospitals' readmission performance with that of other similar hospitals rather than those serving less vulnerable populations; assessing improvements in readmissions rates over time rather than absolute values only; slower phasing in of readmission penalties; incentives for reducing disparities in care; and the use of process measures that incentivize effective transitions and care coordination. Additional funding might also be considered for hospitals serving vulnerable populations to assist them in developing and implementing programs to reduce readmissions (the opposite of current plans to penalize such hospitals).

Summary

We believe the preponderance of evidence suggests an association between SDS factors and readmission rates, and this has profound implications for the health care system if not addressed. Notwithstanding many excellent suggestions and strongly held beliefs, the best way to deal with this issue has yet to be determined. There is very little information regarding this topic in the CABG population. Therefore, with the permission of NQF, and contingent upon our ability to secure funding support, STS requests that our CABG readmission measure enter the NQF trial period.

We appreciate the opportunity to share our thoughts and recommendation with the NQF All-Cause Admissions and Readmissions Standing Committee. Thank you for your thoughtful consideration.

Respectfully yours,



David M. Shahian, MD
Chair, STS Workforce on National Databases
Chair, STS Quality Measurement Task Force

Jeffrey P. Jacobs, MD
Chair, STS Public Reporting Task Force
STS Surgeon Representative for NQF Surgery Project Phase 1 & 2

Richard L. Prager, MD
Chair, STS Quality, Research and Patient Safety Council Operating Board

Frederick L. Grover, MD
Immediate Past Chair, STS Quality, Research and Patient Safety Council Operating Board
STS Voting Representative and Primary NQF Contact

Appendix: Readmission and SDS factors—Focused Literature Review

In a study of nearly 12,000 patients in Massachusetts hospitals, Weissman and colleagues [15] found that patients were more likely to be readmitted within 60 days if they were poor (adjusted OR = 1.25, p < .05), worked in unskilled or semiskilled occupations (adjusted OR = 1.25, p < .05), or rented their homes (adjusted OR = 1.23, p < .01). Philbin and colleagues [16] studied readmission risk among 41,776 New York heart failure patients in 1995. Patients living in lower income neighborhoods were more often women or African-Americans, they had more comorbid illnesses, more frequently used Medicaid insurance, and were more often admitted to rural hospitals. The crude frequency of readmission decreased from the lowest quartile of income (23.2%) to the highest (20.0%, p <0.0001). Even after adjustment for baseline differences and care processes, income was still a significant predictor, with an increased readmission risk for lower levels of income (adjusted odds ratio for comparing quartile 1 to quartile 4, 1.18; 95% CI 1.10 - 1.26, p <0.0001).

Amarasingham and colleagues [17] developed a real-time predictive model to identify hospitalized heart failure patients at high risk for readmission or death, using data from a major urban medical center collected in 2007-2008. As in virtually all other studies, this readmission model had inferior predictive performance compared with mortality risk models. However, discrimination of their electronic readmission model (c-index 0.72) was superior to that of most other readmission algorithms, including the CMS model. **Variables for social instability and lower socioeconomic status were largely responsible for the improved performance of the readmission model, as demonstrated by c-indices with and without these variables (0.72 vs. 0.61, p < 0.05). The authors conclude that the addition of complex social factors may significantly enhance performance of readmission models**. This view is further supported by the work of Rathore and colleagues [18] who found that low SES heart failure patients had a higher risk of readmission (RR 1.08, 95% 1.03–1.12).

Joynt and colleagues [19] studied Medicare fee-for-service patients who had readmissions for heart failure, MI, and pneumonia between 2006 and 2008. Black patients had higher readmission rates than white patients (24.8% vs 22.6%, OR 1.13; 95% CI, 1.11-1.14), and patients from minority-serving hospitals had higher readmission rates than those from non-minority-serving hospitals (25.5% vs 22.0%, OR 1.23; 95% CI, 1.20-1.27). Compared with white patients from non-minority serving hospitals, black MI patients from minority-serving hospitals had the highest readmission rate (26.4% vs. 20.9%; OR 1.35; 95% CI 1.28-1.42), while white patients from minority-serving hospitals had a 24.6% readmission rate (OR, 1.23; 95% CI, 1.18-1.29). Black patients from non-minority-serving hospitals had a 23.3% readmission rate (OR 1.20; 95% CI 1.16-1.23). Patterns were similar for CHF and pneumonia, and the results suggest that site of care may be at least as important a predictor of readmission risk as race. This may reflect the financial inability of hospitals serving predominately minority populations to plan and execute coordinated post-discharge care. Commenting on these findings, Hernandez and Curtis [20] conclude that hospitals serving large minority populations may be penalized to a proportionately greater extent by impending reimbursement changes tied to higher than average readmission rates. Many of these factors are a failure of the health care and societal support systems rather than a particular hospital [21]. The authors argue that if inferior care is being provided to patients solely because of race, then this should not be included in risk models as it masks disparate care. On the other hand, if black race is a proxy for socioeconomic or other markers of vulnerable populations that are unrelated to in-hospital care and outside the control of hospitals, then failure to include this in risk models may result in widening of disparities. It may be unreasonable for hospitals serving low income areas to be held responsible for assuring effective care transitions and outpatient care if the local community environment does not have the necessary resources. The authors conclude that current plans to penalize hospitals based on readmission rates, at least as currently calculated,

