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September 30, 2011

Kathleen Sebelius, Secretary
U.S. Department of Health and Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201

Re: Maryland Report on Hospital Payments Linked with Performance Initiatives and Hospital Value Based Purchasing Program Exemption Request Pursuant to Section 1886(o)(1)(C) (iv) of Social Security Act.

Dear Secretary Sebelius:

We greatly appreciate the opportunity to submit the details of Maryland's hospital patient quality programs linked with payment, including a report on cost and patient quality outcomes; we believe the information we are providing will serve as a basis for the Secretary to consider an exemption from the Centers for Medicare & Medicaid Services' (CMS) Value Based Purchasing (VBP) program.

I. Introduction

Maryland is a leader in the U.S. in innovative hospital payment systems and the development of other mechanisms to achieve its goals of cost containment, access to care, equity in payment, financial stability, and quality improvement. Maryland's exceptional achievements in recent years have resulted in hospital pay-for-performance programs that are broader than any other in design and scope, and encompass a robust set of performance measures with strong and increasing emphasis on patient outcomes.

Since the late 1970s, the State of Maryland has been operating its unique system for paying hospitals that applies to all payers both public and private. The Health Services Cost Review Commission (HSCRC) is the agency in the State that has the legal authority and responsibility to establish payment levels for all inpatient and outpatient services located at a hospital pertaining to all of the State's 46 acute care hospitals. The HSCRC's role is to structure financial incentives (through the payment system) to encourage efficient and effective operations by

hospitals and hospital managers to improve access and quality of care. The HSCRC also uses payment incentives to promote other policy goals, such as transparency, accountability, and improved health. Earlier examples of our successful track record in these areas include:

- ensuring access to care by pooling uncompensated care resources ,with partial pooling beginning in 1997and a transition to full pooling 2009,
- the adoption of statewide All Patient Refined Diagnosis Related Groups,
- establishing an outpatient constraint system, and
- implementing bundled payment strategies.

Maryland has steadily expanded the magnitude and scope of its quality payment reform initiative since HSCRC's initial implementation in July 2008 of the Quality Based Reimbursement Initiative (QBR), which allocated rewards and penalties for hospitals based on their performance in clinical process of care measures for heart attack, heart failure, pneumonia, and surgical infection prevention. A year later, Maryland Hospital Acquired Conditions Program (MHAC) was implemented and resulted in adjustments to hospital rates using potentially preventable complication rates. In addition, over the past two years, the Commission has implemented several bundled payment strategies designed to reduce utilization and readmissions, and improve the efficiency and effectiveness of hospital care in the State. We believe that the totality of the quality and other payment initiatives will result in large improvements in hospital care quality and cost savings - potentially by $1 billion per year.

The initiatives that HSCRC began implementing in 2008 (QBR and MHAC) are consistent in design and intent with the CMS VBP program and other CMS initiatives under consideration as they target performance on a robust set of process of care/effectiveness measures, patient safety measures, preventable complication rates and readmissions, but they are even broader in that they apply to all private and public payers in the State.

Early evaluations of two HSCRC quality payment programs show tremendous promise. Figure 1 below illustrates how all of the clinical process of care measures included in the QBR initiative have improved since the program was launched in 2008. In addition, as shown in Figure 2 the number of complications included in the MHAC program declined by 20% in two years, resulting in cost savings of $105.4 million, after adjusting for changes in patient characteristics.

Therefore, with this correspondence, we respectfully submit this report of outcomes and cost savings from the HSCRC quality initiatives. We request that the Secretary exercise the discretion provided under 1886(o)(1)(C)(iv) of the Social Security Act to exempt Maryland from the VBP program in light of Maryland's having demonstrated its success in implementing a substantially similar program that has resulted in positive health outcomes, cost savings, and improved quality of care.

Figure 1. Changes in QBR Measures from Calendar Year 2008 to 2010

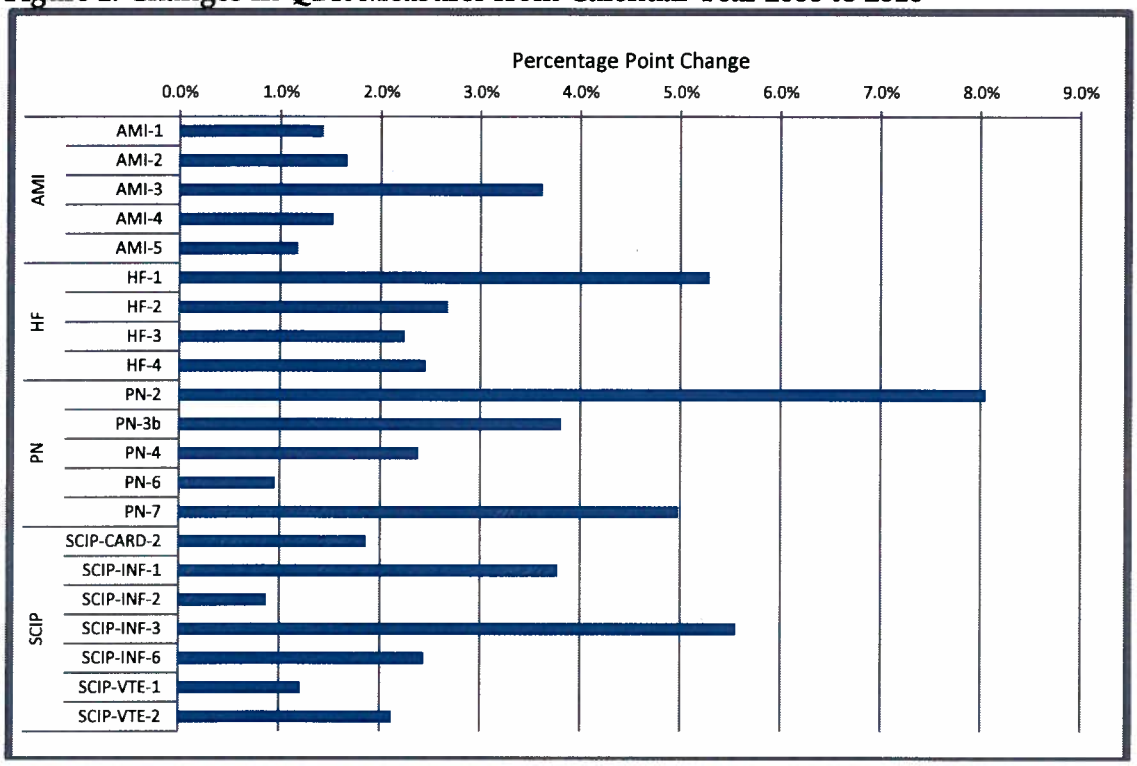
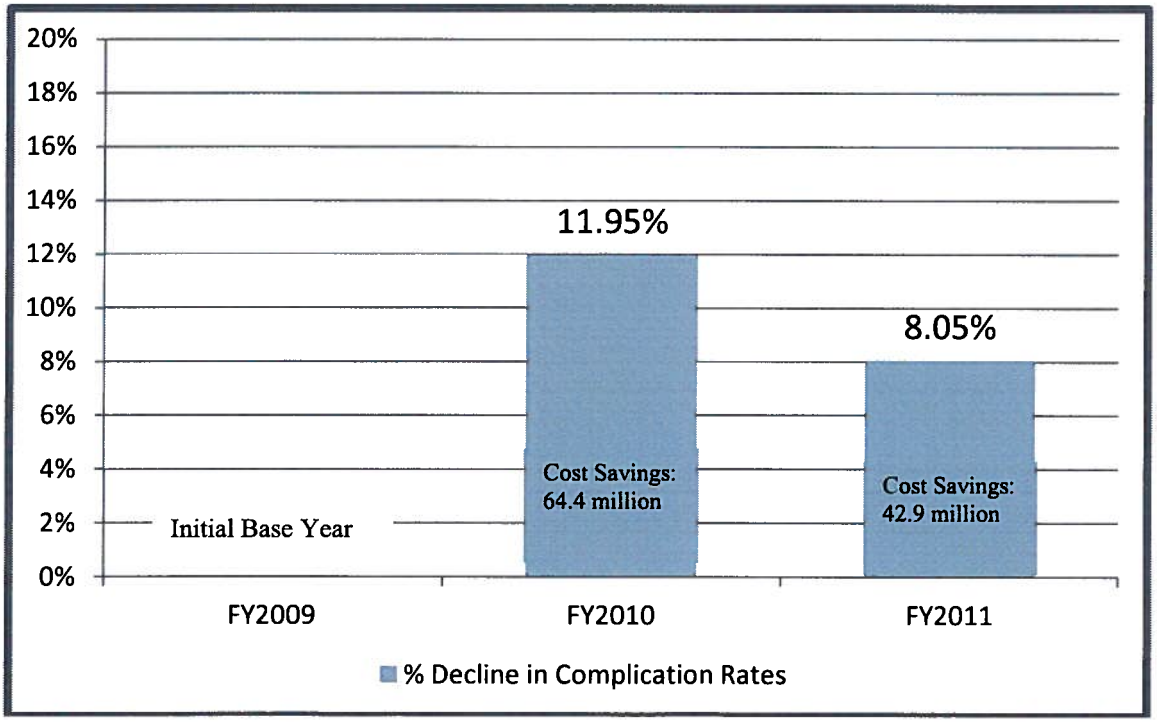


Figure 2: Percent Annual Rate Decline in Complications in MHAC



II. Background-Maryland's Success in Hospital Rate Setting Spans Five Decades

A. Maryland's Rate Setting Structure Provides a Unique Opportunity to Improve Quality

In 1977, Maryland was the first of five states granted a waiver by the federal government exempting the State from national Medicare and Medicaid reimbursement regulations to establish an all-payer system. To implement this system, the Maryland legislature established the HSCRC, a government agency and independent Commission, with broad powers of hospital rate setting and public disclosure.

