

**Draft Recommendation for the  
Maryland Hospital Acquired Conditions Program  
for Rate Year 2021**

January 9, 2019

Health Services Cost Review Commission

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This document contains the draft staff recommendations for updating the Maryland Hospital-Acquired Conditions (MHAC) Program for RY 2021. Please submit comments on this draft to the Commission by Friday, January 18, 2019, via email to [hscrc.quality@maryland.gov](mailto:hscrc.quality@maryland.gov).

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## List of Abbreviations

AHRQ	Agency for Health Care Research and Quality
APR-DRG	All Patients Refined Diagnosis Related Groups
CMS	Centers for Medicare & Medicaid Services
CY	Calendar Year
DRG	Diagnosis-Related Group
FFY	Federal Fiscal Year
FY	State Fiscal Year
HAC	Hospital-Acquired Condition
HAI	Hospital Associated Infection
HSCRC	Health Services Cost Review Commission
ICD	International Statistical Classification of Diseases and Related Health Problems
MHAC	Maryland Hospital-Acquired Condition
NHSN	National Healthcare Safety Network
NQF	National Quality Forum
PMWG	Performance Measurement Work Group
POA	Present on Admission
PPC	Potentially Preventable Complication
PSI	Patient Safety Indicator
QBR	Quality-Based Reimbursement
RY	Rate Year
SIR	Standardized Infection Ratio
SOI	Severity of Illness
TCOC	Total Cost of Care
VBP	Value-Based Purchasing
YTD	Year to Date

## Key Methodology Concepts and Definitions

**Potentially preventable complications (PPCs):** 3M originally developed 65 PPC measures, which are defined as harmful events that develop after the patient is admitted to the hospital and may result from processes of care and treatment rather than from the natural progression of the underlying illness. PPCs, like national claims-based hospital-acquired condition measures, rely on **present-on-admission codes** to identify these post-admission complications.

**At-risk discharge:** Discharge that is eligible for a PPC based on the measure specifications

**Diagnosis-Related Group (DRG):** A system to classify hospital cases into categories that are similar clinically and in expected resource use. DRGs are based on a patient's primary diagnosis and the presence of other conditions.

**All Patients Refined Diagnosis Related Groups (APR-DRG):** Specific type of DRG assigned using 3M software that groups all diagnosis and procedure codes into one of 328 All-Patient Refined-Diagnosis Related Groups.

**Severity of Illness (SOI):** 4-level classification of minor, moderate, major, and extreme that can be used with APR-DRGs to assess the acuity of a discharge.

**APR-DRG SOI:** Combination of Diagnosis Related Groups with Severity of Illness levels, such that each admission can be classified into an APR-DRG SOI "cell" along with other admissions that have the same Diagnosis Related Group and Severity of Illness level.

**Case-Mix Adjustment:** Statewide rate for each PPC (i.e., normative value or "norm") is calculated for each diagnosis and severity level. These **statewide norms** are applied to each hospital's case-mix to determine the expected number of PPCs, a process known as **indirect standardization**.

**Observed/Expected Ratio:** PPC rates are calculated by dividing the observed number of PPCs by the expected number of PPCs. Expected PPCs are determined through case-mix adjustment.

**Diagnostic Group-PPC Pairings:** Complications are measured at the diagnosis and Severity of Illness level, of which there are approximately 1,200 combinations before one accounts for clinical logic and PPC variation.

**Zero norms:** Instances where no PPCs are expected because none were observed in the base period at the Diagnosis Related Group and Severity of Illness level.

## Recommendations

This is a draft recommendation for the Maryland Rate Year (RY) 2021 Hospital-Acquired Conditions (MHAC) policy. At this time, the staff requests that Commissioners consider the following draft recommendations:

- A. Continue to use 3M Potentially Preventable Complications (PPCs) to assess hospital-acquired complications.
  1. Include focused list of PPCs in payment program that are clinically recommended and that generally have higher statewide rates and variation across hospitals.
  2. Monitor all PPCs and provide reports for hospitals and other stakeholders.
  3. Explore development of national benchmarks for PPCs in future years.
- B. Assess hospital performance on attainment only using a wider and more continuous scale that better differentiates performance, rewarding high attainment but also incentivizing improvement.
- C. Weight the PPCs in payment program by 3M cost weights as a proxy for patient harm.
- D. Convert weighted PPC scores to revenue adjustments using a prospective revenue adjustment scale that focuses on performance outliers; two options for revenue adjustment scale presented are:
  1. Set maximum penalty at 2 percent and maximum reward at 1 percent and use continuous linear scaling with a hold harmless zone between 60 and 70 percent; or
  2. Set maximum penalty at 2 percent and maximum reward at 1 percent and use continuous non-linear scaling with a 65 percent cut point.

Staff appreciates Commissioners input on the current draft policy, and anticipates substantial stakeholder comments. While considerable work has been done with a clinical subgroup under the Performance Measurement Workgroup (PMWG) to consider the appropriate PPCs and weighting to include in the program, stakeholders have yet to come to a consensus on the preset revenue adjustment scale (Recommendation D). As such, staff has provided various scaling options for Commissioner input in this draft, which may require delaying the final MHAC policy until the March Commission meeting to allow sufficient time to address concerns and finalize the policy. Nevertheless, staff is putting forth this draft recommendation to provide hospitals with some indication that a narrowed down list of the PPC measures will be used since the performance period began on January 1, 2019.

## Introduction

A central tenet of the healthcare reform in Maryland since 2014 is that hospitals are funded under Population Based Revenue, a fixed annual revenue cap that is adjusted for inflation, quality performance, reductions in potentially avoidable utilization, market shifts, and demographic growth. Under the Population Based Revenue system, hospitals are incentivized to transition services across the continuum of care and may keep savings that they achieve via improved quality of care (e.g., reduced hospital-acquired infection or other complications, avoidable utilization, readmissions). On the other hand, constraining hospital resources can have unintended consequences, including declining quality of care. Thus, Maryland's Quality programs must measure and reward better quality and reinforce the incentives of the Population Based Revenue system, as well as penalize poor performance and potential unintended consequences.

The Maryland Health Services Cost Review Commission's (HSCRC's or Commission's) Hospital Acquired Conditions (MHAC) program incentivizes hospitals to improve patient safety and value over time. The MHAC policy currently holds 2 percent of hospital revenue at-risk for performance measures related to complications that occur during a hospital stay as a result of treatment. Under the 2014-2018 All-Payer Model Agreement between Maryland and the Centers for Medicare & Medicaid Services (CMS), there were specific quality performance requirements, including reducing all-payer complications by 30 percent by the end of 2018 as measured by 3M Potentially Preventable Complication (PPC) measures. Maryland has well exceeded this target with a 51.54 percent reduction in the all-payer case-mix adjusted complication rate based on data through June of 2018. However, the hospital industry has expressed concerns that the inclusion of 45 PPC/PPC combinations in a pay-for-performance program well exceeds the number and type of complications measured nationally, hindering the ability to focus on priority areas.

As Maryland enters into a new Total Cost of Care (TCOC) Model Agreement with CMS on January 1, 2019, performance standards and targets in HSCRC's portfolio of quality and value-based payment programs will be updated. In CY 2018, staff focused on revising two of the Commission's Quality programs, the Maryland Hospital-Acquired Conditions program and the Potentially Avoidable Utilization program, per directives from HSCRC Commissioners.<sup>1</sup>

For the complications program redesign, staff worked to address industry concerns regarding the large number of complication measures and to focus on the most meaningful and significant measures of patient safety. To do this work staff contracted with Dr. Zahid Butt of Medisolv to provide subject matter expertise and to convene a group of clinical and measurement experts as well as hospital and payer representatives to review existing all-payer complications measures and provide suggestions for evaluating hospital performance. The Clinical Adverse Event Measures

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<sup>1</sup> In the fall of 2017, HSCRC Commissioners with staff supports conducted several strategic planning sessions to outline priorities and guiding principles for the upcoming Total Cost of Care Model. Based on these sessions, the HSCRC developed a Critical Action Plan that delineates timelines for review and possible revisions of financial and quality methodologies, as well as other staff operations.

(CAEM) subgroup met from February through September and their suggestions were then brought to the Performance Measurement Workgroup (PMWG) for further discussion. Details on the complication subgroup process and suggestions are provided throughout this policy and Appendix I contains a report on the process from Dr. Butt.

The draft MHAC policy reflects consensus recommendations from the CAEM subgroup and PMWG, including: maintaining the use of 3M Potentially Preventable Complications but reducing the number of complication measures; moving to an attainment only system given Maryland's sustained improvement over the past several years; and weighting complications by their associated cost weights. Justifications for retaining the PPCs are explained in the Assessment section, but in short, stakeholders and staff believes these are valid patient safety measures that address important clinical areas. Moreover, the subgroup expressed concern about utilizing other viable complication measure sets, i.e., the National Health Safety Network (NHSN) measures and Agency for Health Care Research and Quality (AHRQ) Patient Safety Indicators (PSI). Specifically, the subgroup did not support duplicating the use of the NHSN measures, which are already in the Quality Based Reimbursement program, and was generally concerned about increasing the weight on NHSN because of the potential for incomplete risk adjustment and the possibility of surveillance bias, among other things. In terms of AHRQ PSI's, the subgroup noted that the all-payer risk-adjustment is not yet available for and therefore is not viable for inclusion in a pay-for-performance program at this time.