have the potential of harming the hospitals most in need of support, and that the result may be a progressive widening of disparities.

Kansagara and colleagues [22] conducted a comprehensive review of risk prediction models for hospital readmission. Thirty studies of 26 unique risk models met their search criteria. Fourteen models were derived from retrospective administrative data and were thought to be potentially useful for comparative hospital profiling. Nine of these were tested in large US studies and demonstrated predictive discrimination (c-index 0.55 - 0.65) that was poor compared with most mortality prediction models, including the three current CMS models [23] for AMI [24], heart failure [25], and pneumonia [26] which have c-indices of 0.61-0.63. Three studies used real-time administrative data collected during the hospitalization to identify patients at high risk of readmission for targeted interventions. Because they were not being used for hospital profiling, these models included a broad range of social factors such as number of address changes, census tract socioeconomic status, cocaine use, marital status, in addition to comorbidities and prior use of medical services. The discrimination of these models (0.69-0.72) was superior to that of profiling models with more limited range of variables, which suggests that social factors play an important role in the risk of readmission.

Arbaje and colleagues [14] found that among Medicare beneficiaries, after adjusting for demographics and clinical status, the odds of early readmission were increased by living alone (odds ratio or OR = 1.50, 95% confidence interval or CI = 1.01-2.24), having unmet functional need (OR = 1.48, 95% CI = 1.04-2.10), lacking self-management skills (OR = 1.44, 95% CI = 1.03-2.02), and having limited education (OR = 1.42, 95% CI = 1.01-2.02). Using the Singh census block area deprivation index (ADI) and a 5% Medicare sample from 2004 to 2009, Kind and colleagues [28] found that within the most disadvantaged 15% of neighborhoods, rehospitalization rates increased from 22% to 27% with worsening ADI, even with full adjustment. The magnitude of this effect was comparable to that of chronic pulmonary disease and actually greater than that of uncomplicated diabetes. In a study of 30-day readmission rates for a variety of surgical procedures, using Medicare data from 2007 to 2010, Tsai and colleagues [27] found that "Black patients had higher readmission rates than white patients (14.8% vs 12.8%, odds ratio [OR] 1.19; 95% confidence interval [CI], 1.16–1.22; $P < 0.001$). Patients undergoing major surgery at minority-serving hospitals also had higher readmission rates (14.3% vs 12.8%, OR 1.14, 95%CI 1.09–1.19; $P < 0.001$). In multivariate analyses, black patients at minority serving hospitals had the highest overall odds of readmissions (OR 1.34). White patients at minority-serving hospitals (OR 1.15) and black patients at non–minority-serving hospitals (OR 1.20) also had higher odds of readmission than the reference group of white patients at non–minority-serving hospitals. Racial disparities were mediated in part by poverty."

In a study of patients at Henry Ford Hospital, Hu and colleagues [8] found that patients living in high-poverty neighborhoods were 24 percent more likely than others to be readmitted, after adjustment for demographic characteristics and clinical conditions. Married patients were less likely to be readmitted, perhaps because they had more social support.

In their comprehensive review, Calvillo-King and colleagues [29] found that "Our systematic review identified 72 studies that had some information on the impact of social factors on risk of readmission or mortality in patients with CAP and HF… a broad spectrum of social factors were associated with worse outcomes in two common but different conditions: CAP, an acute infectious illness, and HF, a chronic disease with acute exacerbations. There were some themes across conditions and outcomes. Among Level 1 sociodemographic characteristics, older age was clearly the most consistent risk factor. Findings of disparities by race/ethnicity or gender were very mixed. Among Level 2 factors, various measures of low socioeconomic status (low income, education, Medicaid insurance) clearly increased risk. While few studies examined the same Level 3 variables, there was proof of concept

evidence that social environment (housing stability, social support), behavioral (adherence, smoking, substance abuse), socio-cognitive (language proficiency), and neighborhood (rurality, distance to hospital) factors were independent predictors of poor posthospital outcomes."