The HSCRC's unique structure and authority allowed it to create a framework for Maryland to consider emerging best practices in payment and delivery system reform and implement these reforms across all payers. This "All-Payer" payment model has been recognized nationally for its accomplishments in the areas of cost containment, access expansion, payment equity, financial stability, accountability, and more recently quality improvement. Maryland has been a leader in the development of bundled payment and pay-for-performance (P4P) initiatives, including the use of strong financial incentives to reduce preventable hospital acquired complication and infection rates. Maryland is also the only state that assures its citizens that they can receive medically necessary care at any hospital regardless of their ability to pay. In Maryland alone, uncompensated care is financed by all payers, including Medicare and Medicaid. As a result, there are no hospitals of "last resort" in the State, and the uninsured have access to care at any hospital, including the State's two premier academic medical centers.

Of all of the Maryland hospital system's considerable successes prior to implementation of the quality initiatives, none is as compelling as the Maryland experience in bending the cost curve. In 1976, the cost of a Maryland hospital admission was 26% above the national average. In 2009, average hospital cost per case in Maryland was approximately 3% below the national average. During this period, Maryland experienced the second lowest rate of increase of cost per admission of any state. Had Maryland grown at the national rate of growth from 1976 to 2009, there would have been cumulatively $44 billion more hospital expenditures (in nominal terms) than what resulted under rate setting. On the other hand, had the nation grown at Maryland's rate of growth, cumulative U.S. savings would have been in excess of $2.0 trillion. Maryland's hospital rate setting system is one of the most enduring and successful cost-containment programs in the U.S. The lessons learned from this experience are relevant to the nation and provide useful basis for consideration of future health reform strategies.

The Commission's rate setting authority applies to the 46 acute general, three specialty, and three private psychiatric hospitals in the State with regulated revenue in excess of $13 billion annually as of FY 2011. The HSCRC's rate regulatory authority applies to inpatient services (as defined by Medicare) and outpatient and emergency services at a hospital (on the campus). The Commission does not regulate physician fees.

The Commission's primary mandates are to review and approve reasonable hospital rates and publicly disclose information on the costs and financial performance of Maryland hospitals. The Commission establishes hospital-specific and service-specific rates for all inpatient, hospital-based outpatient and emergency services. In approving hospital rates, the Commission is required to assure that:

- The total costs of all services offered by a hospital are reasonable;
- Aggregate revenues of a hospital are reasonably related to its aggregate costs;
- Rates are set equitably among all purchasers of hospital services.

To meet its rate setting charge, the Commission has created a significant data infrastructure that includes a uniform accounting and reporting system and extensive data collection on, and analysis of, every aspect of hospital operations. To fulfill its broad disclosure responsibilities, it distributes annual reports on hospital operations and makes all such Commission files accessible to the public.

Through the rate setting system, as noted previously, Maryland began implementing hospital payment adjustments linked with quality performance in 2008. The sub-sections and sections that follow provide details regarding the development and implementation of these programs, including a report on patient health outcome results and cost savings.

B. Maryland is an Early Adopter of Innovative Hospital Payment Structures Targeting Quality Improvement

In 2003, the HSCRC established a Steering Committee of a broad set of stakeholders and quality experts to make recommendations toward implementing quality initiatives. The Steering Committee recommendations report approved by the HSCRC Commissioners in January 2004 stated it was clear that the delivery of high quality health care involves the convergence of quality care, access of appropriate care, and cost and that the Maryland system was unique in the ability to affect all three of these elements in a broad manner. The report also included the Mission, Vision and Goal statements for the quality initiatives that the Steering Committee thought would be broad enough to be flexible over time but explicit enough to set the tone and momentum for the work that needed to be done.

The **mission** articulated was to use the Commission's authority over hospital rates and revenue to improve the quality of patient care and the efficiency and effectiveness of services provided at Maryland hospitals by providing financial support and rewards/incentives.

The **vision** articulated was a health care environment where Maryland hospitals provide high quality patient care in an efficient manner.
The **goals** articulated were:

- to work with Maryland hospitals to enhance the quality of patient care by providing financial support and rewards/incentives consistent with evidence-based health services research;

- to select and maintain a set of measures that appropriately reflect the delivery of quality health care services provided at Maryland hospitals;
- to collect data that will support the generation of accurate and reliable quality measures;
- to better understand the relationship between quality and cost; and
- to become a model for enhancing health care quality in the hospital setting while being consistent with broader quality initiatives.

The Steering Committee report defined quality as the right care - at the right time - at the right price; this was intentionally parallel to the Agency for Healthcare Research and Quality definition to do the right thing at the right time in the right way for the right person and having the best results possible.

The Steering Committee and subsequent planning and implementation work groups of the quality initiatives expressly intended to start the quality initiatives with available evidence-based measures (which at the time were only process measures) and progress to outcome measures as the field of quality measurement developed and as experts gained experience with risk adjustment necessary to measure outcomes.

C. Better Quality, Safer Care at Lower Cost Must be Patient Centered and Transparently Measured

From their early planning stages the QBR and MHAC programs are designed to address emerging national concerns and best practices in effort to improve healthcare quality. Key principles of the programs are outlined below.

Patient-centered focus: The QBR program measures performance at the patient level. Hospitals' scores are equally weighted between their performance under an "opportunity model" and the "appropriateness model." The opportunity model measures how often the hospital delivers care according to each measure, at any opportunity. The appropriateness model sets the bar higher by requiring the hospital to meet all the measures appropriate to the individual patient to receive a positive score. Further, HSCRC believes that the quality initiatives and reforms that will be most successful and effective are those that increasingly center on the patient rather than the provider community. Therefore, we will continue to engage consumer stakeholders in the implementation phases of these projects and programs.

Patient safety improvement: Patient safety is addressed by both the QBR and the MHAC programs in that they constitute a broad-based systems approach to build in safer processes and to promote safer care and patient outcomes over time. HSCRC quality initiatives have resulted in impressive improvements, but, knowing that errors continue to occur, much work remains.

Administrative ease: HSCRC has built a rich inpatient administrative data submission and analysis infrastructure that mirrors the standard claims data set, and has worked with our sister Commission, the Maryland Health Care Commission (MHCC), to use established quality data collection and submission mechanisms for both public reporting

and payment purposes. We note that the QBR program utilizes core measures data hospitals are already reporting to CMS and the State, and the MHAC policy relies on administrative data hospitals report to the HSCRC that parallel the claims data submission; utilizing the administrative data allows the HSCRC to measure performance on a large number of diagnostic categories for all payers, rather than a sample of the hospital's Medicare patients.

Appropriate risk adjustment: HSCRC risk adjusts outcome measures to accurately and meaningfully distinguish performance among hospitals. HSCRC has been measuring case-mix using the 3M APR-DRG grouper for 10 years, and uses the APR severity levels to adjust outcome measures. In addition to severity adjustment, hospital acquired conditions are measured using another 3M product that takes into account the patient's diagnoses and procedures to determine which complications were potentially preventable.

Revenue neutrality with target of lowering costs: The delivery of high quality health care involves the convergence of quality care, access to appropriate care, and cost. The Maryland system, under the authority of the HSCRC and our sister Commission, the MHCC, is unique in the ability to affect all three of these elements in a broad manner. The payment structure of the HSCRC quality initiatives are revenue neutral and provide rewards for high performing systems and incentives for low performers to improve. Cost savings to payers, the public, and providers are generated as more efficient care is delivered-- the right care - at the right time - at the right price.

Public reporting and transparency: The MHCC publishes the core process measures' scores and HCAHPS measure scores on the Maryland Hospital Performance Evaluation Guide website prior to their use in the QBR program. Consistent with all of the rate setting data that predates the quality programs, the HSCRC also, publishes the MHAC complication rates and QBR and MHAC scaling results on the HSCRC website.

III. Quality Based Reimbursement (QBR) and Maryland Hospital Acquired Conditions (MHAC) Early Implementation

A. QBR Initiative Implementation

The HSCRC approved in June 2008 the staff recommendation titled, "Final Staff Recommendations regarding the HSCRC's Quality-Based Reimbursement (QBR) Project - based on deliberations of the Initiation Work Group (IWG)." For the first year of the QBR Initiative 19 process measures in four care domains including heart attack, heart failure, pneumonia and surgical care were used , and hospital payment rates were adjusted based on performance in calendar year (CY) 2008 with a base year CY2007 for State fiscal year 2010.

For year two of the QBR initiative which used base CY 2008, measurement CY 2009 for the rate year FY 2011, the Commission approved the use of 17 measures consistent with the changes to the core CMS/Joint Commission measures. In addition, to mitigate the

effects of topped off measures, better distinguish hospital performance, and shift some focus to the patient as the unit of measure, the Commission modified its methodology to include a blended Opportunity and Appropriateness score whereby hospital scores were based 25% on Opportunity, that is each time the measure was provided, and 75% on Appropriateness, that is each patient that received all the measures for which they were included in the denominator (in other words, a perfect care score). In its third year of implementation, patient experience of care measure domains were added to the QBR initiative to strengthen incentives for patient centered care.