The draft policy also reflects several scaling options with no staff recommendation because, in the absence of national benchmarks and a movement to attainment only performance evaluation, the cut point by which hospitals receive penalties versus rewards is a policy decision for the Commission. Staff will continue in future iterations of the MHAC policy to develop methodologies that align Maryland PPC's with national performance standards.

## Background

### Overview of the Federal Hospital-Acquired Condition Programs

The Federal Government operates two hospital complications payment programs. Detailed information may be found in Appendix II.

Beginning in Federal Fiscal Year 2009 (FFY 2009), per the provisions of the Federal Deficit Reduction Act, the Hospital-Acquired Condition Present on Admission Program was implemented. Under the program, patients were no longer assigned to higher-paying Diagnosis Related Groups if certain conditions were acquired in the hospital and could have reasonably been prevented through the application of evidence-based guidelines.

CMS expanded the use of hospital-acquired conditions in payment adjustments in FFY 2015 with a new program, entitled the Hospital-Acquired Condition Reduction Program, under authority of the Affordable Care Act. That program focuses on a narrower list of complications and penalizes hospitals in the bottom quartile of performance. Of note, as detailed in Figure 1 below, the measures in both Domains 1 and 2 of the Hospital-Acquired Condition Reduction Program are used

in the CMS Value Based Purchasing program, and the measures in Domain 2 are also used in the Maryland Quality Based Reimbursement (QBR) program.

**Figure 1. CMS Hospital-Acquired Condition Reduction Program (HACRP) FFY 2018 Measures**

<b>HACRP Domain 1 – Recalibrated Patient Safety Indicator (PSI) measure:<sup>^</sup></b>
Recalibrated PSI 90 Composite
<b>HACRP Domain 2 – National Healthcare Safety Network (NHSN) Healthcare-Associated Infection (HAI) measures:<sup>^*</sup></b>
Central Line-Associated Bloodstream Infection (CLABSI)
Catheter-Associated Urinary Tract Infection (CAUTI)
Surgical Site Infection (SSI) – colon and hysterectomy
Methicillin-resistant Staphylococcus aureus (MRSA) Bacteremia
Clostridium Difficile Infection (CDI)

<sup>^</sup>All Measures included in the CMS VBP Program

\* All Measures included in the Maryland QBR Program

Because of the State’s unique all-payer hospital model and its population based revenue system, Maryland does not directly participate in these Federal programs. Instead, the State administers the Maryland Hospital Acquired Conditions program (MHAC), which relies on quality indicators validated for use with an all-payer inpatient population. However, there is some overlap between MHAC and the federal programs. Following the recommendation of Commissioners and stakeholders, staff is continually evaluating opportunities to align patient safety measurement more closely with federal programs and to compare the State’s performance against national benchmarks.

### Overview of the Maryland MHAC Policy

The MHAC program, which was first implemented for RY 2011, is based on a system developed by 3M Health Information Systems (3M) to identify potentially preventable complications (PPCs) using present-on-admission codes available in claims data. 3M originally developed specifications for 65 PPCs<sup>2</sup>, which are defined as harmful events that develop after the patient is admitted to the hospital and may result from processes of care and treatment rather than from the natural progression of the underlying illness. For example, the program holds hospitals accountable for adverse drug reactions and surgical-site infections during inpatient stays. These complications can lead to 1) poor patient outcomes, including longer hospital stays, permanent harm, and death; and 2) increased costs. Thus, the MHAC program is designed to provide incentives to improve patient care

<sup>2</sup> In RY 2020 there were 45 PPC/PPC combinations included in the program as 3M had discontinued some PPCs and others were deemed not suitable for a pay-for-performance program



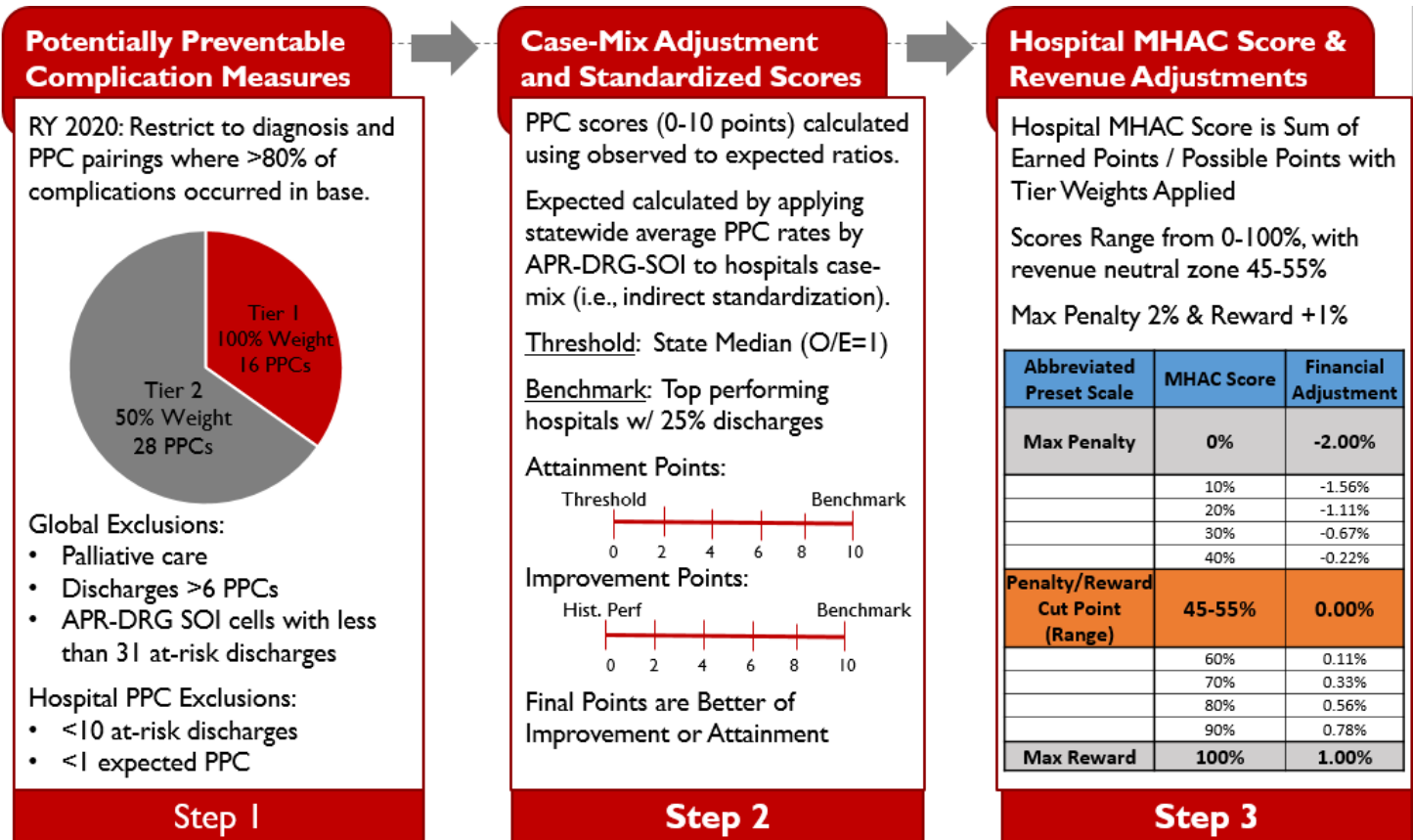
by adjusting hospital budgets based on PPC performance.

### RY 2020 MHAC Methodology

The initial methodology for the MHAC program estimated the percentage of inpatient revenue associated with excess PPCs, penalized hospitals that had higher estimated PPC costs than the statewide average, and provided revenue neutral rewards to hospitals with lower-than-average PPC costs. In RY 2016, the Commission changed the MHAC methodology to evaluate hospital performance based on case-mix-adjusted PPC rates rather than excess PPC costs. Annual adjustments have been made to the patient populations and PPCs included in the MHAC payment program based on stakeholder input and staff analytic findings in order to strengthen its clinical and statistical merits. The revenue adjustment scales have also been modified over time to better incentivize improvements. For RY 2020, the Commission approved an interim solution to address the low normative values by focusing the payment program on the diagnosis and complication pairs where at least 80 percent of PPCs occurred in the base period. Staff recommends discontinuing this approach for reasons that will be discussed in the Assessment section

Beyond the annual updates outlined above, the scoring methodology has remained the same since RY 2016. Figure 2 provides an overview of the three steps in the MHAC methodology that convert hospital performance, to standardized scores, and then payment adjustments. Step 1, PPCs are grouped and weighted into tiers according to their level of priority and exclusions are applied. Step 2, case-mix adjustment is used to calculate observed to expected ratios that are then converted to a standardized point based score (0-10 points) based on the better of improvement or attainment using the same scoring methodology that is used for CMS Value-Based Purchasing and Maryland QBR. Step 3 uses a preset linear point scale that is set prospectively to calculate a percent revenue adjustment. This prospective scaling approach differs from national programs that relatively rank hospitals after the performance period. A list of the PPCs used in the RY 2020 program is provided in Appendix III.