Cardiac Surgery

There is little current information regarding the association of SES factors with readmission after cardiac surgery, and specifically CABG. However, in the excellent review of New York CABG readmissions by Hannan and colleagues [30], in multivariable analyses African American patients had an increased odds of 30-day readmission (1.16, 1.01-1.32, $p = 0.03$) and Medicaid patients had an increased odds ratio of 1.44 (1.22-1.70, $p < 0.0001$).

Reference List

(1) NQF Risk adjustment for Socioeconomic Status or other Sociodemographic Factors, accessed at http://www.qualityforum.org/Publications/2014/08/Risk_Adjustment_for_Socioeconomic_Status_or_Other_Sociodemographic_Factors.aspx Accessed on January 15, 2015.

(2) Bernheim SM. Measuring quality and enacting policy: readmission rates and socioeconomic factors. *Circ Cardiovasc Qual Outcomes* 2014; 7(3):350-352.

(3) Krumholz HM, Bernheim SM. Considering the role of socioeconomic status in hospital outcomes measures. *Ann Intern Med* 2014; 161(11):833-834.

(4) Lipstein SH, Dunagan WC. The risks of not adjusting performance measures for sociodemographic factors. *Ann Intern Med* 2014; 161(8):594-596.

(5) Casalino LP, Elster A, Eisenberg A, Lewis E, Montgomery J, Ramos D. Will pay-for-performance and quality reporting affect health care disparities? *Health Aff (Millwood)* 2007; 26(3):w405-w414.

(6) Chien AT, Chin MH, Davis AM, Casalino LP. Pay for performance, public reporting, and racial disparities in health care: how are programs being designed? *Med Care Res Rev* 2007; 64(5 Suppl):283S-304S.

(7) Joynt KE, Jha AK. A path forward on Medicare readmissions. *N Engl J Med* 2013;368(13):1175-1177.

(8) Hu J, Gonsahn MD, Nerenz DR. Socioeconomic status and readmissions: evidence from an urban teaching hospital. *Health Aff (Millwood)* 2014; 33(5):778-785.

(9) Nagasako EM, Reidhead M, Waterman B, Dunagan WC. Adding socioeconomic data to hospital readmissions calculations may produce more useful results. *Health Aff (Millwood)* 2014; 33(5):786-791.

(10) Axon RN, Williams MV. Hospital readmission as an accountability measure. *JAMA* 2011; 305(5):504-505.

(11) Medicare Hospital Quality Chartbook-- Performance Report on Outcome Measures-- September 2013, Accessed January 15, 2015 at http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Downloads/-Medicare-Hospital-Quality-Chartbook-2013.pdf

(12) Atkinson G, Giovanis T. Conceptual errors in the CMS refusal to make socioeconomic adjustments in readmission and other quality measures. *J Ambul Care Manage* 2014; 37(3):269-272.

(13) Atkinson JG. Flaws in the Medicare readmission penalty. *N Engl J Med* 2012; 367(21):2056-2057.

(14) Arbaje AI, Wolff JL, Yu Q, Powe NR, Anderson GF, Boult C. Postdischarge environmental and socioeconomic factors and the likelihood of early hospital readmission among community-dwelling Medicare beneficiaries. *Gerontologist* 2008; 48(4):495-504.

(15) Weissman JS, Stern RS, Epstein AM. The impact of patient socioeconomic status and other social factors on readmission: a prospective study in four Massachusetts hospitals. *Inquiry* 1994; 31(2):163-172.

(16) Philbin EF, Dec GW, Jenkins PL, DiSalvo TG. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. *Am J Cardiol* 2001; 87(12):1367-1371.

(17) Amarasingham R, Moore BJ, Tabak YP et al. An automated model to identify heart failure patients at risk for 30-day readmission or death using electronic medical record data 50. *Med Care* 2010; 48(11):981-988.

(18) Rathore SS, Masoudi FA, Wang Y et al. Socioeconomic status, treatment, and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure Project. *Am Heart J* 2006; 152(2):371-378.

(19) Joynt KE, Orav EJ, Jha AK. Thirty-day readmission rates for Medicare beneficiaries by race and site of care. *JAMA* 305(7):675-681.

(20) Hernandez AF, Curtis LH. Minding the gap between efforts to reduce readmissions and disparities. *JAMA* 2011; 305(7):715-716.