To apply rewards and penalties for both year one and year two of the QBR program, HSCRC used a cube root exchange function to translate scores into rankings and scaled 0.5% of revenue in the hospitals' update factors in a revenue neutral manner. In the third year, scaling was based on a linear function as staff determined that the results of the linear function was very similar to a cube root function, was easier to understand, and aligned with the VBP methodology.

HSCRC has continued to update and refine the QBR initiative; a detailed description of the program details is provided in Section IV below.

B. MHAC Initiative Implementation

In 2008, HSCRC began developing its Maryland Hospital Acquired Conditions (MHAC) program. HSCRC convened a MHAC Payment Policy Group comprising hospital industry and payer stakeholders. The group reviewed the CMS HAC list, the Maryland Hospital Association voluntary policy on non-billing for seven serious adverse events that result in death or serious disability, and the 3M Health Information Systems list of 64 Potentially Preventable Complications (PPC). After extensive deliberation with stakeholders, HSCRC recommended a subset of conditions from the 3M PPC list that were most highly preventable as these complications had a wide variation in hospital performance rates.

In March 2009, the Commission approved a payment policy based on 11 PPCs (MHACs) that would eliminate additional payments for the complications identified as highly preventable. 11 MHACs were chosen for several reasons:

- They are conceptually similar to the hospital acquired conditions (HACs) developed by CMS;
- They were judged the "most highly preventable" of the 3M PPCs, and therefore amenable to a straightforward payment adjustment.

In the course of the discussion and vetting of the MHAC policy recommendations, several concerns were raised about the initial MHAC approach. Primary among those concerns were the following:

- MHACs are case specific. Adjustments to allowable charges are calculated based on specific cases, leading to debate on whether the adjustment was correct in that specific case, and conversely, cases where an adjustment was clearly appropriate not occurring. In other words, disagreement over the likelihood of false positives and false negatives.

- MHACs are narrowly focused. The choice of only 11 MHACs effectively narrows the focus of the quality incentive that the Commission was trying to introduce.

Based on the concerns raised, the Commissioners directed staff to continue to consider the list of conditions that were candidates for MHACs as well as deletions or expansions to the MHAC methodology that would address some of the concerns that arose in the discussions. The Commissioners also strongly encouraged staff to consider alternative, more balanced and more macro incentive systems to help the industry focus on sustained quality improvement.

Staff in turn developed an alternative approach that calculated actual versus expected rates of complications for each of the 64 3M PPCs risk adjusted using APR DRG and severity of illness (SOI) categories. The revised approach improved on MHACs in two ways: First, it moved from the case specific mechanism of MHACs to a broader, rate-based approach; second, it expanded the number of complications included for consideration when assessing the performance of hospitals. Following multiple broad stakeholder vetting sessions in 2009, HSCRC staff refined the list of PPCs by adjusting exclusions to individual PPCs and by pairing down the list of PPCs to be used for the MHAC program to the 49 PPCs determined to be clinically most appropriate and with significant cost implications when they occur.

HSCRC first implemented the MHAC initiative using State FY 2009 as the base year and FY 2010 as the performance year, with rate adjustments based on performance applied to FY 2011 hospital rates. In this first year, HSCRC used a linear exchange function to translate scores into rankings and scaled 0.5% of revenue in the hospitals' update factors in a revenue neutral manner.

Like the QBR program, HSCRC has continued to update and refine the MHAC initiative; a detailed description of the program details is provided in Section IV below.

IV. QBR and MHAC Programs: Detailed Descriptions and Results

A. Measures Used for the QBR and MHAC Programs

As previously stated, HSCRC currently includes 21 clinical process of care measures and 8 patient experience of care measures in the QBR program and a robust set of 49 PPCs in the MHAC program. Figures 3 and 4 list the QBR and MHAC measures.

Figure 3. QBR Measures

Clinical Process of Care Measures
AMI-1 Aspirin at Arrival
AMI-2 Aspirin prescribed at discharge
AMI-3 ACEI or ARB for LVSD
AMI-4 Adult smoking cessation advice/counseling
AMI-5 Beta blocker prescribed at discharge

HF-1 Discharge instructions
HF-2 Left ventricular systolic function (LVSF) assessment
HF-3 ACEI or ARB for LVSD
HF-4 Adult smoking cessation advice/counseling
PN-2 Pneumococcal vaccination
PN-3b Blood culture before first antibiotic – Pneumonia
PN-4 Adult smoking cessation advice/counseling
PN-6 Initial Antibiotic Selection for CAP in Immunocompetent Patient
PN-7 Influenza vaccination
SCIP CARD -2 Surgery Patients on Beta-Blocker Therapy Prior to Admission Who Received a Beta-Blocker During the Perioperative Period
SCIP INF 1- Antibiotic given within 1 hour prior to surgical incision
SCIP INF 2- Antibiotic selection
SCIP INF 3- Antibiotic discontinuance within appropriate time period postoperatively
SCIP INF 6- Surgery Patients with Appropriate Hair Removal
SCIP VTE 1- Surgery Patients with Recommended Venous Thromboembolism Prophylaxis Ordered
SCIP VTE 2 - Surgery Patients with Recommended Venous Thromboembolism Prophylaxis Given 24 hours prior and after surgery
Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS)
Cleanliness and Quietness of Hospital Environment
Communication About Medicines (Q16-Q17)
Communication With Doctors (Q5-Q7)
Communication With Nurses (Q1-Q3)
Discharge Information (Q19-Q20)
Overall Rating of this Hospital
Pain Management (Q13-Q14)
Responsiveness of Hospital Staff (Q4,Q11)

Figure 4. MHAC Measures

PPC Number	PPC Description
1	Stroke & Intracranial Hemorrhage
2	Extreme CNS Complications
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation
5	Pneumonia & Other Lung Infections
6	Aspiration Pneumonia
7	Pulmonary Embolism
8	Other Pulmonary Complications
9	Shock
10	Congestive Heart Failure
11	Acute Myocardial Infarction

PPC Number	PPC Description
12	Cardiac Arrythmias & Conduction Disturbances
13	Other Cardiac Complications
14	Ventricular Fibrillation/Cardiac Arrest
15	Peripheral Vascular Complications Except Venous Thrombosis
16	Venous Thrombosis
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding
19	Major Liver Complications
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding
22	Urinary Tract Infection
23	GU Complications Except UTI
24	Renal Failure without Dialysis
25	Renal Failure with Dialysis
26	Diabetic Ketoacidosis & Coma
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion
28	In-Hospital Trauma and Fractures
31	Decubitus Ulcer
33	Cellulitis
34	Moderate Infectious
35	Septicemia & Severe Infections
36	Acute Mental Health Changes
37	Post-Operative Infection & Deep Wound Disruption Without Procedure
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure
39	Reopening Surgical Site
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Proc
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc
42	Accidental Puncture/Laceration During Invasive Procedure
43	Accidental Cut or Hemorrhage During Other Medical Care
44	Other Surgical Complication - Mod
47	Encephalopathy
48	Other Complications of Medical Care
49	Iatrogenic Pneumothrax
50	Mechanical Complication of Device, Implant & Graft
51	Gastrointestinal Ostomy Complications
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions
54	Infections due to Central Venous Catheters
56	Obstetrical Hemorrhage with Transfusion

B. Key Features of the QBR and MHAC Program Methodologies

1. QBR Program

The QBR score upon which the payment adjustments are based combines clinical score, which comprises opportunity and appropriateness scores, and HCAHPS score. The clinical score is based on performance on process measures across four clinical domains (AMI, HF, PN and SCIP). As listed in the previous section, opportunity model includes 21 clinical measures, appropriateness model combines these measures into four clinical domains and HCAHPS includes 8 dimensions. The domain scores (opportunity, appropriateness, HCAHPS) evaluate hospital performance on each measure based on the higher of an "Attainment Score" in the most recent measurement period, or an "Improvement Score" based on a comparison of that hospital's performance in the most recent period relative to a base period. To avoid giving credit for an improvement score based on a performance record which was worsened in the previous year, the improvement score is based on the highest rate in previous years included in the program.

Performance points are given based on a range between "Benchmark" and an "Attainment Threshold", which are determined using the previous calendar year's data. The Benchmark is a reference point defining a high level of performance, which equals to the mean of the top decile. Hospitals whose rates are equal or above the benchmark receive 10 full attainment points. The Attainment Threshold is the minimum level of performance required to receive minimum attainment points, which is set at the 50th percentile. The Improvement points are given based on a scale between the hospital's prior year score (baseline) on a particular measure and the benchmark and range from 0 to 9. The formulas to calculate the attainment and improvement points are as follows:

- Achievement Points: [9 * ((Hospital's performance period score - achievement threshold)/ (benchmark -achievement threshold))] + .5, where the hospital performance period score falls in the range from the achievement threshold to the benchmark
- Improvement Points: [10 * ((Hospital performance period score -Hospital baseline period score)/(Benchmark - Hospital baseline period score))] -.5, where the hospital performance score falls in the range from the hospital's baseline period score to the benchmark

In addition to achievement and improvement points, HCAHPS domain includes consistency points to provide incentive to improve all of HCAHPS dimensions. Hospitals may earn 0-20 points based on their lowest HCAHPS dimension. Hospital would receive 0 consistency points if its performance on one or more HCAHPS dimensions during the performance period was at least as poor as the worst performing hospital's performance on that dimension during the baseline period. A hospital would receive a maximum score of 20 consistency points if its performance on all eight HCAHPS dimensions was at or above the achievement threshold (50% of hospital performance during the baseline period).