Figure 2. Overview Rate Year 2020 MHAC Methodology



**RY 2021 MHAC Program Redesign**

With conclusion of the All-Payer model and beginning of the TCOC model in 2019, the Commission prioritized redesigning the MHAC program because of concerns regarding the large number of PPCs being assessed and the lack of national benchmarks for performance. Under the new TCOC model, the State has the opportunity to use measures other than PPCs, but must ensure the improvement in complication rates seen under the All-Payer model is maintained and that outcomes continue to be comparable or better than the nation.

As mentioned above, the staff contracted with Dr. Zahid Butt of Medisolv to provide subject matter expertise and to convene the Clinical Adverse Event Measures subgroup to review existing all-payer complications measures and provide suggestions for evaluating hospital performance. Appendix I contains the final CAEM report, which provides an overview of the process that was used to select measures and recommendations on how to score hospital performance. These suggestions/recommendations on measures and scoring were then provided to the PMWG for consideration. The PMWG was then tasked with assessing subgroup recommendations and developing methodology for converting scores to revenue adjustments.

Details on the recommendations and how they were developed are outlined in the assessment section below. Staff would like to thank Dr. Butt and the dozens of CAEM and PMWG members who

have collaborated with the Commission on the MHAC program redesign. As evidenced below, significant thought and effort went into the decisions on what measures should be in the RY 2021 MHAC policy and how hospitals should be scored, yet there are still some concerns that will need to be addressed in future years. Furthermore, as mentioned above in the recommendations, the PMWG and staff has not come to a consensus on the preset revenue adjustment scale. Instead, this draft policy provides options for Commissioner input and staff anticipates that the final policy may need to be delayed to finalize the revenue adjustment scaling approach, provide sufficient time for Commission and stakeholder input, and for staff to address this input. However, since the performance period started on January 1st, staff is putting forth this draft recommendation to provide hospitals with some indication of whether the Commission will approve the narrowed down list of the PPC measures.

## Assessment

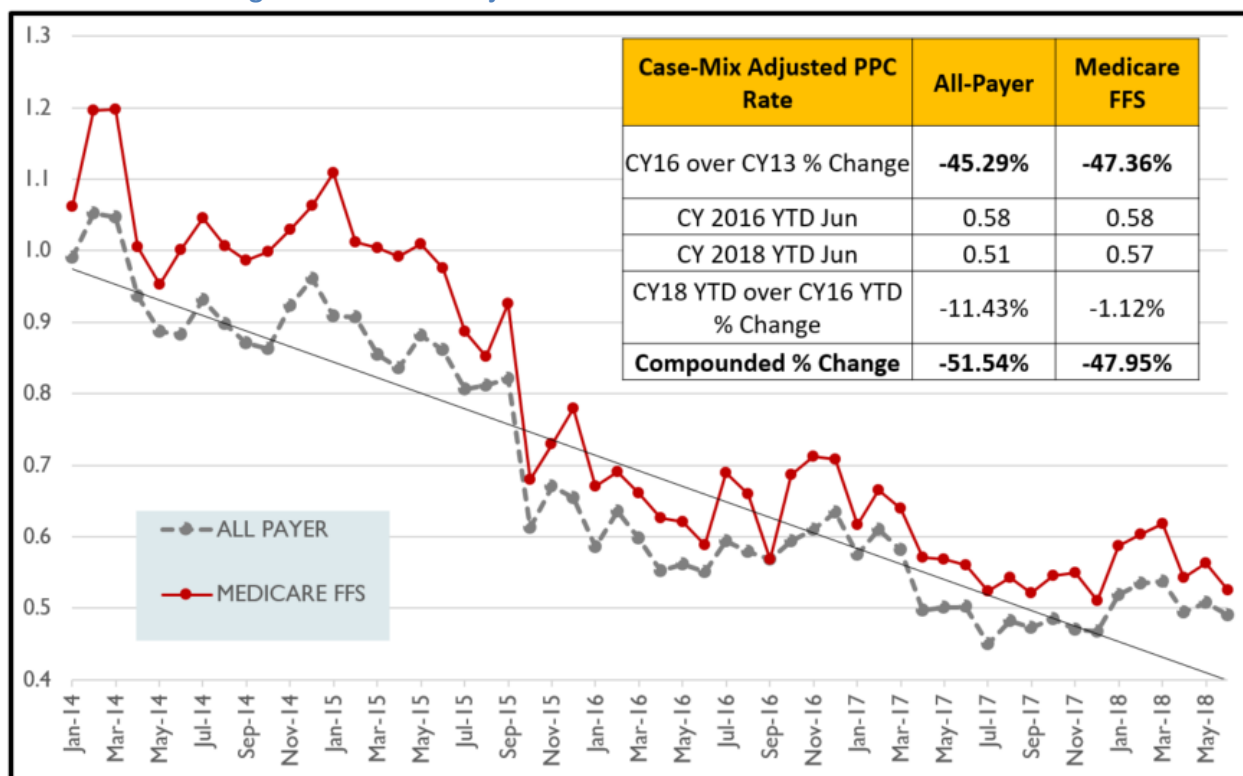
In this section, staff analyzes statewide PPC trends, discusses the rationale for the RY 2021 recommendations, and provides modelling on proposed measurement and methodology changes, including:

- Measurement Selection and Weighting
- Scoring (Risk Adjustment, Attainment versus Improvement, Additional Gradations of Performance)
- Scaling (Reward/Penalty Cut Point, Linear versus Non-Linear)

## Statewide PPC Performance Trends

As noted previously, the State has made dramatic progress in reducing PPCs under the MHAC Program and has continued this improvement under the All-Payer Model, reaching its 30 percent reduction target under the Agreement in the second year. Most recently, available performance trends reveal a cumulative All-Payer case-mix adjusted PPC rate reduction of 51.54 percent (compared to the base period of CY 2013) as illustrated in Figure 3 below.

Figure 3. Case Mix Adjusted Cumulative PPC Rates as of June 2018



**Note: Line graph based on v32 prior to October 2015; and v35 October 2015 to June 2018; all data are final, but are subject to validation.**

PPCs, like national claims-based hospital-acquired condition measures, rely on present-on-admission codes to identify these post-admission complications. Reliance on present on admission codes has made all hospital-acquired complications programs susceptible to criticism, because better documentation and coding, rather than clinical improvement, may drive performance. However, audits conducted by the HSCRC show the improvements in PPC rates are not driven primarily by inappropriate coding. While hospitals acknowledge improvements in documentation and coding, several systems report quality improvement efforts that have resulted in reduced PPCs. These efforts were detailed in the RY 2020 MHAC policy.

### RY 2021 MHAC Measures

Over the last several years, Commissioners and other stakeholders raised concerns regarding the use of the 3M PPCs, including a lack of national standards and difficulty in focusing quality improvement resources on the large number of PPC measures - there were 45 separate PPCs/PPC combinations in the RY 2020 payment program. Maryland, in consultation with CMMI, has the option to change or reduce the complication measures in the MHAC program under the TCOC model. However, as documented below, many experts and stakeholders support continued use of a focused list of PPCs.

Commissioners have previously recommended focusing on reliable complication measures that align with the TCOC model requirements and may be compared to national benchmarks. The

complications subgroup was tasked with developing criteria for measure selection consistent with Commission guidance, reviewing measure specifications, analyzing performance, and providing recommendations on what measures to include in RY 2021 and beyond. The criteria to select measures is listed here and additional details are provided in CAEM subgroup report (Appendix I):

- Used in current CMS or public reporting program or reflects key clinical areas within acute care hospital setting
- The measure has a strong scientific evidence-base to demonstrate that when implemented can lead to the desired outcome(s) and addresses unwarranted or significant variation in care that is evidence of a patient safety challenge
- The measure contributes to efficient use of measurement resources and/or supports alignment of measurement across programs.
- The measure can be feasibly reported without adding significant reporting burden
- The measure is reliable and valid for reporting and analysis at the Hospital level
- The measure has high Usability: Clinically actionable and shows variation
- No unreasonable implementation issues that outweigh the benefits have been identified

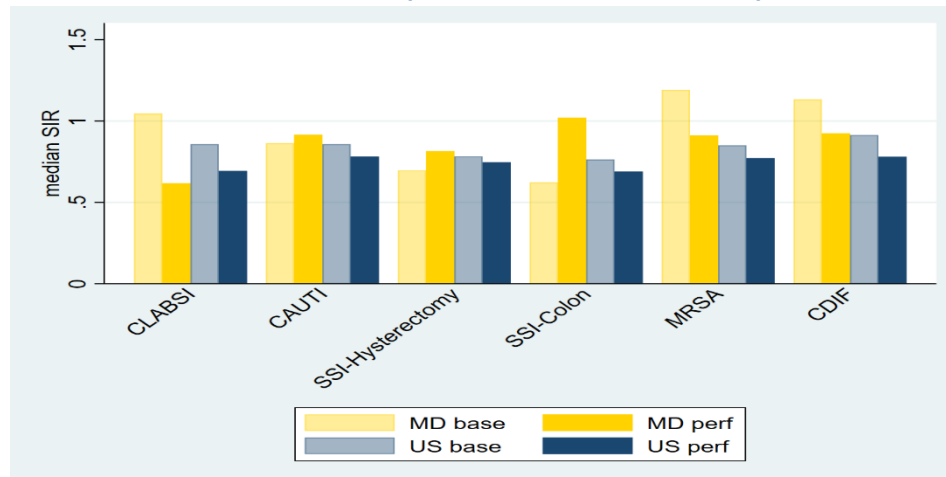
Following a comprehensive scan of candidate measures, the CAEM subgroup evaluated the following three sets of measures in greater detail:

- CDC National Health and Safety Network Hospital Acquired Infection measures
- AHRQ Patient Safety Indicators
- 3M Potentially Preventable Complications

#### ***CDC National Health and Safety Network (NHSN)***

The CMS HACRP and VBP programs include six CDC National Health Safety Network (NHSN) healthcare associated infection (HAI) measures. As discussed in the RY 2021 Quality Based Reimbursement policy and shown in Figure 4 below, Maryland's performance on the NHSN measures has been mixed (lower scores are better). While median hospital standardized infection ratios (SIR) for all six HAI categories declined nationally, Maryland hospitals SIRs increased in three out of six of the infection categories. For the three infections in which Maryland hospitals experienced declining standardized rates, the declines in Maryland were larger than national peers.