(21) Epstein AM. Revisiting readmissions--changing the incentives for shared accountability. *N Engl J Med* 2009; 360(14):1457-1459.

(22) Kansagara D, Englander H, Salanitro A et al. Risk prediction models for hospital readmission. *JAMA* 2011; 306(15):1688-1698.

(23) CMS readmission measure methodology, accessed 12/31/11 at http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841

(24) Krumholz HM, Lin Z, Drye EE et al. An administrative claims measure suitable for profiling hospital performance based on 30-day all-cause readmission rates among patients with acute myocardial infarction. *Circ Cardiovasc Qual Outcomes* 2011; 4(2):243-252.

(25) Keenan PS, Normand SL, Lin Z et al. An administrative claims measure suitable for profiling hospital performance on the basis of 30-day all-cause readmission rates among patients with heart failure. *Circ Cardiovasc Qual Outcomes* 2008; 1(1):29-37.

(26) Lindenauer PK, Normand SL, Drye EE et al. Development, validation, and results of a measure of 30-day readmission following hospitalization for pneumonia. *J Hosp Med* 2011; 6(3):142-150.

(27) Tsai TC, Orav EJ, Joynt KE. Disparities in surgical 30-day readmission rates for Medicare beneficiaries by race and site of care. *Ann Surg* 2014; 259(6):1086-90.

(28) Kind AJ, Jencks S, Brock J, Yu M, Bartels C, Ehlenbach W et al. Neighborhood socioeconomic disadvantage and 30-day rehospitalization: a retrospective cohort study. *Ann Intern Med* 2014;161(11):765-74.

(29) Calvillo-King L, Arnold D, Eubank KJ, Lo M, Yunyongying P, Stieglitz H et al. Impact of social factors on risk of readmission or mortality in pneumonia and heart failure: systematic review. *J Gen Intern Med* 2013; 28(2):269-282.

(30) Hannan EL, Zhong Y, Lahey SJ, Culliford AT, Gold JP, Smith CR et al. 30-day readmissions after coronary artery bypass graft surgery in New York State. *JACC Cardiovasc Interv* 2011; 4(5):569-576.

MEMORANDUM

ACUMEN
500 Airport Blvd., Ste 365
Burlingame, CA 94010
Main (650) 558-8882
Fax (650) 558-3981
http://www.acumenllc.com

TO: NQF Staff
FROM: Acumen, LLC
DATE: January 22, 2015
SUBJECT: Relationship between SDS Factors and Home Health Rehospitalization Measures

The recent National Quality Forum (NQF) technical report "Socioeconomic Status or Other Sociodemographic Factors" describes several categories of risk adjustment factors that move beyond clinical factors currently used for risk-adjustment of NQF endorsed outcome measures. These categories include genetics; demographic characteristics such as age, sex, race, or ethnicity; psychosocial, socioeconomic, and environmental factors; health related behaviors such as tobacco use, diet, or physical activity, and factors related to quality of life, attitudes, and perceptions. In response to NQF's memo titled "Next Steps for Admissions/Readmissions Measures Endorsed with Conditions", this memo evaluates the expansion of existing clinical risk adjustment models to account for additional sociodemographic factors that can be reliably and feasibly captured, the conceptual relationship between these factors and the measured outcome, and the variation of these factors across the measured health care providers, and provides a recommendation to include the Home Health (HH) rehospitalization measures in the trial period.

This memo initially recaps risk-factors currently used to adjust the Rehospitalization during the First 30 days of Home Health (NQF 2380) and Emergency Department (ED) Use without Hospital Readmission during the First 30 Days of Home Health (NQF 2505) measures. Second, we identify additional socio-demographic status (SDS) variables that are reliably and feasibly available to further adjust these measures. Third, we describe a conceptual relationship between rehospitalization and emergency department use and select socio-demographic variables. Fourth, we present population-level summary statistics for some of these factors, illustrating variation and disparities in outcomes. We conclude with a recommendation for including NQF 2380 and 2505 in the trial period and by discussing the next steps for developing sociodemographic risk-adjustment models.