The lowest dimension score is defined as the lowest value across the eight HCAHPS dimensions using the following formula:

((Hospital's performance period score−floor)/(achievement threshold−floor)).

The formula for the HCAHPS consistency points score is as follows:

(20 * (lowest dimension score)-0.5), rounded to the nearest whole number, with a minimum of zero and a maximum of 20 consistency points.

In considering the performance of hospitals on the basis of the selected process measures, the initiation work group identified several measures for which all hospitals were performing at a very high level. Where hospital performance is concentrated at high values, a measure is said to have "topped off." It is important to distinguish "topped-off measures from "non-topped off" measures because the methodology should not provide a reward for very small variations in scoring. For example, it may not be appropriate to provide a greater attainment reward to a hospital that scores .983 than a hospital that scores .980. In the first two years of the program a "topped-off" measure was defined as one where it is difficult to distinguish the scores between the 75th percentile and the 90th percentile. An additional criterion, the truncated coefficient of variation less than 0.10, was added in FY2012. The truncated coefficient of variation is calculated by eliminating 5% of the lowest and 5% of the highest performance scores from the calculation. The quality initiatives work groups and staff believed it was important to retain these topped off measures in the analysis. Retaining topped off measures would enable to calculate the appropriateness score based on a comprehensive set of measures and would eliminate the need to track which measures were included or excluded from the program each year. (Although the list of topped off measures seems fairly consistent, staff observed slight changes over the years). Special rules concerning the scoring of performance on topped off measures, however, have been developed. The benchmark for the topped off measures is set at 90% and the attainment threshold is set at 65%.

The hospital's overall performance score for each domain is the ratio of its earned points divided by its available points. Opportunity and Appropriateness models are weighted equally to calculate the clinical score. The clinical score constitutes 70% of the final QBR score combined with the HCAHPS score, which is 30% of the total.

QBR program requires specific thresholds for each domain. For the opportunity score, a measure should have at least 10 cases reported, for appropriateness 25 and for HCAHPS 100. In addition, to avoid assessment based on a narrow perspective, hospitals should have a minimum of 5 measures scored for the clinical model.

The original scaling approach for adjusting payment levels was an exchange rate function (cubed-root functional form) for translating scoring into payment adjustment to minimize rate changes for miniscule differences in total scores, however, HSCRC established that linear function provided a better straightforward application and adapted it for rate year 2012. The maximum amount of penalties/rewards is 0.5% of the

total revenue of the hospital, translating to a total amount at risk of $7.1 million for FY2012.

2. MHAC Program

As mentioned above, the MHAC program is based on a list of 64 PPCs developed by 3M Health Information Systems. PPCs are identified based on the present on admission (POA) information on hospital discharge abstract data set submitted to HSCRC. MHAC scaling is determined by two components: a. incidence of complications b. amount of additional charges for each PPC. The incidence of complications is the count of each PPC included in the MHAC program adjusted for the patient mix using APR-DRG and SOI categories. This method calculates hospital's expected incidence of complications given the severity of its patients mix based on the defined performance criteria (state average in the previous year) and compares expected values to the observed incidence to scale the hospital's overall performance. The amounts of additional charges for each PPC are estimated using a state-wide regression analysis of standardized charges in the previous year, which controls for the admission APR-DRGs and SOIs. For each PPC, the overall impact is calculated as follows:

PPC_i=Each of the 49 PPCs included in MHAC
A=hospital's actual number of PPC
E=hospital's expected rate of PPC
RA=estimated additional charge of PPC based on state-wide regression estimate

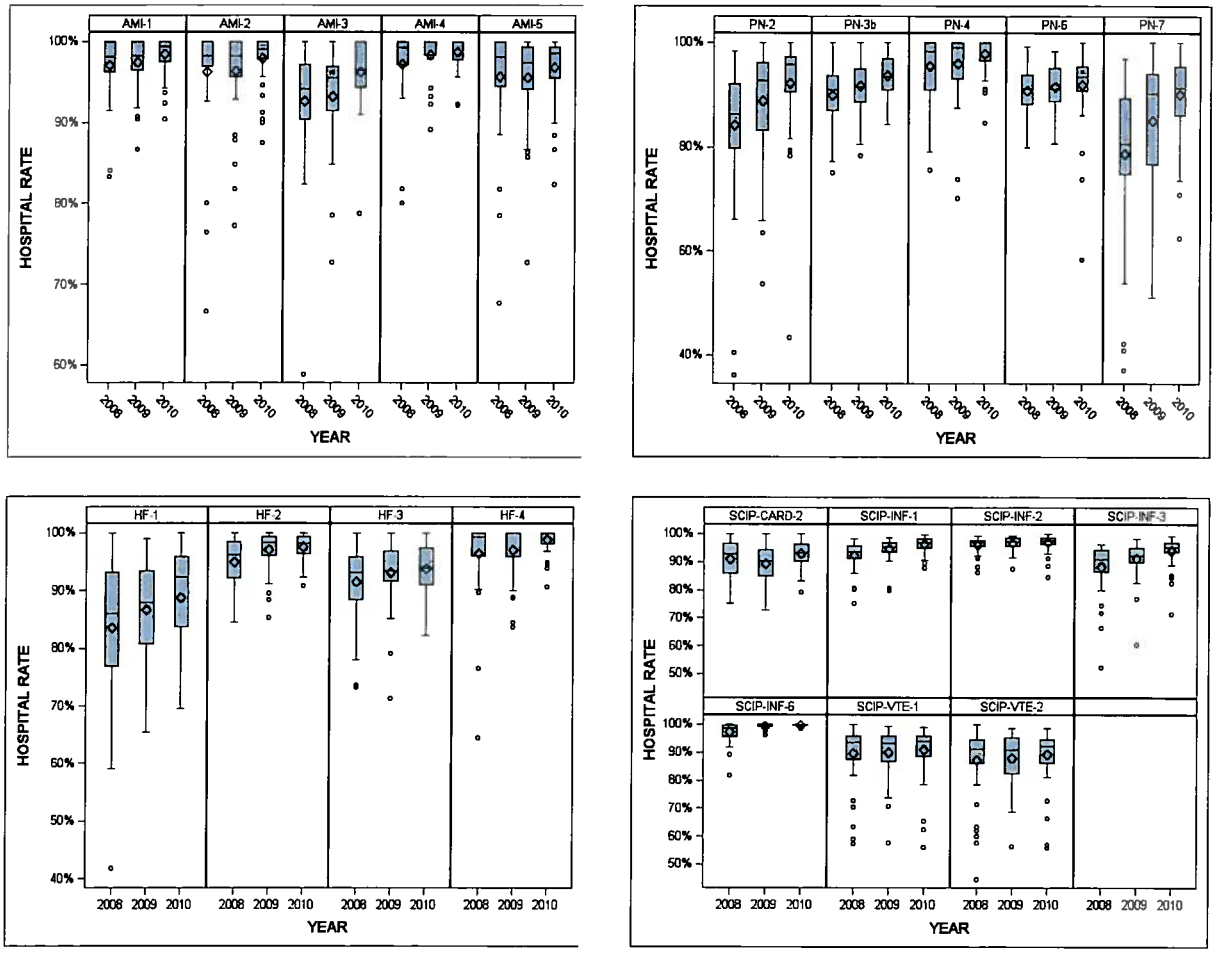
$$IMPACT_i=(A_{PPCi}-E_{PPCi})*RA_{PPCi}$$

The sum of each individual PPC impact yields an overall additional resource use due to excess/low complication rates for each hospital. More technical and detailed information is provided in Appendix A. The MHAC hospital index is calculated as the overall additional resource use as a percentage of hospital revenue from cases that were included in the PPC determination. For FY2012, the maximum scaled amount was 1% of the hospital inpatient revenue, which resulted in a total of $13.3 million allocated through a linear exchange function.

C. Patient Quality Outcome and Cost Results

Initial analysis of trends in the clinical process of care measures that are included in the QBR Program revealed very promising results. Using box-plots Figure 5 illustrates each measure by clinical domain (AMI, HF, PN, SCIP). As previously illustrated in Figure 1, all measures are improved from 2008 to 2010 and, most importantly, variation between hospitals decreased quite substantially in almost all measures as well. The highest improvement occurred in PN-2 Pneumococcal Vaccination measure which had a state-wide average of 84.2% in 2008 and increased to 92.2% in 2010. The SCIP VTE-1 and SCIP VTE-2 measures show smaller improvements compared to other measures; however, they were newly added to the program in FY2011. The SCIP CARD-2 and SCIP INF-6 measures were also added the same year. The average percentage point increase in the state-wide average of all measures is 2.9%.

