ONLINE APPENDIXES 4

Refining the hospital readmissions reduction program

ONLINE APPENDIX 4-A

Comparison of readmission measures

TABLE 4-A1

Comparison of different hospital readmission measures

Factors	Hospital Compare / CMS Readmission Reduction Program	Yale/CMS All Condition	3M Potentially Preventable Readmissions
Purpose of measure and uses of measure	• Hospital quality reporting • Used in calculation of excess readmissions in hospital readmission reduction program • NQF endorsed	• Hospital quality reporting • NQF endorsed	• Hospital quality reporting and/or payment adjustments: • Medicaid or other state health departments (CA, FL, IL, MA, NC, NY, TX, UT) • Managed care plans (Wellmark BCBS, IBC, Washington Premera BC) • State hospital associations (MN, OR, WA)
Time period covered	30 days	30 days	15, 30, 60, or 90 days
Patient population	Medicare 65+	Medicare 65+	All patients, all Medicare, Medicare 65+
Types of cases included	Diagnosis specific: • AMI, heart failure, pneumonia • Others for reporting • PCI • Total hip and knee replacements	All conditions categorized into 5 groups: • Cardiology • Cardiovascular • Neurology • Surgery • Other medicine	All conditions
Initial admission exclusions	• In-hospital death • Transfers out • Left against medical advice • Rehospitalizations within 30 days for the same condition are not considered initial admissions • Patients w/o 12 months prior FFS enrollment • Patients w/o 30 days post-discharge information	• In-hospital death • Transfers out • Left against medical advice • Patients w/o 12 months prior FFS enrollment • Patients w/o 30 days post-discharge information • Admissions for primary psychiatric diagnosis, rehabilitation, medical treatment of cancer	• In-hospital death • Transfers out • Left against medical advice • Rehospitalizations (chained) • Admissions for metastatic cancer, trauma, burns, neonates, certain chronic conditions (CF), eye care
Readmissions counted	All cause	Unplanned admission for any cause	Potentially preventable: • Medical readmission for continuation or recurrence for initial condition • Medical readmission for acute decomposition of chronic problem • Medical readmission for acute medical complication plausibly related to initial admission • Surgical procedure to address problem that caused initial admission • Surgical procedure to address complications of initial admission

Note: NQF (National Quality Forum), BCBS (Blue Cross and Blue Shield), IBC (Independence Blue Cross), BC (Blue Cross), AMI (acute myocardial infarction), PCI (percutaneous coronary intervention), FFS (fee-for-service), CF (cystic fibrosis).

Source: 3M Health Information Systems 2008; Bernheim, S. D., J. N. Grady, S. Spivack, et al. 2012; Horwitz, L., C. Partovian, Z. Lin, et al. 2012; Krumholz, H. M., S. T. Normand, M. M. Desai, et al. 2008; Krumholz, H. M., S. T. Normand, P. Keenan, et al. 2008a; Krumholz, H. M., S. T. Normand, P. Keenan, et al. 2008b; Qualitynet.org 2013; and Vertrees, J. C., 3M Health Information Systems, Inc. 2013.

TABLE 4-A1 **Comparison of different hospital readmission measures (continued)**

Factors	Hospital Compare / CMS Readmission Reduction Program	Yale/CMS All Condition	3M Potentially Preventable Readmissions
Readmission exclusions	• None for heart failure or pneumonia • AMI has limited set of exclusions for certain cardiac procedures so long as they are not accompanied by an AMI diagnosis on readmission	Planned readmissions: • Nonacute readmission in which 1 of 35 typically planned procedures occurs • Maintenance chemotherapy or rehabilitation	Planned and clinically unrelated events: • Multiple trauma and burns • Major or metastatic malignancies • Clinically related, not preventable • Probably planned • Transplants • Obstetrics
Risk adjustment	• Hierarchical logistic regression for each diagnosis (results in shrinking all rates toward the national mean) • Selected HCCs based on 1 year of prior hospital and outpatient claims • Age • Sex	• Hierarchical logistic regression in 5 categories of cases (some shrinking of results toward the national mean) • AHRQ CCS to classify condition • CMS CCs categorized into 31 groups based on inpatient hospital data for current admission and prior admissions • Age	• Uses DRG, age, and severity level cell average to calculate expected value • Base DRG • Severity level within DRG • Mental health–related diagnosis • Age

Note: DRG (diagnosis related group), HCCs (hierarchical condition categories), AHRQ (Agency for Healthcare Research and Quality), CCS (Clinical Classifications Software), CCs (complications or comorbidities).