Current Risk Adjustment and Available Socio-Demographic Factors

The current risk adjustment model for NQF 2380 and 2505 relies on five categories of risk factors:

- Prior Care Setting including: acute care received in 30 days prior to HH, acute care received in 6 months prior to HH, and length of index hospitalization
- Age and sex interactions
- Health Status as measures by: Hierarchical Condition Categories (HCCs) based on past 6 months of Medicare claims, Diagnosis-Related Grouping (DRGs) on index hospitalization, and activities of daily living indicators, as captured on HH claims

- Medicare Enrollment Status, which identifies beneficiaries who are eligible for Medicare due to End-Stage Renal Disease (ESRD) or who were originally eligible due to disability
- Additional interactions between HHCs and Medicare Enrollment Status

The current model already includes demographic characteristics of age and sex. Additionally, the prior care setting risk factors likely account for some of the impact that additional SDS factors have on acute care utilization. Finally, both the age categories and the Medicare Enrollment Status indicators identify beneficiaries who are disabled and disability may act as both a clinical risk factor and a socio-demographic factor, due to correlation with income or employment.

Our team has identified several additional socio-demographic factors that can be reliably and feasibly captured using existing data sources. These include:

- Race/Ethnicity – included in Medicare Enrollment Database (EDB)
- Medicaid Status – included in EDB
- Rural location – determined from beneficiary address, as captured in EDB
- Neighborhood characteristics – determined from beneficiary address linked to survey data, such as the American Community Survey, and potentially including median income, employment rate, and crime rate

CMS is also proposing to pursue additional indicators of SDS for evaluation of use in the measures, such as the Area Deprivation Index.

Conceptual Relationship between Proposed SDS factors and Outcomes

While a recent scoping review[1] found general agreement that persons of lower socioeconomic status are not disadvantaged in terms of HH care services, there is a well-documented socioeconomic gradient seen with primary and acute care services. Findings from the literature support a linkage between proposed SDS factors and ED use and hospital readmission. Individuals with lower social economic status (SES) are more likely to use EDs for primary health care services. In the home health setting, the 30-day period for re-hospitalization occurs while the patient is living in their own home, increasing the likelihood that non-medical factors, including geographic location and economic resources, will have an impact on acute care use. More specific findings regarding the documented relationship between socio-demographic factors, readmission and ED use are described below.

- A recent study of 30-day hospital readmission of elderly patients with initial discharge destination of HH care found race to be a significant predictor of readmission.[2]
- One study of 1375 patients examining differential use of EDs by various racial and ethnic groups found confounding impact by other SDS variables and concluded that programs to reduce inappropriate ED use must be sensitive to an array of complex socioeconomic issues and may necessitate a substantial paradigm shift in how acute care is provided in

[1] Goodridge et al. Socioeconomic disparities in home health care service access and utilization: A scoping review 2012: *International J. Nursing Studies* 49(10); 1310-19

[2] Richmond, D. Socioeconomic Predictors of 30-day Hospital Readmission of Elderly Patients with Initial Discharge Destination of Home Health Care (2013)

low SES communities. Research has also shown that ED wait time is also linked to factors related to race/ethnicity, with black patients having longer wait times than non-black patients.

- Even after adjustment for potential confounding factors, lower income is a positive predictor of readmission risk of patients for heart failure.[3]
- A study of community-dwelling elders with Medicare coverage discharged to home found that living alone and lower levels of education were significant predictors of readmission.[4]
- Significant disparities have been found in visits to the ED for conditions sensitive to ambulatory care by race/ethnicity, insurance status, age group, and socioeconomic status.[5]

Variation in Socio-Demographic Factors

Several socio-demographic factors were used to stratify the population level outcomes of rehospitalization and ED use in our original submission to NQF. Table 1 presents these results, using all HH stays beginning between July 1, 2010 and June 30, 2013. These results support the decision to include age, sex, and disability status in the existing risk adjustment model and also show that both race/ethnicity and Medicaid Status vary and are correlated with different outcome rates.

Table 1: Outcome Rates by Socio-Demographic Factor from NQF Submission

Population Group		Total Stays	ED Use without Hospital Readmission in 30 days		Rehospitalization in 30 days	
			# of Stays	% of Stays	# of Stays	% of Stays
National		2,889,894	261,706	9.1%	384,857	13.3%
Sex	**Female**	1,712,939	154,844	9.0%	218,827	12.8%
	Male	1,176,955	106,862	9.1%	166,030	14.1%
Race/ Ethnicity	**Black**	310,006	34,644	11.2%	48,879	15.8%
	Hispanic	59,306	6,028	10.2%	8,691	14.7%
	White	2,434,340	214,197	8.8%	315,750	13.0%
	Other	86,242	6,837	7.9%	11,537	13.4%
Age	**<65**	381,099	50,105	13.1%	61,686	16.2%
	65 - 74	900,504	75,013	8.3%	106,446	11.8%
	75 - 84	980,203	82,758	8.4%	129,262	13.2%
	85+	628,088	53,830	8.6%	87,463	13.9%
Medicaid Status	**Yes**	654,587	76,918	11.8%	105,326	16.1%
	No	2,235,307	184,788	8.3%	279,485	12.5%
Disabled	**Yes**	674,764	79,113	11.7%	105,372	15.6%
	No	2,215,130	182,593	8.2%	279,485	12.6%