Figure 5: Box Plots of Clinical Process of Care Measures by Year



In the MHAC program, HSCRC has noted improvements in patient outcomes and costs that have been sustained based on the data from initial two years as shown in Figure 6. The summary of the results, which controls for changes in patient mix over the years, are as follows:

- Complication rates declined by 20% in the first two years of the program.
- Of the 49 PPCs used in the MHAC program:
  - 37 PPCs decreased in both years (75%);
  - 3 had declines in FY2010 with an average of 16%, and small increases in FY2011 (average increase was 6%);
  - 6 PPCs increased in FY2010 (average increase was 5%) and declined in FY2011 (average decrease was 8%); and
  - 3 PPCs showed increases in both years with an average annual increase of 11%.
- Estimated total cost savings due to reductions in complication rates in the initial two years were $105.4 million.

Figure 6: State-wide Changes in Complications Rates and Cost Savings in MHAC Program

PPC NUMBER/ NAME		PERCENT ANNUAL RATE CHANGE		2 YEAR TOTAL RATE CHANGE	2 YEAR TOTAL COST CHANGE
		FY2010	FY2011		
.	MD TOTAL	-11.95%	-8.32%	-20.27%	-$105,464,576
13	Other Cardiac Complications	-26.61%	-18.73%	-45.34%	-$364,816
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions	-27.74%	-15.80%	-43.54%	-$2,127,790
15	Peripheral Vascular Complications Except Venous Thrombosis	-20.79%	-22.58%	-43.37%	-$1,402,442
35	Septicemia & Severe Infections	-20.97%	-20.53%	-41.50%	-$16,564,123
22	Urinary Tract Infection	-27.40%	-12.30%	-39.70%	-$17,254,363
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	-6.46%	-32.15%	-38.61%	-$448,209
36	Acute Mental Health Changes	-23.57%	-12.11%	-35.68%	-$258,851
10	Congestive Heart Failure	-15.40%	-20.13%	-35.53%	-$2,636,381
44	Other Surgical Complication - Moderate	-18.44%	-16.96%	-35.40%	-$1,600,777
54	Infections due to Central Venous Catheters	-20.97%	-12.84%	-33.81%	-$2,664,024
34	Moderate Infectious	-13.73%	-18.43%	-32.16%	-$1,626,652
23	GU Complications Except UTI	-10.96%	-20.63%	-31.59%	-$468,867
28	In-Hospital Trauma and Fractures	-8.67%	-19.06%	-27.73%	-$266,330
31	Decubitus Ulcer	-25.06%	-0.84%	-25.90%	-$5,554,086
11	Acute Myocardial Infarction	-14.67%	-10.93%	-25.60%	-$2,332,141
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Proc	-11.30%	-13.64%	-24.94%	-$4,154,100
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	-23.79%	-1.13%	-24.92%	-$2,641,854
5	Pneumonia & Other Lung Infections	-12.62%	-10.73%	-23.35%	-$10,286,330
33	Cellulitis	-18.82%	-3.70%	-22.52%	-$798,443
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection	-12.00%	-9.87%	-21.87%	-$1,956,314
25	Renal Failure with Dialysis	-3.16%	-17.72%	-20.88%	-$461,888
42	Accidental Puncture/Laceration During Invasive Procedure	-16.22%	-4.49%	-20.71%	-$1,254,462
2	Extreme CNS Complications	-10.53%	-9.90%	-20.43%	-$968,065
16	Venous Thrombosis	-19.63%	0.69%	-18.94%	-$2,414,286
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	-5.88%	-11.67%	-17.55%	-$992,140
14	Ventricular Fibrillation/Cardiac Arrest	-13.96%	-3.51%	-17.47%	-$5,566,386
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	-5.25%	-10.08%	-15.33%	-$4,739,899
8	Other Pulmonary Complications	-9.93%	-4.97%	-14.90%	-$1,466,468

PPC NUMBER/ NAME		PERCENT ANNUAL RATE CHANGE		2 YEAR TOTAL RATE CHANGE	2 YEAR TOTAL COST CHANGE
		FY2010	FY2011		
50	Mechanical Complication of Device, Implant & Graft	-4.03%	-10.10%	-14.13%	-$780,030
51	Gastrointestinal Ostomy Complications	-5.40%	-7.06%	-12.46%	-$484,861
47	Encephalopathy	-11.78%	-0.58%	-12.36%	-$1,543,462
9	Shock	1.21%	-13.48%	-12.27%	-$3,654,322
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	-3.27%	-8.42%	-11.69%	-$2,231,164
7	Pulmonary Embolism	-14.20%	2.61%	-11.59%	-$357,218
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	-2.12%	-9.00%	-11.12%	-$608,184
6	Aspiration Pneumonia	-6.74%	-2.48%	-9.22%	-$2,052,555
19	Major Liver Complications	-5.37%	-3.17%	-8.54%	-$338,033
24	Renal Failure without Dialysis	-3.68%	-2.04%	-5.72%	-$1,905,890
12	Cardiac Arrythmias & Conduction Disturbances	-3.97%	-0.15%	-4.12%	-$44,424
43	Accidental Cut or Hemorrhage During Other Medical Care	6.03%	-10.14%	-4.11%	$29,824
1	Stroke & Intracranial Hemorrhage	-1.47%	-2.09%	-3.56%	-$250,565
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	6.88%	-9.65%	-2.77%	-$156,734
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	2.00%	-4.25%	-2.25%	$107,935
26	Diabetic Ketoacidosis & Coma	3.69%	-4.86%	-1.17%	$35,470
48	Other Complications of Medical Care	-12.98%	13.97%	0.99%	-$216,874
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	0.71%	2.33%	3.04%	$134,742
49	Iatrogenic Pneumothrax	11.69%	-8.10%	3.59%	$83,125
56	Obstetrical Hemorrhage with Transfusion	4.68%	7.84%	12.52%	$189,077
39	Reopening Surgical Site	46.51%	6.98%	53.49%	$1,850,051

Note: Changes are adjusted for differences in patient mix over the years. The average cost of each PPC may differ in FY2010 and FY2011, resulting in cost increases despite reductions in rates or vice versa in some cases.

D. The HSCRC Quality Programs are to a Large Degree in Sync with, but More Aggressive than, the CMS VBP Program

HSCRC staff have reviewed the VBP methodology in detail and have aligned the quality initiatives, to the extent possible and appropriate, with the defined VBP methodology. Figure 7 below illustrates the similarities and differences of the key design features of the CMS VBP Program and the Maryland hospital quality initiatives similar to VBP.

Figure 7. Comparison of CMS and Maryland Initiatives

	CMS VBP PROGRAM	MARYLAND QBR and MHAC PROGRAMS
PROGRAM COMPONENTS		
FY13	Clinical Process of Care Measures	Clinical Process of Care Measures (since FY2009)
	Patient Experience Measures	Patient Experience Measures (since FY2012)
		Hospital Acquired Potentially Preventable Complication Rates (since FY2010)
FY14 (additions)	Inpatient Mortality Measures (Medicare Only)	Addition of Risk Adjusted Mortality Rates for all payers is under consideration.
	AHRQ Patient Safety Indicators (PSIs), Inpatient Quality Indicators (IQIs) Composite Measures	Addition of AHRQ PSI and IQI Composite Measures is under consideration. Most or all measures comprising the composites are already included in the MHAC measure set.
	Hospital Acquired Condition Measures	Hospital Acquired Potentially Preventable Complication Rates (since FY2010)
METHODOLOGY		
Clinical Process of Care, Patient Experience Measures		**MARYLAND QBR PROGRAM**
Measurement Period (FY13)	*(3 Qtrs) 7/1/11 - 3/31/12*	*(4 Qtrs) CY2011*
Baseline Period (FY13)	*(3 Qtrs) 7/1/09 - 3/31/10*	*(4 Qtrs) CY2010*
Benchmark	Mean of top Decile	Consistent with VBP
Threshold	50th percentile	Consistent with VBP
Score used better of Improvement or Attainment	Yes	Consistent with VBP
Index Score Calculation	0 through 10	Consistent with VBP
Adjustment for year to year fluctuation	*No*	*Yes-improvement is based on the highest score attained in the past program years*
Topped off Measure Definition	75th percentile and 90th percentile are statistically indistinguishable	Consistent with VBP
Topped off Measures	*Removed from policy*	*Used in policy with adjusted benchmark (95%) and threshold (65%).*
Measurement Population	All payer	Consistent with VBP
Minimum Number of Cases in Each Measure	10- Process of Care; 100- HCAHPS	Consistent with VBP
Minimum Number of Measures	*4*	*5*
Utilization of Appropriateness of Care (Perfect Care) by Topic	*No*	*Yes- weighted as 50% of overall clinical score for FY 2012*
Weighting of Measures	70% clinical process of care measures 30% patient experience measures	Consistent with VBP
Outcome Measures		**MARYLAND MHAC PROGRAM**
Measurement Period (FY14)	(18 months) 7/1/11 - 12/31/12	(12 monts) FY2013
Baseline Period (FY14)	(18 months) 7/1/08 - 12/31/09	(12 months) FY2012

	CMS VBP PROGRAM	MARYLAND QBR and MHAC PROGRAMS
Measurement Population	*Mortality (Medicare), others (All-Payer)*	*All-payer*
Score calculation	*Same as Clinical Process of Care, Patient Experience methodology outlined above*	*Risk adjusted rates of complications ~50 potentially preventable complications, developed by 3M HIS, weighted by cost of each complication*
TRANSLATING PERFORMANCE INTO PAYMENTS		**MARYLAND QBR and MHAC PROGRAMS**
Scaling Curve	Linear	Consistent with VBP
Adjustment Type	One-time	Consistent with VBP
Payments Covered	*Medicare Payments Only*	*All-payer*
Financial Impact	Nationally Revenue Neutral	State-wide Revenue Neutral
Amount at Risk	*Withold from BASE DRG rate-* *FY13: 1%* *FY14: 1.25%* *FY15: 1.5%* *FY16: 1.75%* *FY17: 2.0%*	*Update factor for State fiscal year (FY) adjusted* *FY 10- QBR: 0.5%* *FY 11- QBR: 0.5%, MHAC: 0.5%* *FYI 12- QBR: 0.5%, MHAC: 1%* *FY 13- QBR Proposed: 0.5%, MHAC Proposed 1.5%-2%*
Reward/Penalty	After 1% witholding; hospitals earn back the 1% based on performance above 0	Based on statewide scaling with maximum penalty for the worst hospital set by the amount of risk.