**Figure 4. Maryland vs. National Median Hospital SIRs on NHSN HAI Safety Measures (Base period Calendar Year 2015, Performance period October 1, 2016 to September 30, 2017)**



While the CAEM subgroup and PMWG members all agree that Maryland must improve performance on NHSN measures relative to the nation, the consensus was that including the same measures in two programs would confuse clinicians and hospital administrators because the results and revenue adjustments may differ or not align. This has been a concern raised regarding the national program, and CMS indicated they might remove the NHSN measures from VBP in the Medicare IPPS 2019 proposed rule. But the final rule retained the measures in both programs for at least another year in order to provide incentives for improvement and opportunity for positive revenue adjustments through VBP.

Based on CMS policy and Maryland’s need for improvement, staff recommended including the NHSN measures in the RY 2021 QBR program and weighting the domain more heavily than it is in VBP (35 percent vs. 25 percent), along with an aggressive revenue adjustment cut point for rewards. Furthermore, staff agrees with the stakeholders who expressed concerns on duplication of measures, and thus does not recommend including these measures in the MHAC program.

This recommendation means Maryland hospitals have less revenue at-risk for NHSN measures. Staff believes this is appropriate given that Maryland has improved on some NHSN measures under current QBR incentives, and that subgroup members raised concerns methodologic issues related to NHSN. These include low NHSN event counts at some hospitals, which may result in one event having a large impact on SIR, the potential for incomplete risk adjustment, and the possibility of surveillance bias, which would arise if hospitals allocating more resources to identifying infections experienced inappropriately high SIRs. Staff will continue to monitor CMS policy and may recommend moving the measures to the MHAC program or consolidating the QBR and MHAC programs, and increasing revenue at-risk if Maryland performance does not improve.

#### **AHRQ Patient Safety Indicator Measures**

As discussed in greater detail in Appendix I, the AHRQ Patient Safety Indicator 90, a composite of 10 PSI measures, is used in the CMS HACRP and will be reintroduced in the FFY2023 VBP program.

The PSI measures calculated using Medicare data are also used for other public reports such as those published by The Leapfrog Group and US News and World Report, and given their national significance Maryland needs to monitor performance on these measures.

In the Leapfrog Group's Safety Grades Fall 2018 release, which includes 7 PSI measures of the 28 total measures used in the report, 19 Maryland hospitals received high grades, with 15 hospitals showing improvement from the Spring 2018 release.<sup>3</sup> Staff anticipates that these PSI measures can be calculated on an all-payer basis going forward, but national benchmarks for risk-adjustment under ICD-10 are not yet available.

Because of the lack of risk adjustment the CAEM subgroup recommended to not include these measures for CY 2019 but recommend monitoring once the risk-adjustment becomes available. In future years, the clinical logic and overlap with PPCs should be more thoroughly evaluated to determine whether PSIs should be included in the MHAC program.

### **3M Potentially Preventable Complications**

The 3M PPCs have been used in the MHAC program since its inception in RY 2011. PPC rates for a given hospital have been shown in published literature to be stable over time, indicating that the measures have acceptable reliability. Patients with a PPC experience large increases in length of stay, risk of mortality, and charges. In the case of acute lung edema, for example, patients experienced a five-fold increase in mortality and a doubling of charges and length of stay<sup>4</sup>. The association of the PPC metrics with downstream consequences of complications suggests that PPCs are valid measures of in-hospital complications

However, the hospital industry has been concerned about the large number of PPCs included in the Maryland program compared to national programs, as this has made clinical focus difficult. Furthermore, some PPCs have low statewide rates and little variation across hospitals. These PPCs may be less reliable, and instead should be monitored. In addition, stakeholders expressed concern that some PPCs may measure complications that are not actionable with evidence-based care interventions (e.g., PPC 14 Ventricular Fibrillation/Cardiac arrest, PPC 11 Acute Myocardial Infarction), and that it may be difficult to determine whether various complications are present on admission (e.g., PPC 21 Clostridium Difficile Infection). And last, there are some PPCs with coding concerns that impact comparability across hospitals, such as PPC 40 (Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure), which has a degree of subjectivity because any documented bleeding flags this PPC, and clinicians use discretion in determining the degree of bleeding that merits such documentation. Nevertheless, clinical experts in the CAEM subgroup recommended moving forward with targeted list PPCs in a reformed MHAC program because of the comprehensibility and all-payer nature of them and because they have sufficient risk adjustment and opportunity for improvement, as evidenced below.

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<sup>3</sup> Of the 7 PSI measures included The Leapfrog Group Report, 6 of the PSI measures overlap with the set of 10 PSI measures included in the PSI 90 composite measure.

### Criteria for Selection of Potentially Preventable Complications

In order to assess which PPCs should be included in a pay-for-performance program, CAEM and PMWG members were provided with statewide rates and histograms of hospital performance for each PPC. Figure 5 provides the Selection Criteria and Considerations recommended by CAEM subgroup. The overlap and similarity with AHRQ PSIs was also evaluated since the PSIs are areas of national focus. And while this overlap was surprisingly low for some similar clinical measures due to the surgical focus and other clinical logic differences for the PSIs, the CAEM members did decide to retain PPCs that address similar clinical areas of national focus (e.g., sepsis and hospital falls).<sup>4</sup>

**Figure 5. Criteria for PPC Inclusion**

Clinical Criteria	<ul style="list-style-type: none"> <li>• All-payer focus</li> <li>• Clinically significant complication</li> <li>• Area of national focus</li> <li>• Evidence-based prevention protocols/opportunity for improvement</li> </ul>
Statistical Criteria	<ul style="list-style-type: none"> <li>• At least half of hospitals eligible for PPC</li> <li>• Higher statewide rate (generally 0.5 events per 1,000 discharges)</li> <li>• Variation across hospitals in performance</li> </ul>

Based on these criteria, the CAEM members narrowed the list from 45 candidate PPCs to 15 PPCs, and the PMWG agreed with all but one of these measures<sup>5</sup>. Figure 6 lists the 14 PPCs that staff is proposing to include for CY 2019 performance with descriptive statistics and final rationale for inclusion and Appendix IV provides histograms for each PPC that show variation across Maryland hospitals. It should be noted that these PPC analyses used PPC Grouper Version 35 but that staff and hospitals recommend PPC Grouper Version 36 be used for CY 2019 since it has most up-to-date clinical logic. Thus, staff is asking the Commission to approve the criteria for selection and will inform the Commission if any PPC changes are warranted once Version 36 data are analyzed.

<sup>4</sup> For example, the PSI for sepsis is only for surgical patients and the PPC is for surgical and medical patients. However analysis of case mix data for same time period identified 305 sepsis PSI cases that were not flagged as a PPC because of clinical logic differences such as separating out septic shock into different PPC and requiring a four day length of stay before sepsis is flagged as hospital acquired.

<sup>4</sup> Hughes, John S., Richard F. Averill, Norbert I. Goldfield, James C. Gay, John Muldoon, Elizabeth McCullough, and Jean Xiang. 2006. "Identifying Potentially Preventable Complications Using a Present on Admission Indicator." *Health Care Financing Review* 27 (3): 63–82.

<sup>5</sup> Clinicians in the CAEM subgroup and PMWG voiced concerns that PPC 40 post-operative hemorrhage without procedure is subjectively evaluated and documented by various clinicians. Thus they did not think PPC 40 should be retained in payment policy. This is not the case with PPC 41 Post-operative Hemorrhage with Procedure to control the bleeding, which clinicians recommended including in the program, further arguing that this PPC is more similar to the intent of PSI 09 Perioperative Hemorrhage or Hematoma.