[3] Philbin EF[1], Dec GW, Jenkins PL, DiSalvo TG. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. Am J Cardiol. 2001 Jun 15;87(12):1367-71

[4] Arbaje AI1, Wolff JL, Yu Q, Powe NR, Anderson GF, Boult C. Postdischarge environmental and socioeconomic factors and the likelihood of early hospital readmission among community-dwelling Medicare beneficiaries. Gerontologist. 2008 Aug; 48(4):495-504

[5] Johnson, P. et al. Disparities in potentially avoidable emergency department (ED) care: ED visits for ambulatory care sensitive conditions. Med Care. 2012 Dec; 50(12):1020-8

In previous measure development work, our team also examined the impact of urban or rural location on Acute Care Hospitalization (NQF 0171) and ED Use without Hospitalization (NQF 0173) measured during the first 60 days of HH care. Table 2 shows that rural beneficiaries with home health stays starting between July 2010 and June 2011 had higher rates of 60 day ED Use and Acute Care Hospitalization than did urban beneficiaries. This measure development work also found that both Rural location and Medicaid Status were significant predictors of hospitalization and ED visits even after controlling for age, sex, and clinical risk factors.

Table 2: Observed Rates of Outcomes by Urban/Rural Stratification

Stratification	# of Stays	No Event	ED Use in 60 days	Acute Care Hospitalization in 60 days
Urban	1,632,523	73.1%	9.2%	17.7%
Rural	378,241	70.1%	11.4%	18.5%

Recommendation Regarding Trial Period

CMS is volunteering to include readmission measures in the SDS trial. This will allow for further examination of impact on provider performance category of additional risk factors, especially Medicaid Status and Rural location.

The next steps for developing a socio-demographic risk adjustment model include: confirming correlation at the patient level between each candidate factor and the outcome after adjusting for health status and prior care risk factors, examining variation of each factor across HHAs, modifying the risk adjustment model include the additional factors that are correlated with outcomes and vary across HHAs, categorizing HHAs as “better than”, “same as”, or “worse than” expected on their rehospitalization and ED use rates using the revised risk adjustment model, and determining how many HHAs are in a different category under the “health factors only” model versus the “health factors plus SDS” model.

Date: January 22, 2015
To: NQF Admissions/Readmissions Standing Committee
From: Measure Developers: ACC & Yale-CORE
RE: Next Steps for Admissions/Readmissions Measures Endorsed with Conditions

Thank you for the opportunity to present the American College of Cardiology's position regarding whether Measure #0695: Hospital 30-Day Risk-Standardized Readmission Rates following Percutaneous Coronary Intervention (PCI) should be a part of the trial period for consideration of Socio-Demographic Status (SDS).

This measure estimates a hospital-level risk-standardized readmission rate (RSRR) following PCI for Medicare Fee-for-Service (FFS) patients who are 65 years of age or older using a hierarchical logistic regression model. The outcome is defined as unplanned readmission for any cause within 30 days following hospital stays. The measure uses clinical data available in the National Cardiovascular Disease Registry (NCDR) CathPCI Registry for risk adjustment and Medicare claims to identify readmissions.

1. Conceptual relationship between readmission post PCI and possible SDS risk factors.

A number of studies have suggested that across a number of conditions and procedures, patients' risk of readmission varies by sociodemographic status. However, there is limited scientific literature that links sociodemographic factors to hospital-level risk adjusted readmission rates.

There is limited scientific evidence to support a relationship between readmissions after PCI procedures and socio-demographic factors. Specific to PCI, it has been shown that patients with less than a high school education were more likely to be readmitted after PCI than those with high school or higher education (Khawaja, 2012). Potential socioeconomic variables include: income, education, occupation/employment, language, race & ethnicity, homelessness, marital status, literacy & health literacy, and patient community conditions (crime rate, percent vacant housing, smoking rate, level of insurance). This readmission post PCI measure is mapped to Medicare claims data, thus requiring the patient population evaluated be covered with CMS insurance. Our measure includes variables for gender and age. Race and ethnicity are captured within the registry dataset. Consistent with the previous recommendation to exclude socioeconomic status and race from statistical risk models, these variables were not included in the PCI readmission measure.