In the interest of aligning incentives and initiatives, HSCRC has reviewed CMS' Partnership for Patients (PFP) -a CMS priority project designed to reduce inpatient harm and readmissions over a three year period in ten primary areas of focus, including those listed below. HSCRC further understands that CMS will contract with Hospital Engagement Contractors (HECs) to develop content and learning activities and to make them available to hospitals participating in the partnership. Under the terms of the contract, the HECs are to design and conduct various types of hospital training events and sessions.

HSCRC notes that each of the ten PFP focus areas listed below are addressed through measurement and/or payment adjustments in HSCRC's MHAC initiative, and in Admission Readmission Revenue Program, which aims to reduce readmissions through a bundled payment structure starting in FY2012.

- Adverse drug events (ADE)
- Catheter-associated urinary tract infections (CAUTI)
- Central line-associated bloodstream infeons (CLABSI)
- Injuries from falls and immobility
- Obstetrical adverse events
- Pressure ulcers
- Surgical site infections
- Venous thromboembolism (VTE)
- Ventilator-associated pneumonia (VAP)
- Preventable readmissions

HSCRC plans to collaborate in any feasible way with HECs working in Maryland in order to leverage their work to improve performance.

E. Ongoing Data Monitoring, Program Evaluation and Provider Feedback Efforts

1. Monitoring and Provider Feedback

HSCRC undertakes several efforts and activities to ensure and validate the clinical and administrative data accuracy that serves as the basis for the QBR and MHAC initiatives, as well as to evaluate and update the program accuracy and relevancy. The Commission also takes steps each year to provide timely data to hospitals that are useful and actionable in quality improvement. Examples of these activities are outlined below.

- The MHCC oversees ongoing audit and validation activities of an audit contractor for the chart abstracted core process measures used for the QBR program.
- HSCRC has established Present on Admission (POA) coding data thresholds for data accuracy and requires hospital data submissions to fit within the established thresholds, e.g., coding all diagnosis codes as POA is not permitted.
- We evaluate, on an ongoing basis, the accuracy of coding, especially POA, through hospital level screening tools (developed by Michael Pine & Associates) and targeted chart reviews (Ingenix routine diagnosis code audit)..
- HSCRC provides quarterly reports to each hospital with their total count of each PPC, ranking in the state, and case level information.
- Within the last year, HSCRC has contacted two hospitals with the worst complication rates and provided more detailed analysis to help them understand the data.
- Within the last year, another high complication rate hospital contacted HSCRC and provided information voluntarily about their efforts to cut complications.
- In addition, analyses of complication rates are provided to State Health Department Office of Health Care Quality that augments the information they receive to target hospital quality reviews.
- HSCRC plans to continue to contact high rate hospitals of concern on an ongoing basis as well, and revise the routine data reports to make them more useful.
- FY2010 complication rates were published on HSCRC website in a more user-friendly format, which attracted some attention from the media and others.
- HSCRC updates the list of PPCs included in the MHAC program every two years based on the statistical significance of additional cost estimates for each PPC using a regression analysis.
- Since the inception of the quality initiatives, HSCRC has on a regular basis convened formal technical/clinical and payment work groups comprised of providers, payers, the Maryland Hospital Association staff, labor union representatives, and HSCRC staff to review and achieve consensus on changes to the measures, the key methodology components, payment reward and penalty magnitudes and scaling options; HSCRC will look to include additional consumer representatives on these groups going forward.
- HSCRC has encouraged inputs from providers and other stakeholders on an informal "rolling" basis as well, and has been able to efficiently use the information and make

changes that improve the programs on a close to real time basis, e.g., Karen Jerome, MD, Medical Director, Care Management at Holy Cross Hospital provided feedback on specific PPCs in May and August of this year and, as a result, 3M HIS is making changes to the clinical logic in v. 29 of the PPC Grouper to be issued in October 2011 (please see Appendix B).

2. External Evaluation

HSCRC strongly supports external program evaluation as a means to objectively gauge the effects and outcomes of quality initiatives linked with payment, and to gain additional insights on potential unintended consequences of our programs. To this end, HSCRC is collaborating with Steven Garfinkel, PhD from American Institutes for Research on a study funded by the Robert Wood Johnson Foundation. For this study, HSCRC staff are providing data to support examination of the set of pay-for-performance programs for hospital inpatient care and their impact on health disparities in the State of Maryland. The results of this three year study should be made publicly available in 2012.

F. Anticipated Future Direction to Strengthen the Programs

HSCRC will continue to track the developments at the Federal level in terms of health reform and quality and efficiency performance measurement. HSCRC will conduct activities that include, but are not limited to:

- Updating and refining the measures used, including increasing the focus on patient experience and outcome measures, adding measures for the outpatient setting, etc.
- Updating and refining the methodologies raising the bar for the performance measurement targets that define expected performance, etc.
- Monitoring the programs for unintended consequences such as shifts of patients perceived to have high complication rates.
- Continuing to increase the amount of revenue at risk for performance-based reimbursement over time.
- Engaging patients/consumers in the planning/design phases as well as the implementation and evaluation phases of the programs.
- Continuing to audit hospital clinical charts for coding accuracy and core measures validation.

V. Conclusion

The Maryland hospital quality initiatives linked with payment individually and as a whole are advancing the quality of hospital care by improving patient outcomes and cost. The HSCRC has demonstrated the value that patients and payers have accrued as a result of the HSCRC initiatives and desires to continue this progress. Without this exemption, it would not be feasible to operate both the CMS VBP and the HSCRC QBR program in Maryland at the same time. Further it is not clear how payment incentives would be applied under a VBP program since, pursuant to the Medicare waiver, Medicare reimburses Maryland hospitals based on Commission-approved rates.

Although there is no additional data reporting burden on providers, overlapping State and national payment reward and incentive programs would create difficulties for providers in managing their programs under similar, but ultimately somewhat different measurement systems and methodologies. Not only do Maryland's QBR and MHAC policies achieve CMS's requirements as outlined in the VBP and HAC programs but they also are broader than the CMS proposal and integrate well with Maryland's all-payer system.

An exemption from the CMS VBP and HAC programs will allow Maryland to continue its all-payer system approach in developing new reimbursement strategies and act as a large-scale pilot for these and other innovative strategies for cost containment and improved quality of care. The early and dramatic results of the MHAC program, in particular, illustrate the importance of allowing the programs to continue. In his letter of 9/30/2011, Dr. Joshua Sharfstein, Secretary of the Maryland Department of Health and Mental strongly supports our exemption request and notes the early, promising findings of our initiatives and the potential for broader positive impact on the Medicaid population, among other benefits.

Maryland again respectfully requests that the Secretary use the discretion provided under 1886(o)(1)(C)(iv) of the Social Security Act to grant a VBP exemption for Maryland under the condition that the State submit an updated report each year of any changes to the methodology of the HSCRC hospital quality initiatives linked with payment along with a report that demonstrates that the HSCRC programs' results continue to achieve or surpass those of the Federal Value Based Purchasing program.

Sincerely,

Stephen Ports, Acting Executive Director
Maryland Health Services Cost Review Commission

CC: Joshua Sharfstein, M.D., Secretary, Maryland Department of Health and Mental Hygiene

John M. Colmers, Chairman, HSCRC
Vice President, Health Care Transformation and Strategic Planning for Johns Hopkins Medicine

Donald Berwick, M.D., Administrator, Centers for Medicare and Medicaid Services

Tzvi Hefter, Director Division of Acute Care, CMS Center for Medicare, Hospital and Ambulatory Care Policy Group

Jean Moody-Williams, Director, Quality Improvement Group, CMS Office of Clinical Standards and Quality

APPENDIX A: MHAC Statistical Methods

1. Introduction

The 3M™ APR™ DRG classification system categorizes patients based on their severity of illness and risk of mortality at the time of admission. In version 27.0 of the APR classification system, there are 314 APR DRG categories, each of which is subdivided into four subclasses for a total of 1,356 unique patient categories.

Potentially Preventable Complications (PPCs) identify complications that can occur during an admission. There are 64 PPCs. Depending on their clinical characteristics, some patients are totally excluded from the PPC analysis, while others are partially excluded (i.e., cannot be considered for some PPCs, but may be considered for others).

Rates of PPC occurrence can be calculated for each APR DRG category. These rates may be calculated using the occurrence of any PPC, a specific PPC, or a specific number of PPCs (e.g., one, two, three or more). These rates were calculated using the full Maryland dataset. These rates are typically referred to as norms because they reflect the experience of groups of hospitals.