Source: 3M Health Information Systems 2008; Bernheim, S. D., J. N. Grady, S. Spivack, et al. 2012; Horwitz, L., C. Partovian, Z. Lin, et al. 2012; Krumholz, H. M., S. T. Normand, M. M. Desai, et al. 2008; Krumholz, H. M., S. T. Normand, P. Keenan, et al. 2008a; Krumholz, H. M., S. T. Normand, P. Keenan, et al. 2008b; Qualitynet.org 2013; and Vertrees, J. C., 3M Health Information Systems, Inc. 2013.

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Qualitynet.org. 2013. Hospital readmissions reduction program, frequently asked questions: 30-day risk-standardized readmission measures for acute myocardial infarction (AMI), heart failure (HF), and pneumonia (PN) calculated for the fiscal year 2013 hospital readmissions reduction program. https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1228772412995.

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ONLINE APPENDIX 4-B

Computation of how penalty is not reduced with a decline in readmission rates

In this appendix, we present an intuitive explanation of the readmission penalty and a simplified formula. We show the penalty is roughly equivalent to:

Excess cost penalty multiplier

(Payment rate for initial DRG) × (adjusted number of excess readmissions)	×	1/national readmission rate for the condition

where:

DRG is diagnosis related group.

The purpose of this appendix is to show how the language in the law governing readmission penalties is roughly equivalent to the simplified formula above for cases in which the initial admission has a DRG payment similar to the DRG payment for the readmission. We also show that, under current law, the penalty does not decline as national readmission rates decline. The reason is that the reduction in penalties due to a lower cost of excess readmissions (first box above) is offset by an increase in the multiplier (second box above).

The actual computation is shown below. We start with the criteria that readmission measures must meet under the law, which requires that: "measures of such readmissions—

I. have been endorsed by the entity with a contract under section 1890(a) [which refers to the National Quality Forum (NQF)];

II. such endorsed measures have exclusions for readmissions that are unrelated to the prior discharge (such as planned readmission or transfer to another applicable hospital)."

CMS has chosen to use three condition-specific readmissions measures developed by Yale University and endorsed by the NQF. These measures meet criterion I but have very limited exclusions. The measures incorporate a statistical technique that is intended to reduce the chance that a hospital will appear to have excess readmissions solely due to random variation. In effect, that technique blends the hospital's actual readmission value with the national mean readmission value. The national mean value is given less weight as the number of cases in the hospital increases. This blending tends to dampen the effect of random variation in readmission rates that is due to small numbers of cases. But, as we show here, using this measure will have a large influence on computation of the penalty.

The formula in the law can be written as follows:

The readmission penalty reduces a hospital's total base operating DRG payments (*DRGP*):

Equation 1

$$DRGP_A = DRGP_B \times A$$

where:

$DRGP_A$ = total base DRG payments after readmission penalty

$DRGP_B$ = total base DRG payments before readmission penalty

A = readmission penalty adjustment factor

The readmission penalty is limited by law not to exceed 1 percent in fiscal year 2013, 2 percent in fiscal year 2014, and 3 percent in 2015 and later years:

Equation 2

A = greater of [R, floor]

Floor =	0.99	2013
	0.98	2014
	0.97	2015 and after

The preliminary readmission penalty ratio (before applying the annual limit) is 1 minus the ratio of two amounts:

Equation 3

$$R = 1 - \frac{\sum_{i=1}^{c} DRGP_{Bi} \times n_i \times (X_i - 1)}{\sum_{j=1}^{k} DRGP_{Bj} \times n_j}$$

where:

R = penalty ratio (preliminary)

c = number of conditions for which readmissions are assessed

n_i = number of admissions for DRG_i

k = total number of DRGs in hospital

n_j = total number of admissions in DRG_j, and

Equation 4

$$X_i = \text{greater of } [1, \frac{n_{P_i}}{n_{E_i}}]$$

where:

X_i = excess readmission ratio

n_{P_i} = adjusted actual number of readmissions for condition i (risk adjusted)

n_{E_i} = expected number of readmissions for condition i (risk adjusted)

The adjusted actual ("predicted" in CMS terminology) number of readmissions is a function of the hospital's actual number of readmissions and the shrinkage factor. The shrinkage factor is the weight given to the hospital's actual risk-adjusted rate of readmissions. One minus the shrinkage factor is the weight given to the national average readmission rate. Those weighted rates are averaged to yield the adjusted actual rate. The shrinkage factor is small when the number of cases for the given condition at the hospital is small and when the variance within the hospital is large relative to the variance across hospitals (Mukamel et al. 2010).