Figure 6. PPCs Recommended for FY 2021 MHAC Program with Rationale

PPC #	PPC Description	Eligible Hospitals/ At Risk Discharges (2 yrs)	Obs/At-Risk*1,000	CAEM, PMWG, HSCRC Staff Recommendation
			Rate >1.0 per 1,000	
			Rate >0.5 per 1,000	
3	Acute Pulmonary Edema and Resp Failure w/o Ventilation	46 hospitals  696,950 at risk discharges	1.78	Meets rate and variation criteria. Clinically supported. Small overlap with PSI 11 Postoperative Respiratory Failure. PSI is limited to post-operative patients but PPC applies to broader patient population. Include in payment program
4	Acute Pulmonary Edema, Resp Failure w/ventilation	47 hospitals  698,946 at risk discharges	1.21	Meets rate and variation criteria. Clinically supported. Small overlap with PSI 11 Postoperative Respiratory Failure. PSI is limited to post-operative patients but PPC applies to broader patient population. Include in payment program
7	Pulmonary Embolism	44 hospitals  824,106 at risk discharges	0.49	Nearly meets rate criteria and has variation. Clinically preventable with well-defined interventions. Overlap 25% with PSI 12 Perioperative Pulmonary Embolism and Deep Vein Thrombosis but PPC includes broader patient population. DRA HAC is measured only in patients with total knee or hip replacements. Include in payment program.
9	Shock	46 hospitals 833, 605 at risk discharges	1.18	Meets rate criteria and has variation Clinically preventable. Include in payment program.
16	Venous Thrombosis	44 hospitals  822,712 at risk discharges	0.36	Below rate threshold but has variation. Clinically preventable with well-defined interventions. Some overlap with PPC 12 but PPC rate is lower but with applicability to a broader population. DRA HAC is measured only in patients with total knee or hip replacements. Include in the payment program.
28	In-Hospital Trauma and Fractures	38 hospitals  827456 at risk discharges	0.13	In hospital injuries are highly preventable and serious. PPC includes more injury types than PSI 08 In Hospital Fall with Hip Fracture Rate but PPC rate is lower as it is applicable to a broader patient population. DRA HAC applies to a broader set of in hospital injuries. Include in payment program.
35	Septicemia & Severe Infections	47 hospitals  289,205 at risk discharges	2.77	Meets rate and variation criteria. Clinically important. Include in payment program.
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	39 hospitals  128,674 at risk discharges	2.48	Meets rate and variation criteria. Clinically preventable. Overlaps slightly with PSI 14- Postop Wound Dehiscence, and with NHSN SSI and with DRA HAC but PPC is broader in scope. Include in payment program.

PPC #	PPC Description	Eligible Hospitals/ At Risk Discharges (2 yrs)	Obs/At-Risk*1,000	CAEM, PMWG, HSCRC Staff Recommendation
			Rate >1.0 per 1,000	
			Rate >0.5 per 1,000	
41	Post-Operative Hemorrhage & Hematoma w/ Hemorrhage Control Procedure or I&D	32 hospitals  241,162 at risk discharges	0.69	Meets rate and variation criteria. Clinically preventable. Overlap with PSI 09- Perioperative Hemorrhage or Hematoma Rate with PSI having similar applicability but higher rate. Include in payment program.
42	Accidental Puncture/ Laceration During Invasive Procedure	43 hospitals  897,351 at risk discharges	0.49	Meets rate and variation criteria. Clinically supported. Overlap with PSI 15 Unrecognized Abdominopelvic Accidental Puncture or Laceration Rate. PPC is applicable to a much broader patient population so has a lower rate. Include in the payment program.
49	Iatrogenic Pneumothorax	40 hospitals  829,953 at risk discharges	0.19	Does not meet rate criteria but applicable to large at-risk denominator population, but observed events are >100. Clinicians agreed this is an important clinical measure with national focus. There is hospital variation in performance, some PSI 06 Iatrogenic Pneumothorax Rate overlap and DRA HAC is applicable to patients with infusion catheter insertion procedures only. Include in the payment program.
60	Major Puerperal Infection and Other Major Obstetric Complications	27 hospitals  125,667 at risk discharges	0.98	Meets rate and variation criteria; 3M believes clinical concerns are addressed in the risk adjustment, and will address this PPC's overlap with other PPCs in v. 36. Obstetric morbidity is clinically important in an all-payer environment. Include in the payment program.
61	Other Complications of Obstetrical Surgical & Perineal Wounds	25 hospitals  122,183 at risk discharges	0.82	Meets rate and variation criteria; 3M believes clinical concerns are addressed in the risk adjustment, and will address this PPC's overlap with other PPCs in v. 36. Obstetric morbidity is clinically important in an all-payer environment. Include in the payment program.
67	Pneumonia Combo (with and without aspiration)	47 hospitals  713,219 at risk discharges	1.80	Meets rate and variation criteria. Clinically supported in combined PPC as 3M also to combine in next grouper version. Include in payment program.

The CAEM and PMWG members discussed at length whether very low occurrence PPCs referred to as “serious reportable events” or “never events” (e.g., transfusion incompatibility) should be included in the policy. The RY 2020 policy has designated five PPCs as such events, setting their thresholds and benchmarks at zero. Because these PPCs are rare they would never meet the selection criteria of high rate, variation, and occurrences in the majority of hospitals. Furthermore hospital stakeholders expressed that there were clinical protocols in place if these very serious events occurred such that they are intensely reviewed regardless of the MHAC policy. Thus, for RY 2021 staff concurred that these PPCs should be monitored by HSCRC and addressed separately with hospitals if they occur.

### PPC Weighting

Since RY 2016, PPCs have been placed into tiers that were weighted in order to prioritize PPCs that have high volume, high cost, opportunity for improvement, and are of national focus. With the narrowed list of 14 PPCs, the workgroups discussed whether to continue weighting PPCs. Weighting options included continuing with the tiered approach, weighting each PPC equally, and using 3M cost weights.

The 3M cost weights are calculated based on national data and represent the relative incremental cost associated with a complication and can be considered as a proxy for patient harm<sup>6</sup>. Figure 7 provides the PPC cost weights sorted from highest to lowest. Based on support from stakeholders, clinical experts, and MHA, the staff recommends using the 3M cost weights to differentially weight the PPCs

**Figure 7. 3M PPC Marginal Cost Weights for Proposed MHAC Measures**

PPC NUMBER	PPC Description	3M v33 PPC Marginal Costs
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	2.74
9	Shock	1.51
16	Venous Thrombosis	1.43
35	Septicemia & Severe Infections	1.37
7	Pulmonary Embolism	1.37
67	Pneumonia Combo (with and without aspiration)	1.30
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	1.27
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	1.10
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	0.80
49	Iatrogenic Pneumothrax	0.61
42	Accidental Puncture/Laceration During Invasive Procedure	0.45
28	In-Hospital Trauma and Fractures	0.34
60	Major Puerperal Infection and Other Major Obstetric Complications	0.17
61	Other Complications of Obstetrical Surgical & Perineal Wounds	0.12

### MHAC Performance Scoring

In redesigning the MHAC program the CAEM subgroup and PMWG considered the performance metric and case-mix adjustment, whether measures should be assessed for improvement and

<sup>6</sup> Currently the 3M cost weights are under Version XX of the PPC grouper, which uses the ICD-9 measure specifications. 3M anticipates releasing Version 36 cost weights in the near future, and the HSCRC staff proposes to implement these new cost weights for CY 2019.

attainment or attainment only, and the methodology to convert measure rates to standardized scores. The next sections summarize the rationale for:

- Continuing to use the observed-to-expected ratio with indirect standardization
- Moving to an attainment only program
- Using a points system that is similar to the current program but more continuous and better able to distinguish gradations in performance and incentivize improvement

### *Performance Metric*

The MHAC program assesses performance using an observed to expected ratio for each PPC<sup>7</sup>. The expected number of PPCs at a hospital is calculated through indirect standardization, in which a statewide rate for each PPC (i.e., normative value or “norm”) is calculated for each diagnosis and severity of illness level. The advantage of this method is that it is conceptually simple to understand and can be implemented easily in a prospective system. However, over time hospitals have raised concerns that the low statewide rates and granular indirect standardization at the diagnosis and severity level have led to what has been termed a “zero-norm” issue, i.e., hospitals are potentially penalized for a singular random event as opposed to materially poor clinical performance<sup>8</sup>. In RY 2020, two changes were made to the program were approved by the Commission to address this zero-norm concern<sup>9</sup>:

1. The minimum number of at-risk discharges statewide for diagnosis and severity of illness level was raised from 2 to 31 discharges. This “denominator” change focuses payment program on diagnosis and severity of illness levels with larger numbers of patients so that a zero norm is reflective of performance and not small numbers.
2. Exclude low frequency Diagnosis Related Group-PPC pairings from pay-for-performance program. Staff implemented this policy by restricting the diagnosis and complication pairs to those that account for at least 80 percent of complications. This “numerator” change was at the diagnosis level and thus there are still a significant number of zero norms at the diagnosis and severity of illness level.

For the RY 2021 policy, staff recommends continuing to require at least 31 discharges per diagnosis and severity of illness cell. While staff considered raising this even further, concerns about the comprehensiveness of the measurement were expressed by some stakeholders.