Once the expected occurrence of a PPC is computed, the difference between the observed (actual) occurrence and expected occurrence of a PPC can be multiplied by the PPC marginal charge amount in order to calculate the resource use or savings by PPC. Multiplying the marginal charge amount for each PPC times the case differential between the observed and expected PPC occurrence allows for each PPC to be weighted by an estimated resource use when summed across the various PPC, This total impact allows for the user to financially assess the difference in the observed and expected occurrence of each PPC.

Further, using admission APR DRG categories to control differences in the clinical characteristics between their patients or those of the norm, individual hospitals can compare their PPC rates to those of the normative data. These comparisons will enable them to determine if and how their performance differs from comparable hospitals. A provider's experiences and those of normative populations are likely to be different. This can represent a true difference or can be caused by normal variation. Statistical techniques can be used to determine which of the observed differences in outcomes are most likely to be true differences and which are probably the result of natural variation.

2. Expected Values

The expected value of PPCs is the number of PPCs a hospital, given its mix of patients as defined by APR DRG category and severity of illness level, would have experienced had its rate of PPCs been identical to that experienced by a reference or normative set of hospitals.

The technique by which the expected value or expected number of PPCs is calculated is called indirect standardization. For illustrative purposes, assume that every discharge can meet the criteria for having a PPC, a condition called being "at risk" for a PPC. All discharges will either have no PPCs or will have one and possibly more PPCs. For this exercise, therefore, each

discharge either has a PPC or does not have a PPC. The PPC rate is proportion or percent of admissions which have at least one PPC.

The rates of PPCs in the normative database are calculated for each APR DRG category and its severity of illness levels by dividing the observed number of PPCs by the total number of admissions. The PPC norm for a single APR DRG severity of illness level is calculated as follows:

Let:

N = norm
P = Number of discharges with one or more PPCs
D = Number of discharges that can potentially have a PPC
i = An APR DRG category and a single severity of illness level

$$N_i = \frac{P_i}{D_i}$$

For this example, this number is displayed as PPCs per discharge to facilitate the calculations in the example. Most reports will display this number as a rate per one thousand.

Once a set of norms has been calculated, they can be applied to each hospital. For this example, the computation is for an individual APR DRG category and its severity of illness levels. This computation could be expanded to include multiple APR DRG categories or any other subset of data, by simply expanding the summations.

Consider the following example for an individual APR DRG category illustrated in Table 1 below.

Table 1 Expected Value Computation Example

1 Severity of illness Level	2 Discharges at risk for PPCs	3 Discharges with PPCs	4 PPCs per discharge	5 Normative PPCs per discharge	6 Expected # of PPCs
1	200	10	.05	.07	14.0
2	150	15	.10	.10	15.0
3	100	10	.10	.15	15.0
4	50	10	.20	.25	12.5
Total	500	45	.09		56.5

For the APR DRG category, the number of discharges with PPCs is 45, which is the sum of discharges with PPCs (column 3). The overall rate of PPCs per discharge, 0.09, is calculated by dividing the total number of discharges with PPCs (sum of column 3) by the total number of discharges at risk for PPCs (sum of column 2), i.e., 0.09 = 44/500. From the normative population, the proportion of discharges with PPCs for each severity of illness level for that APR DRG category is displayed in column 5. The expected number of PPCs for each severity of illness level shown in column 6 is calculated by multiplying the number of discharges at risk for PPCs (column 2) by the normative PPCs per discharge rate (column 5) The total number of

PPCs expected for this APR DRG category is the expected number of PPCs for the severity of illness levels.

In this example, the expected number of PPCs for this APR DRG category is 56.5 compared to the actual number of discharges with PPCs of 45. Thus the hospital had 11.5 fewer actual discharges with PPCs than were expected for this APR DRG category. This difference can be expressed as a percentage difference as well.

APR DRG by SOI categories are excluded from the computation of the actual and expected rates when there are only zero or one at risk admission statewide for the associated APR DRG by SOI category.

3. Estimate of the Marginal Additional Charge of PPCs in Maryland

Objective: Estimate the marginal hospital charge increase when a patient develops a PPC during a hospital stay (i.e., acquired post admission) in Maryland.

Data Source: Maryland inpatient acute care all payer statewide hospital data from July 2009 through June 2010 containing 759,991 discharges were used as the basis for the estimates. Forth Washington Hospital is excluded from the analysis due to problems with present at admission (POA) codes. Discharges that died or were transferred to another acute care facility were excluded. Discharges from two inpatient rehab hospitals were excluded. Further, discharges with charge values below $200 or above $2,000,000 were excluded. Individual case level charges were standardized based the ratio of the statewide average hospital Charge Per Case (CPC) of $12,491.48 to the hospital average CPC (CMI of 1.0). The hospital CPC targets used were from the FY2010 CPC targets, updated in February 2011. The resultant analysis file contained 727,430 discharges.

Method: Since the marginal charge impact of a PPC, will vary depending on a patient's reason for admission and severity of illness at the time of admission, it was necessary to adjust for these factors in order to determine the marginal charges of a PPC. 3M All Patient Refined Diagnosis Related Groups (APR-DRGs) classify discharges to one of 314 reasons for admission and one of four severity of illness levels (1,256 unique patient categories). Each discharge in the analysis database was assigned to an APR DRG v28.0. Since patients who develop a post admission complication often develop multiple associated complications, it was necessary to adjust for the presence of multiple complications in order to determine the marginal charge of an individual PPC. 3M Potentially Preventable Complications (PPCs) v28 identify 64 different types of post admission complications analyzing 1,450 ICD-9-CM diagnosis codes and a select set of procedure codes. All PPCs present on each discharge (potentially preventable or not) were identified and used in the regression analysis.
A simple linear regression was specified of the form:

$$\text{Charge}_i = \alpha + \beta_j \text{PPC}_{j,i} + \gamma_k \text{APR-DRG}_{k,i} + \varepsilon_i$$

Where:
Charge_i is the total charge standardized for discharge i

APR DRG $_{k,i}$ is a binary variable (0,1) indicating which of the 1,256 APR DRGs was assigned to the i^{th} discharge

PPC $_{j,i}$ is a binary variable (0,1) indicating which of the j PPCs were present for the i^{th} discharge

α is a constant value applied to each discharge in the model. α is the average baseline charge for a reference APR DRG.

γ_k is the coefficient associated with APR-DRG k and measures the marginal additional charge above α that is due to the patient's reason for admission and severity of illness level at the time of admission.

β_j is the coefficient associated with PPC j and measures the marginal additional charge above α that is due to the presence of PPC j

ε_i is the residual error of the model for discharge i

The coefficient β_j for each PPC is a measure of the marginal additional charges due to the occurrence of the PPC taking into account the patient's reason for admission, severity of illness and the presence of any other post admission complications (PPCs).
Cases in low volume APR-DRGs were omitted from the regression (less than 20 cases in each APR-DRG SOI combination). No effort was made to identify and exclude outlier cases.

Results: A regression model was calculated. For each of the PPC categories, coefficients (additional per case charges) and t-values are shown in Table 2 below.

The results of the regression are used for computing the dollar impact for each of the 64 PPCs. The dollar impact is used to create an index of either additional, or averted, resource use based on a hospital's rate of a PPC summed across all PPCs. Eleven (11) PPCs with less predictive t-values (under 1.96) were excluded from the quality based payment adjustment PPC policy in FY2009. This list was kept constant for the second year to maintain consistency. Only two of these PPCs had t-value above 1.96 and sufficient number of cases. None of the PPCs included in FY 2009 had non-significant t-values in FY2010. Four additional PPCs are excluded from the program due to clinical and coding problems. Since the charge values in the regression file used standardized charges, the additional per case charge value for each PPC needs to be converted back to a hospital specific value by the ratio of the hospital CPC divided by the statewide average CPC of $12,491.48.