The preponderance of data suggests that hospital related factors, specifically detailed discharge planning and post discharge follow up, exert a stronger influence on readmission rates. A 2011 systematic review of 43 studies, 16 of which were randomized trials, found that the strategies employed in successful studies involved several simultaneous interventions, including patient-centered discharge instructions and a post discharge telephone call. A 2012 systematic review identified several interventions (including medication reconciliation, structured electronic discharge summaries, discharge planning, and facilitated communication between hospital and community providers) that favorably influenced readmission rates (Hesselink, 2012).

2. Description of the relationship between the SDS risk factor and the measured unit..

The socioeconomic status analyses included within the NQF application for this measures provides the strongest evidence suggesting that these SDS factors do not exert a strong impact on hospital RSRR. We analyzed whether disparities in performance on this measure exist at the hospital level. To identify potential disparities, we examined the relationship between hospital-level RSRR and hospital proportion of African-

American patients among all hospitals grouped by quintile of the proportion of African-American patients. We used the Medicare Provider Analysis and Review (MEDPAR) File for 2010 to calculate the proportion of African-American patients treated at each hospital, using all patients admitted to each hospital. There were 277,439 admissions to 1,195 hospitals.

Our analyses demonstrated that there were modest differences in the RSRRs by quintile. Specifically, the median RSRR for hospitals with the highest proportion of African-American patients was 12.4% compared with 11.2% for hospitals with the lowest proportion of African-American patients. In comparison to the registry average of 11.8%, hospitals with high proportions of African-American patients have modestly higher 30-day RSRRs. However, the distributions for the RSRRs overlapped across hospital quintiles, and many hospitals caring for the highest percentage of African-American patients performed well on the measures.

Similarly, to identify potential disparities related socoioeconomic status, we examined the relationship between RSRR and hospital proportion of dual eligible patients. We used the MEDPAR File for 2010 to calculate the percentage of patients 65 or older and eligible for both Medicare and Medicaid (dual eligible patients) treated at each hospital. There were 277,439 admissions to 1,195 hospitals. The proportion of dual eligible patients was used as a marker for determining the SES status of hospitals' patients because this is a low income and vulnerable population. Similar to the analysis above, we examined hospital-level RSRRs across quintiles of the proportion of dual eligible patients.

There were no differences in RSRRs across income quintile. Analyses demonstrated that the median RSRR for hospitals in the top quintile of dual eligible patients was 12.3% compared with 11.6% for hospitals in the bottom quintile of dual eligible patients. In comparison to the registry average of 11.8%, hospitals that treat a high percentage of dual eligible patients have moderately higher 30-day RSRRs. However, the distributions for the RSRRs overlapped, and many hospitals in the highest quintile of dual eligible patients performed well on the measure.

Aside from our own analysis, an exhaustive review of the literature found only one, single center study that identified a possible link between sociodemographic factors and readmissions post PCI. Khawaja and colleagues reported on a review of over 15,000 patients who underwent (both urgent and non-urgent) PCI between 1998 and 2008, the 30-day readmission rate was 9.4 percent (Khawaja, 2012). The author's intent was to identify factors associated with 30-day readmission rates. Demographic variables, including age and sex, were collected from the Mayo Clinic PCI registry. Additional demographic variables were collected from Mayo Clinic administrative databases and merged with the PCI registry. These variables included marital status (single, married, divorced, separated, or widowed), education level (eighth grade or less, some high school, high school graduate or equivalent, some college, college graduate, postgraduate studies, or unknown), miles traveled to Mayo Clinic, and insurance type (Medicare, Medicaid, uninsured, or privately insured). Clinical variables were also evaluated. After their multivariable analysis, the following factors were found to be associated with an increased risk of readmission: female sex, Medicare insurance, having less than a high school education, unstable angina, cerebrovascular accident or transient ischemic attack, moderate to severe renal disease, chronic obstructive pulmonary disease, peptic ulcer disease, metastatic cancer, and a length of stay of more than three days (Khawaja, 2012).

While patient's level of education had a weak association, it is one isolated sociodemographic risk factor that has been identified to influence readmission rates throughout the literature. Wasfy et al. (2013), provided evidence from a 5573 patients during 2007 -2011 in a single center study, identifying that the largest proportion of readmissions after PCI is due to symptoms that prompt concern for angina. The overwhelming majority of which (90.0%) do not require repeat revascularization (Wasfy, 2013). Feasible suggestions to

reduce readmission rates derived from this study suggested that hospitals may be able to minimize 30-day readmission rates after PCI substantially by postponing non-urgent, non-coronary procedures after PCI. Transferring the evaluation of low-risk chest pain to the outpatient setting or to emergency department observation units could dramatically reduce 30 day readmission rates after PCI (Wasfy, 2013). These suggestions to reduce the rate of readmission are actionable, feasible and do not add additional burden to the hospitals. Requiring hospitals to query each patient for their level of education, would increase data collection burden and demands on the hospitals for minimal gains.