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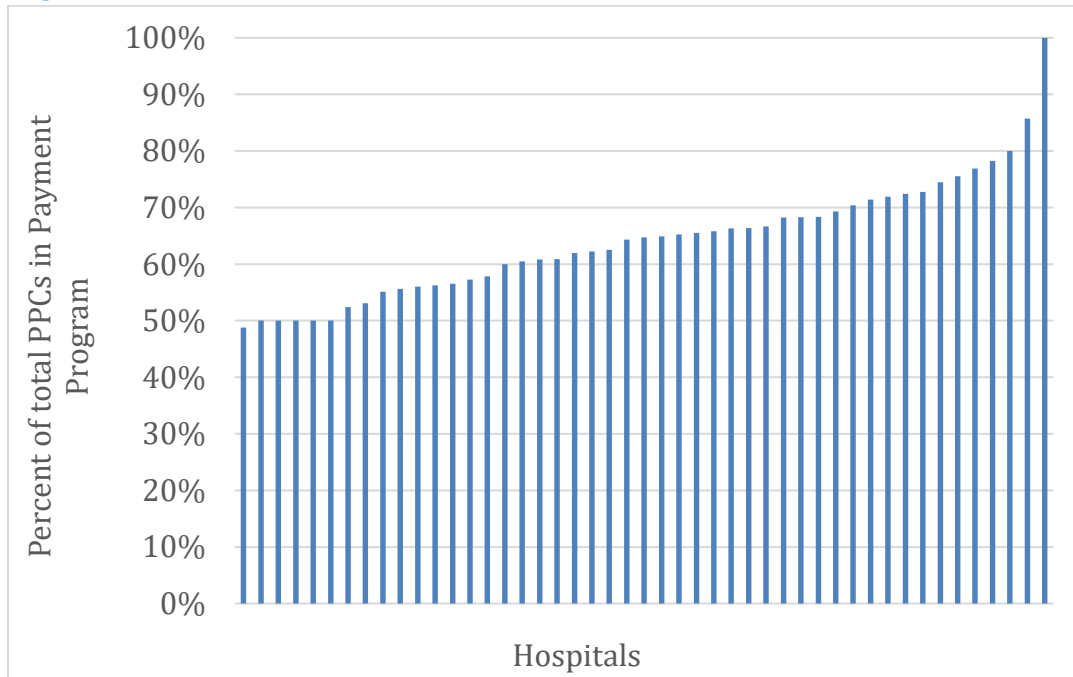
<sup>7</sup> The CAEM subgroup also evaluated alternatives to the observed to expected ratio such as an excess PPC rate that takes into account the number of discharges. However, staff believes that the current performance metric takes into account the number of discharges through its calculation of the expected rate and that further adjustment for number of discharges is not warranted. Furthermore, the use of an observed to expected ratio aligns with other measures such as the NHSN standardized infection ratios.

<sup>8</sup> In RY 2020 there were 328 diagnosis groups and 45 PPC/PPC combinations proposed, which results in over 56,000 cells for which a statewide average PPC rate is calculated, majority of which have a normative value of zero.

<sup>9</sup> In the RY 2020 final policy it was estimated that the two changes above reduced the cells with a zero norm from 88% to 70%, a 21% reduction.

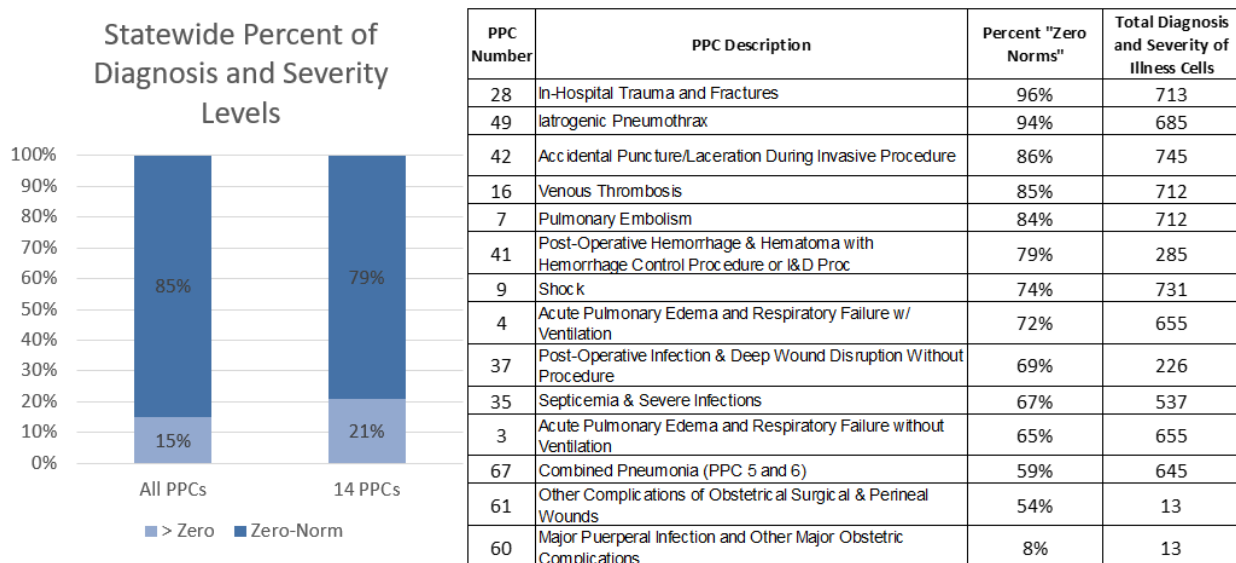
Staff does not recommend the 80 percent exclusion for RY 2021 because RY 2020 YTD results (through June) show that only 65 percent of PPCs are included in the payment program, with only three hospitals having > 80 percent of PPCs included. In other words, because of the variation in PPC occurrences each year, staff’s interim solution resulted in 35 percent of complications being removed from consideration in the MHAC program versus the desired effect of 20 percent, and in some cases hospitals had more than half of their potentially preventable complications removed. Figure 8, shows the percentage of PPCs being included in the payment program by hospital.

**Figure 8. RY 2020 Percent of PPCs included in Performance Period under 80% Exclusion**



In addition to concerns that the 80 percent approach removes too large number of complications, staff believes that it is not necessary to restrict PPC measurement beyond the 3M clinical logic with the narrowed down PPC list of fourteen PPCs. While some stakeholders from Johns Hopkins and UMMS continue to advocate for the 80 percent exclusion, other clinical experts on the CAEM subgroup support the staff recommendation to discontinue this exclusion because the PPCs selected already represent a more narrow focus on areas where clinicians believe improvements can be made. Figure 9 shows the reduction in the zero norm cells with the paired down PPC list and the by PPC percent of cells with zero norms. The by PPC results shows the zero norm issue is highly variable across PPCs, with those with lower rates and higher number of diagnosis and severity of illness cells having the highest zero norms.

Figure 9. Percent Zero Norms Statewide and for Select PPCs



An additional consideration would be to increase the time period for determining norms from 1 year to 2 years. Increasing to 2 years for calculating norms lowers percentage of zero norms and increases the number of diagnosis and severity of illness cells included in payment program if the minimum number of at-risk discharges per cell is kept at 31. It also potentially raises normative values because it averages across time periods where significant improvements have been achieved but these values may be more stable given the small numbers. Staff plans to analyze the impact of using 2 year norms for the January PMWG meeting and may amend policy to suggest the longer time period.

The RY 2020 policy proposed that statistical techniques such as Bayesian smoothing should be considered for RY 2021. This was discussed by CAEM, but the statistical complexity remained a concern for clinicians and quality improvement experts. While staff did not model the use of Bayesian statistics, it was our understanding that MHA contracted with statistical experts to develop more reliable risk adjustment and found that it was difficult to employ in a prospective system. Thus, they could not get agreement from members and did not bring a proposal to CAEM or PMWG. With additional statistical experts now at the Commission, staff will reconsider during 2019 whether Bayesian statistics or other techniques could be used in a prospective system, at the same time as 3M national norms are evaluated. It should be noted that the AHRQ PSI do use Bayesian statistics in its risk adjustment based on national data.

### Attainment Only Prospective System

The CAEM subgroup and PMWG considered recommendations from Commissioners that performance should be assessed based on attainment only using a scoring methodology that recognizes improvement for poor performers through reduced attainment penalties. This aligns

with the CMS HACRP program that is attainment only. Furthermore, staff believes that given the large improvements in PPCs over the past several years, hospital rewards should now focus on optimal performance and not provide positive revenue adjustments for improvement.

However, it should be noted that stakeholders continue to desire a system that sets prospective targets and allows hospitals to track performance during the performance period. Thus, the normative values and performance standards under an attainment only prospective system need to be set on a historical time period, which differs from the National attainment only program.