Table 2. PPC Regression Results

		FY2010			
PPC #	PPC Description	Adm $	Adm T	Cases	Notes
			T Value<1.96		Exclusion Reason
1	Stroke & Intracranial Hemorrhage	$12,653	40.71	1,005	
2	Extreme CNS Complications	$15,059	35.16	542	
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	$5,559	40.79	5,824	
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	$22,105	67.72	949	
5	Pneumonia & Other Lung Infections	$16,847	110.38	4,470	
6	Aspiration Pneumonia	$12,949	55.85	1,853	
7	Pulmonary Embolism	$13,655	34.62	623	
8	Other Pulmonary Complications	$9,112	61.22	4,669	
9	Shock	$14,911	65.51	2,010	
10	Congestive Heart Failure	$4,023	18.56	2,071	
11	Acute Myocardial Infarction	$5,438	19.87	1,280	
12	Cardiac Arrythmias & Conduction Disturbances	$2,069	6.17	1,119	
13	Other Cardiac Complications	$5,127	9.43	316	
14	Ventricular Fibrillation/Cardiac Arrest	$17,928	49.40	747	
15	Peripheral Vascular Complications Except Venous Thrombosis	$16,183	26.85	266	
16	Venous Thrombosis	$12,571	50.01	1,576	
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	$12,959	37.16	786	
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	$11,954	21.22	298	
19	Major Liver Complications	$14,705	30.89	431	
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	$14,523	31.90	458	
21	Clostridium Difficile Colitis	$16,901	64.85	1,420	Clinical/Coding
22	Urinary Tract Infection	$10,104	76.36	5,665	
23	GU Complications Except UTI	$4,125	9.44	496	
24	Renal Failure without Dialysis	$7,873	70.34	8,069	
25	Renal Failure with Dialysis	$34,892	52.74	215	
26	Diabetic Ketoacidosis & Coma	$3,164	2.35	53	
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	$5,526	19.51	1,191	
28	In-Hospital Trauma and Fractures	$3,553	4.39	148	
29	Poisonings Except from Anesthesia	$1,661	2.31	181	t-value
30	Poisonings due to Anesthesia	-$8,687	-0.90	1	t-value
31	Decubitus Ulcer	$21,968	72.78	1,063	
32	Transfusion Incompatibility Reaction	$22,003	4.57	4	t-value
33	Cellulitis	$4,648	15.86	1,194	
34	Moderate Infectious	$17,957	59.25	1,085	
35	Septicemia & Severe Infections	$16,146	82.11	2,789	
36	Acute Mental Health Changes	$4,343	12.40	766	
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	$16,589	56.54	1,246	
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	$21,994	21.58	92	
39	Reopening Surgical Site	$16,595	21.50	160	
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D F	$7,053	40.82	3,267	
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	$17,974	26.04	198	
42	Accidental Puncture/Laceration During Invasive Procedure	$6,070	23.16	1,463	
43	Accidental Cut or Hemorrhage During Other Medical Care	$3,603	3.86	112	
44	Other Surgical Complication - Mod	$17,458	37.62	445	
45	Post-procedure Foreign Bodies	$4,917	2.70	30	t-value
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	-$21,314	-3.03	2	t-value
47	Encephalopathy	$13,304	51.88	1,480	
48	Other Complications of Medical Care	$17,459	48.75	755	
49	Iatrogenic Pneumothrax	$6,173	19.33	963	
50	Mechanical Complication of Device, Implant & Graft	$15,006	36.13	552	
51	Gastrointestinal Ostomy Complications	$23,849	45.67	350	
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infect	$8,795	30.49	1,163	
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusi	$10,554	21.25	382	
54	Infections due to Central Venous Catheters	$30,766	68.62	495	
55	Obstetrical Hemorrhage without Transfusion	$386	2.85	5,574	Clinical/Coding
56	Obstetrical Hemorrhage wtih Transfusion	$2,271	5.19	508	
57	Obstetric Lacerations & Other Trauma Without Instrumentation	$310	1.11	1,219	t-value
58	Obstetric Lacerations & Other Trauma With Instrumentation	$811	1.84	484	t-value
59	Medical & Anesthesia Obstetric Complications	$210	0.63	865	t-value
60	Major Puerperal Infection and Other Major Obstetric Complications	$116	0.20	289	t-value
61	Other Complications of Obstetrical Surgical & Perineal Wounds	-$364	-0.5	182	t-value
62	Delivery with Placental Complications	$907	1.47	248	t-value
63	Post-Operative Respiratory Failure with Tracheostomy	$110,834	97.21	75	Clinical/Coding
64	Other In-Hospital Adverse Events	$3,578	9.79	725	Clinical/Coding

Note: Shaded PPCs are excluded

APPENDIX B: 3M HIS Response to
Comments from Holy Cross Hospital Regarding 3M PPC Logic
Updates Planned for APR DRG Grouper v.29
(October 2011)

PPC 34 (Moderate Infections)

PPC 34 is assigned when defibrination syndrome (286.6) is coded. However, code 286.6 is sometimes assigned in cases where there is no infection. We have such an example. A Holy Cross patient was undergoing plasmapheresis to treat myasthenia gravis. This resulted in acquired hypofibrinogenemia, which was significant because the patient was to undergo surgery. This patient was not infected. Unfortunately, acquired hypofibrinogenia is assigned the same code, 286.6, as defibrination syndrome. Therefore, Holy Cross was actually assigned PPC 34 for this case. I suppose that a change in coding rules will be required to remedy this. Perhaps a number of cases assigned PPC 34 could be reviewed to determine whether a significant number of others have the PPC assigned despite the absence of infection. If so, perhaps 286.6 should be eliminated from the list of codes that trigger PPC 34, pending a change in the coding rules.

3M HIS Action: Removed 2866 (Defibrination Syndrome) from PPC 34 (Moderate Infections) assignment until the two conditions can be distinguished.

PPC 27 (Post-Hemorrhagic & Other Acute Anemia with Transfusion)

I propose that you consider adding APR 513 to the Major Surgical APR-DRG list. We had a case of a patient with cervical carcinoma in-situ who underwent a TAH-BSO and lysis of adhesions, both peritoneal and perirenal. Clearly this was a complex surgical undertaking, and it codes to APR 513. On the third post-op day, when her hemoglobin had dropped to 6.3, from 8.1 on the prior day, she was appropriately transfused. Holy Cross was therefore assigned PPC 27. If APR 513 (uterine/adnexal procedure—nonmalignant) were added to the Major Surgical group, along with the already included APRs 511, 512, and 519, then PPC 27 wouldn't apply in this case, as the patient would have received her transfusion within 4 days. As there was no substandard care provided here the hospital should not be assigned PPC 27 in this case. This is likely only one example of many complicated cases falling into APR 513 and thus at risk for inappropriate application of PPC 27.

3M HIS Action: Added APR DRG 513 (Uterine & Adnexa Procedures for Non-Malignancy except Leiomyoma) to the Major Surgical DRG list and the associated procedures to the Major OR procedure list. Now the criteria of the transfusion occurring four days following the major procedure will be applied instead of three days for a non-major procedure for assignment of PPC 27 (Post-Hemorrhagic & Other Acute Anemia with Transfusion).

PPC 14 (Ventricular Fibrillation/Cardiac Arrest)

Please consider adding some exclusionary diagnoses for this PPC. A patient was admitted to Holy Cross with severe sepsis, acute respiratory failure, diabetes and chronic kidney disease stage V, and an acute MI (all diagnoses were POA). She suffered a cardiac arrest on the day

after admission. Given her multiple, severe comorbidities on admission the cardiac arrest was likely inevitable, despite aggressive treatment in a critical care unit. Perhaps such an exclusion could require the presence of several diagnoses rather than just a single diagnosis, in order to acknowledge the high likelihood of a cardiac arrest in future complicated cases such as this one.

3M HIS Action: None. The complexity illustrated by this case is accounted for in the expected rate due to the high severity this patient would have due to all the secondary conditions.

PPC 8 (Other Pulmonary Complications)

I have several concerns with this PPC. The diagnosis hydropneumothorax is assigned code 511.89 (other specified forms of effusion, except TB). We had a patient with bronchogenic carcinoma who underwent a left lower lobectomy (32.49) for this and, not surpringly, subsequently developed a hydropneumothorax, for which we were assigned PPC 8. Please consider adding this patient's admission APR-DRG, 120 (Major respiratory and chest procedures), as a PPC 8 exclusion. In addition, please consider adding an exclusionary category for pulmonary malignancies, which would include codes such as 162.3 or 162.5 (malignant neoplasm of upper or lower lobe, respectively).

The diagnosis 239.1 (neoplasm of unspecified nature, respiratory system) is an exclusion for PPC 8 if flagged as being POA, but 162.9 (malignant neoplasm of the bronchus/lung, unspecified site) is not. We had a case of a patient with a 162.9 diagnosis who developed an asthma exacerbation and so received an assignment of PPC 8. If we'd (inappropriately) been less specific in our coding and chosen 239.1 then PPC 8 would have been excluded. This makes little sense to me. Please consider adding 162.9 to the exclusionary codes.

3M HIS Action: Created new PPC-specific malignancy exclusion groups including pulmonary malignancies including 162.3 and 162.5. The conditions in the Malignancy Exclusion Groups are not required to be present on admission to serve as an exclusion. APR DRG 120 was not added as an exclusion for PPC 08.

Description	Content	Applies to PPC
Respiratory Malignancy	All of DRG 136 (Respiratory Malignancy)	05 (Pneumonia & Other Lung Infections) 06 (Aspriation Pneumonia) 08 (Other Pulmonary Complications)
Liver & Pancreas Malignancy	All of DRG 281 (Malignancy of Hepatobiliary System and Pancreas)	19 (Major Liver Complications)
Leukemia & Lymphoma	MDC 17 (Lymphatic, Hematopoietic, Other Malignancies, Chemotherapy, and Radiotherapy)	34 (Moderate Infections) 35 (Septicemia and Severe Infections) 65 (formerly 22 – Urinary Tract Infection) 66 (Catheter-Related Urinary Tract Infection

PPC 48 (Other Complications of Medical Care)

We had a patient who underwent a complicated pulmonary surgical procedure, described in the operative report as "fiberoptic bronchoscopy, left thoracotomy, pneumolysis, resection of large mass left chest, reconstruction, left hemidiaphragm," for a chest mass due to an old traumatic injury. The patient subsequently developed an obstructing mucus plug that had to be identified and removed by repeat bronchoscopy. The mucus plug coded to 934.1 (Foreign Body in Main Bronchus) and resulted in assignment of PPC 48. It seems as if this post-op issue could not necessarily have been prevented, and I ask you to consider adding an exclusion for admission APR 120 (Major respiratory and chest procedures) as well as for APR 121 (Other respiratory and chest procedures) for PPC 48.

3M HIS Action: None. This appears to be a unique set of circumstances. This situation should be addressed by evaluating rates vs. individual records rather than rarely occurring exclusions.