Essentially, the numerator of the second term in Equation 3, $\sum_{i=1}^{c} DRGP_{Bi} \times n_i \times (X_i - 1)$, is the amount of money being collected as the penalty for excess readmissions (putting aside the limit imposed by the floor). The penalty amount is the sum of the three measured conditions of the products of the DRG payment rates, the number of admissions in each DRG, and the percentage of readmissions in each DRG that are calculated to be excess (that is, X_i the excess admission ratio, minus 1). Equation 3 converts the penalty amount to a share of the total DRG payments. Then Equation 1 and Equation 2 take this share and apply it to all Medicare admissions in the hospital.

If we simplify the analysis for illustrative purposes and consider the case in which there is only one condition ($c = 1$, not 3 as is currently the case) then the penalty for DRG_i is the payment rate for that DRG times the number of cases in that DRG times the excess readmission percentage:

Equation 5

$$Penalty_i = DRGP_{Bi} \times n_i \times (X_i - 1)$$

For cases in which the computed number of excess readmissions is positive, this is equivalent to:

Equation 5a

$$P_i = DRGP_{Bi} \times n_i \times (\frac{n_{P_i}}{n_{E_i}} - 1)$$

or

Equation 5b

$$P_i = DRGP_{Bi} \times (n_{P_i} - n_{E_i}) (\frac{n_i}{n_{E_i}})$$

The cost to the government of excess readmissions at a hospital for that DRG (including DRG payments only) would be the product of the average cost of a readmission stemming from initial admissions for that DRG and the number of excess readmissions stemming from that DRG.

If we further simplify by assuming that the cost of the average readmission equals the cost of the initial admission, then the cost of excess readmissions (C_i), where excess is defined as in the regulation, becomes:

Equation 6

$$C_i = DRGP_{Bi} \times (n_{P_i} - n_{E_i})$$

That is the cost of a readmission (assumed equal to the cost of the initial admission) times the adjusted actual (CMS refers to this as predicted) number of readmissions (n_{p_i}) minus the expected number of readmissions (n_{E_i}).

Substituting the cost (C_i) into Equation 5 for the term $DRGP_{Bi} \times (n_{P_i} - n_{E_i})$, we have the following magnitude of a penalty (Equation 7).

Equation 7

$$P_i = C_i (\frac{n_i}{n_{E_i}})$$

In other words, the penalty will exceed the cost by a factor equal to the number of admissions in that DRG divided by the expected number of readmissions in that DRG. We refer to this multiplier as the "penalty multiplier." If the readmission rate (n_{E_i}) were 20 percent, the penalty would be five times larger than the cost. If the national rate were 5 percent, the penalty would be 20 times higher than the cost of the shrunken estimate of excess readmissions in

TABLE 4–B1

Example of why national reductions in hospital readmission rates do not affect average penalties

	Initial case	After 10% national reduction in readmissions
Admissions	1,000	980
Base payment per admission	$10,000	$10,000
Base payments	$10,000,000	$9,800,000
Expected readmission rate	18% (180 readmits)	16.2% (162 readmits)
Actual readmission rate	20% (200 readmits)	18% (180 readmits)
Penalty	20 x $10,000 x 1/0.18 = $1,111,111	18 x $10,000 x (1/(162/980)) = $1,088,888
Penalty as a share of base payments if all payments declined by 2% when readmission rates were reduced	$1,111,111/$10,000,000 =11.1% of base payments	$1,088,888/$9,800,000 = 11.1% of base payments

that DRG. The difference between the penalty and the cost will increase as conditions with smaller readmission rates are included in the policy.

We have made a simplifying assumption that the cost of a readmission equals the cost of the initial admission. If the cost of the average readmission were less, then the penalty would be even more than the cost. This could be the case, for example, if the original DRG included an expensive implant. If the cost of the average readmission were more than the cost of the initial admission, then the penalty would exceed the cost by somewhat less—namely, the ratio of the cost of the admission's DRG divided by the cost of the average readmission's DRG. This is one more reason why the formula needs to be reevaluated.

Now we model a 10 percent reduction in readmissions for all hospitals. We start with the existing penalty formula:

Excess cost penalty multiplier

(Payment rate for initial DRG) × (adjusted number of excess readmissions) × 1/national readmission rate for the condition

If the national readmission rate improves by 10 percent at the hospital in question and nationally, the excess cost will decline by 10 percent, but the penalty multiplier will increase by 10 percent because the national readmission rate declined. The result is that the penalty does not change. An example is shown in Table 4-B1. ■

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