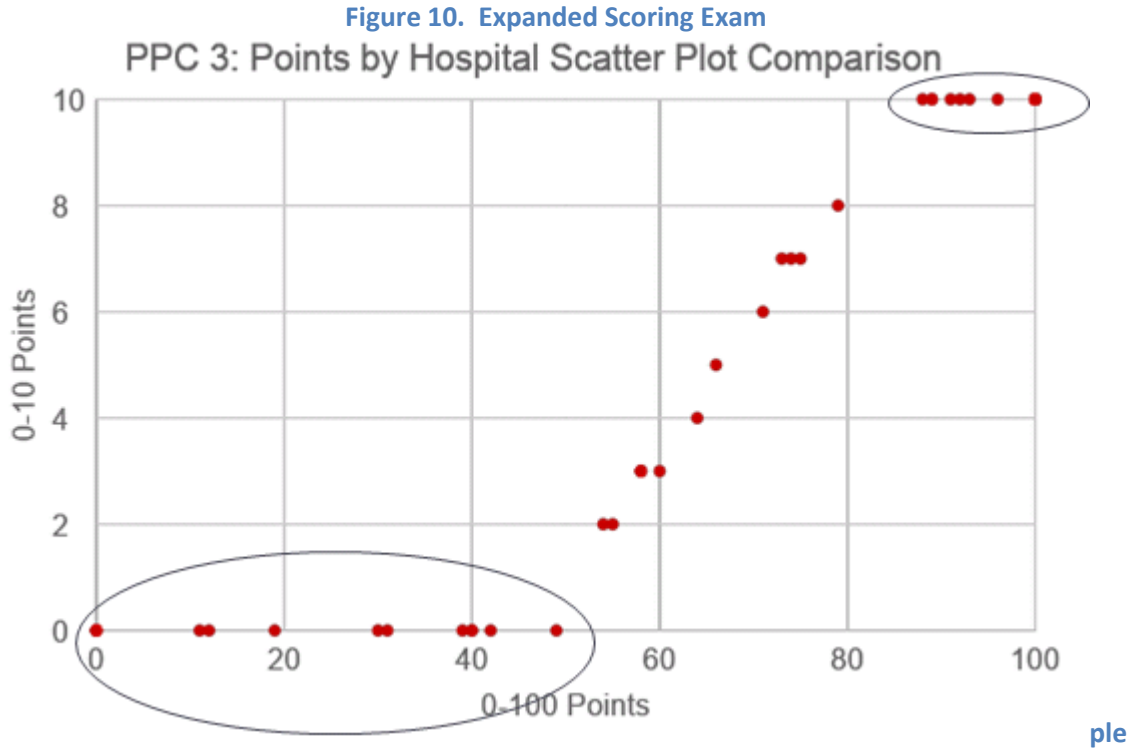
### *Standardized Scoring Methodology*

Commission and other stakeholders who have expressed a preference for an attainment only system believe that such a system could incentivize poor performers to improve through reduced penalties for improvement. However, the current scoring methodology for attainment assigns all hospitals that are worse than the statewide median zero points, and thus does not differentiate hospital performance and may have perverse incentives for poor performers, especially outliers. Therefore, CAEM and PMWG members collaborated with staff to develop a wider and more continuous scoring approach. Two approaches for better differentiating performance were considered: 1) the approach used by the national HACRP to calculate winsorized z-scores; 2. the current point-based approach with wider performance standards (i.e., lowering the threshold where hospitals begin to earn points and raising the benchmark where hospitals receive full points).

Appendix V provides details on the winsorized z-score calculation. However, there was general consensus that hospitals would prefer adapting the points based scoring approach because of its consistency with the current program and because of its more intuitive nature. Thus, staff is not currently recommending to use winsorized z-scores.

Instead, staff adapted the MHAC points system to allow for greater performance differentiation by moving the threshold to the 10th percentile, moving the benchmark to the 90th percentile, and assigning 0 to 100 points for each PPC. Appendix VI provides the thresholds and benchmarks under the current methodology and this revised methodology based on 2016 data.

As shown in Figure 10, the wider range in the performance standards differentiates hospital performance at the lower and upper ends and provides more continuous incentives for improvement. However, because hospitals can begin to earn points for relatively poor performance, hospital scores are higher under this modified scoring methodology and the preset revenue adjustment scale needs to be adapted so that hospitals do not receive financial rewards for lackluster performance, as discussed in the next section.



### Prospective Revenue Adjustment Scale

Since RY 2019, the revenue adjustment scale has been based on the mathematical distribution of possible scores (0 to 100 percent) with a hold harmless zone in the middle of the scale from 45 to 55 percent. This approach is referred to as a prospective revenue adjustment scale as opposed to a retrospective revenue adjustment scale that determines the scale after the performance period or by using historical scores to set the scale. Staff continue to support using a prospective scale based on the range of possible scores, because using a prospective scale provides greater transparency and predictability for hospitals, which are already assuming risk under a population based revenue system.

As mentioned above, the use of a wider and more continuous scoring methodology requires that the revenue adjustment scale be modified. Specifically, the cut point for penalties and rewards should be adjusted to ensure those who receive positive revenue adjustments are attaining or performing well on complications. However, without a national comparison it is difficult to determine an exact cut point for PPC measurements in an attainment only system, the latter of which were supported by the CAEM subgroup as two central tenets of the revised MHAC program<sup>10</sup>.

<sup>10</sup> Currently 3M is working with Medicare claims, large commercial datasets, Maryland data, and other state Medicaid data to develop national norms, and the Commission will need to consider how these norms could be used in future years, recognizing Maryland’s coding has been influenced by the use of the PPCs in the MHAC program.



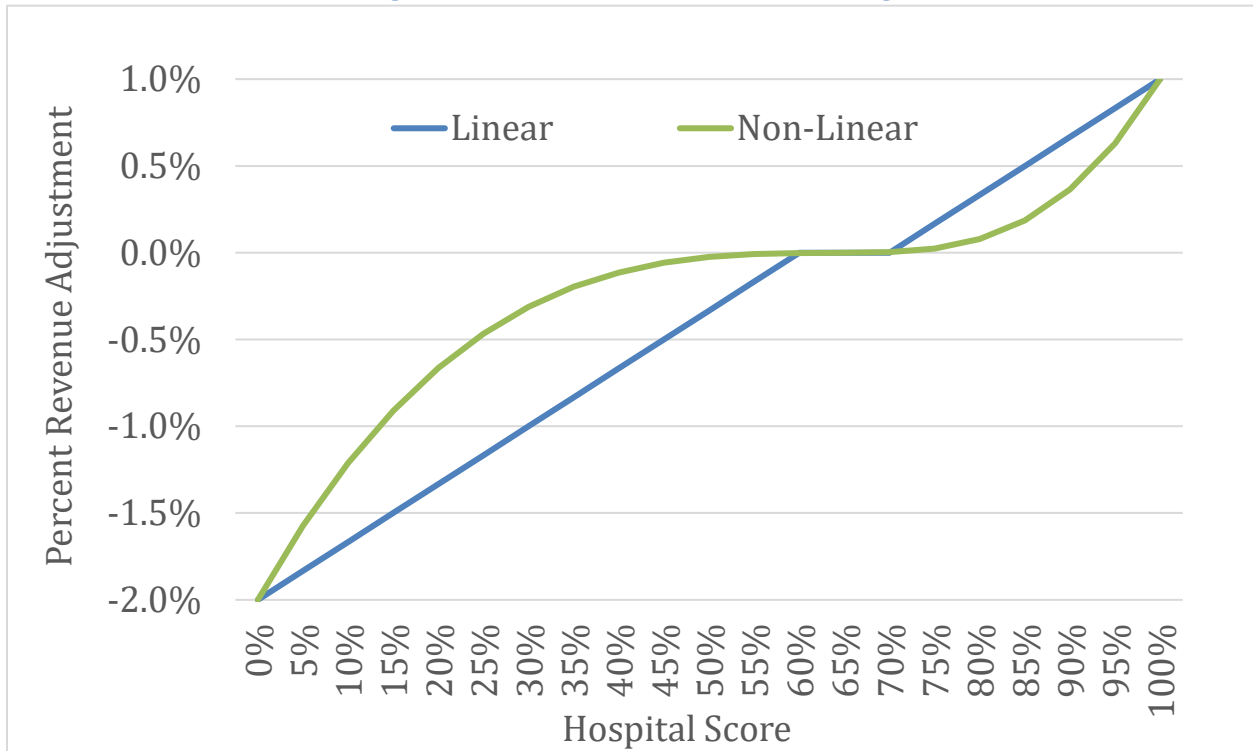
Given the lack of national norms for the PPCs, staff and stakeholders considered several approaches for changing the cut point, such as:

- applying the average change in scores under the modified scoring approach to the 50 percent cut point
- modeling a cut point that results in a distribution of penalties and rewards similar to that of the current methodology, and
- calculating the observed to expected ratio for each PPC at a desired percentile of performance for rewards for all PPCs (e.g., 50th or 75th percentile) and then calculating the score that would be associated with that performance.

Based on all of these approaches staff believe the cut point must be higher than 50% but lower than 80 percent, and at this time are modeling a cut point of 65 percent. Given a cut point of 65 percent the hold harmless zone would be 60 to 70 percent under the current 10 percent zone paradigm. The hold harmless zone of 10 percent is important because it reduces the penalty/reward cliff effect between a score of 49 and 51 percent. However, some Commissioners and stakeholders believe that the hold harmless zone reduces incentives to improve for those with performance in this range.

Staff considered another option, non-linear scaling of penalties and rewards, that could address uncertainty regarding the cut point and concerns with the hold harmless zone. This approach, which was discussed in the RY 2020 policy, reduces the revenue adjustments near the middle of the scale and maintains higher adjustments for hospitals performing at the high or low ends of the scale, i.e. outliers. Figure 11 shows the linear scale with a hold harmless zone between 60 and 70 percent, non-linear with cut point at 65 percent.