The NQF Technical Report (2014, p. 40) clearly states that "data constraints may be the biggest barrier to adjustment for sociodemographic factors and will require further initiatives to define standards and to implement data collection". The National Committee on Vital and Health Statistics proposed that education (i.e., years of schooling) should be considered a core health data element that should be standardized in healthcare and healthcare information fields (NCVHSR, 1996). Despite this recommendation nearly two decades ago, education is not widely collected in healthcare. The NQF Technical Report references work by Kirst et al, (2013) to support the concept that "education may be easier to collect from patients with fewer refusals" than elements such as household income (NQF Technical Panel Report, p.41). In the original article Kirst explains what was required to attain a response rate of only 2.9%.

"… A public opinion and market research firm was employed to administer the survey… 72,216 calls were attempted. …. After excluding, answering machines, calls with no answer, language barriers, ill or incapable respondents, and no eligible respondent being available, a total of 15,976 people were asked to participate in the survey. Of these .. 1,306 [qualified] as eligible and completed the interview. This represents a response rate of 2.9%, with 8.2% of persons asked to complete the survey doing so. Willingness to participate in the survey was taken to imply consent, and no personal identifiers were collected. Surveys were conducted in English and French…" (Kirst, 2013).

While potentially feasible from a clinical trial with the ability to finance a public opinion and market research firm to capture the level of educate data, this is not feasible at a hospital level.

3. In your view, should the measure enter the trial period?

The position of the measure developer for Measure #0695: Hospital 30-Day Risk-Standardized Readmission Rates following Percutaneous Coronary Intervention (PCI) is to not include this measure in a Sociodemographic trial period. We believe that the routine inclusion of SDS into risk models has the potential to explain away meaningful and actionable differences in hospital performance. Analyses have shown that many hospitals caring for a higher proportion of disadvantaged patients perform extremely well on the measure. Furthermore, inclusion of SDS does not meaningfully change estimates of hospital performance.

Contractual relationships in place with the NCDR and hospitals require that 100% of patient's undergoing the PCI are submitted. This implies that 100% of the patients would be asked for level of education. Again, this is not feasible for hospitals as PCI is the most common cardiac intervention with more than 650,000 procedures across the country annually. Furthermore, given what is known about the willingess of individuals to provide this information, even a concerted attempt to collect this data point would likely result in rates of missing data that would render the variable useless. Information surrounding the patient's level of education is not currently available in external data sources, (ie administrative claims data), and thus cannot be electronically mapped to patient records.

Finally, even if we agreed that adjusting for SDS is important and valid, we believe that it is not feasible due to the absence of an accepted manner of reliably capturing SDS including education, income, and other social stressors. The data constraints create insurmountable barriers to capturing sociodemographic data. While there is limited evidence suggesting that people may be more inclined to provide level of education information, over their household income, we would be challenged to validate that information.

References:

Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to reduce 30-day rehospitalization: a systematic review. Ann Intern Med. 2011;155(8):520.

Hesselink G, Schoonhoven L, Barach P, Spijker A, Gademan P, Kalkman C, Liefers J, Vernooij-Dassen M, Wollersheim H. Improving patient handovers from hospital to primary care: a systematic review. Ann Intern Med. 2012;157(6):417.

Risk Adjustment for Socioeconomic Status or Other Sociodemographic Factors; Technical Report. August 15, 2014. Expert Panel on Risk Adjustment for Sociodemographic Factors. Retrieved form http://www.qualityforum.org/Risk_Adjustment_SES.aspx on January 12, 2015.

Khawaja FJ, Shah ND, Lennon RJ, et al. Factors associated with 30-day readmission rates after percutaneous coronary intervention. Arch Intern Med 2012; 172:112.

Kirst M, Shankardass K, Bomze S, et al. Sociodemographic data collection for health equity measurement: a mixed methods study examining public opinions. Int J Equity Health. 2013;12:75.

National Committee on Vital and Health Statistics. Core Health Data Elements, Report of the National Committee on Vital and Health Statistics. *National Committee on Vital and Health Statistics, United States Department of health and Human Services.* Available at: http://www.ncvhs.hhs.gov/ncvhsr1.htm. Updated August, 1996.