Figure 11: Linear versus Non-Linear Scaling



## Modeling of Scores and Revenue Adjustments

### Scoring Models

Three models were first analyzed to test the impact of moving to an attainment only system. These models use CY 2016 for normative values and performance standards (i.e., threshold and benchmark) and July 2017 to June 2018 for the performance period.

- Model 1: Current performance standards and scoring 0 to 10 points for the better of improvement and attainment
- Model 2: Current performance standards and scoring 0 to 10 points for attainment only
- Model 3: Wider performance performance standards and scoring 0 to 100 points for attainment only

Figure 12 provides descriptive statistics for the total hospital scores under each of these models. As would be expected, when moving from improvement and attainment (Model 1) to attainment only (Model 2) the hospital scores drop from a median score of 53 percent to 44 percent. Under the wider performance standards (Model 3) scores increase to a median of 62 percent since hospitals can begin to score points at a lower percentile of hospital performance; this represents a 22 percent increase in the median score when compared to Model 1. By hospital scores under the three models are shown in Appendix VII.

Figure 12. Hospital Score Models

Hospital Scores	Model 1: Improvement and Attainment	Model 2: Attainment Only	Model 3: Wider Performance Standards, Attainment Only	Percent Change Model 1 to Model 3
Median	51%	44%	62%	22%
Average	53%	47%	62%	17%
Min	13%	7%	16%	23%
Max	100%	100%	100%	0%
25th	40%	34%	53%	33%
75th	68%	62%	74%	9%

### Revenue Adjustment Scale Modeling

Using scores from the three models presented above, staff modeled revenue adjustments using the following preset scales:

1. **Current Scale:** Maximum penalty at 2 percent and maximum reward at 1 percent, continuous linear scaling with a hold harmless zone between 45 and 55 percent
2. **Linear scale with higher cut point:** Maximum penalty at 2 percent and maximum reward at 1 percent and use continuous linear scaling with a hold harmless zone between 60 and 70 percent<sup>11</sup>
3. **Non-Linear Scale with higher cut point:** Maximum penalty at 2 percent and maximum reward at 1 percent and use continuous non-linear scaling with a 65 percent cut point

The modeling of the current scale is for reference only, while the linear scale with the hold harmless zone between 60 and 70 percent and the non-linear scale are presented for Commission consideration. Figure 13 provides the count of hospitals in the penalty, hold harmless or zero adjustment, and reward zones. Also provided are the statewide net revenue adjustment, penalties, rewards, average percent adjustment, and average absolute revenue adjustment (used for realized risk). Appendix VIII contains the by hospital revenue adjustments for the two scales under consideration under Model 3.

Model 1 scoring with improvement and attainment and the current preset scale, results in 17 hospitals penalized, 8 hospitals in the hold harmless zone, and 22 hospitals rewarded and a negative net statewide revenue adjustment of \$7.1 million (\$17.9 M in penalties/\$10.8 M in rewards). Staff does not recommend this model because it maintains improvement, which as aforementioned is unnecessary after several years of improvement in PPC performance, but is provided for reference.

As would be expected, the Model 2 attainment only scores with the current preset scale increases the number of hospitals penalized and the statewide net revenue adjustment is \$21.7 million (\$28.5 M in penalties/\$6.8 M in rewards). The staff believes that an attainment only system with the

<sup>11</sup> Staff defer to the Commission and stakeholders on the exact cut point because of the lack of national benchmark

current scoring methodology (0 to 10 points) and preset scale is too punitive but presents the modeling of scores and revenue adjustments for comparison.

Model 3 scores use attainment only under wider performance standards and the current preset scale results in a majority of hospitals being rewarded, with a net positive statewide revenue adjustments of \$14.8 million (\$5.7 M in penalties/\$20.5 M in rewards). Staff believes that this model is too generous and that with the wider performance standards that the preset scale cut point needs to be raised, but again provides the scores and revenue adjustments for comparison.

**Figure 13: Revenue Modeling**

Hospital Revenue Adjustments	Reference Only			For Consideration	
	Model 1: Imp & Att	Model 2: Att Only	Model 3a: Expanded	Model 3b: Expanded	Model 3c: Expanded
	Linear 45-55% Cutpoint	Linear 45-55% Cutpoint	Linear 45-55% Cutpoint	Linear 60-70% Cutpoint	Non-Linear 65% Cutpoint
# Hospitals Penalized	17	24	7	19	25
# Hospitals No Adjustment	8	5	6	12	1
# Hospitals Rewarded	22	18	34	16	21
	<b>2% Max Penalty and 1% Max Reward</b>				
Average % Adjustment	-0.05%	-0.21%	0.15%	-0.09%	-0.02%
Net Revenue Statewide	-\$7.1 M	-\$21.7 M	\$14.8M	-\$8.1 M	-\$2.6 M
Total Penalties	-\$17.9 M	-\$28.5M	-\$5.7 M	-\$13.9 M	-\$3.5 M
Total Rewards	\$10.8 M	\$6.8 M	\$20.5 M	\$5.8M	\$880 K
Realized Risk	0.36%	0.43%	0.33%	0.28%	0.08%

Model 3 scores using the linear scale and hold harmless zone between 60 and 70 percent results in negative net revenue adjustment statewide of \$8.1 million (\$13.9 M in penalties/\$5.8 M in rewards). As you can see, the non-linear scale drastically reduces the revenue adjustments statewide with a negative net revenue adjustment statewide of \$2.6 million (\$3.5 M in penalties/\$5880 K in rewards). While staff thinks this may be appropriate given the lack of national performance standards, some stakeholders felt that this reduced the impact of the program too much given the seriousness of these complications. It should be noted though that an added advantage of the non-linear scale is that it effectively takes into account the additional revenue at-risk under the Medicare Performance Adjustment (MPA), which according to the contract with CMMI, may be counted towards aggregate at-risk. Hospitals have requested that such an accommodation be made by reducing an existing Quality program by 0.5 percent but have also intimated that moving the MHAC program to a non-linear scale would satisfy this request while preserving the all-payer nature of the Commission’s Quality programs.

Staff defers to Commissioners on whether MHAC or other quality program should have lower potential penalties to take into consideration the MPA. Staff does believe that if the Commission choses the non-linear scaling option, this effectively takes into account the MPA without changing the revenue at risk.

## Additional Future Considerations

As mentioned previously, staff thanks the members of CAEM and PMWG and other stakeholders for their input on the RY 2021 MHAC program. The narrowing down of the PPC measures and move to an attainment only system are important accomplishments that should allow hospitals to focus on clinically significant complications and be held accountable for performance rates. For future years it will be important to continue to try and find a national comparison for PPCs, or to move to measures such as the AHRQ PSIs. In addition, staff should continue to monitor other safety measures for possible inclusion in the MHAC program, especially for areas such as maternal and child health. Staff also believe that while there will be a focus on redesigning the readmission methods in CY 2019, that the review of the QBR program in 2020 will provide an opportunity to reevaluate complication measures and whether the QBR and MHAC programs should be merged.

## Recommendations

This is a draft recommendation for the Maryland Rate Year (RY) 2021 Hospital-Acquired Conditions (MHAC) policy. At this time, the staff requests that Commissioners consider the following draft recommendations:

- A. Continue to use 3M Potentially Preventable Complications (PPCs) to assess hospital-acquired complications.
  1. Include focused list of PPCs in payment program that are clinically recommended and that generally have higher statewide rates and variation across hospitals.
  2. Monitor all PPCs and provide reports for hospitals and other stakeholders.
  3. Explore development of national benchmarks for PPCs in future years.
- B. Assess hospital performance on attainment only using a wider and more continuous scale that better differentiates performance, rewarding high attainment but also incentivizing improvement.
- C. Weight the PPCs in payment program by 3M cost weights as a proxy for patient harm.
- D. Convert weighted PPC scores to revenue adjustments using a prospective revenue adjustment scale that focuses on performance outliers; two options for revenue adjustment scale presented are:
  1. Set maximum penalty at 2 percent and maximum reward at 1 percent and use continuous linear scaling with a hold harmless zone between 60 and 70 percent; or
  2. Set maximum penalty at 2 percent and maximum reward at 1 percent and use continuous non-linear scaling with a 65 percent cut point.

## Appendix I. Clinical Adverse Events Measure Subgroup Report



**Health Services Cost Review Commission**  
**Clinical Adverse Events Measure Subgroup Report**



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## Introduction

The Maryland Health Services Cost Review Commission's (HSCRC's or Commission's) quality-based measurement and payment initiatives are important policy tools for providing strong incentives to hospitals for continued improvement to their quality and safety performance. Under the current 5 year (2014-2018) All-Payer Model Agreement (the Agreement) between Maryland and the Centers for Medicare & Medicaid Services (CMS) there are quality performance requirements for reductions to inpatient readmissions and hospital acquired conditions (HAC's). There are also program and performance requirements for all of HSCRC's quality and value-based programs.

As long as Maryland makes incremental progress towards the Agreement goals, the State receives automatic exemptions from the CMS Hospital Acquired Conditions Reduction Program (HACRP) and the Hospital Readmission Reduction program (HRRP). The exemption from the CMS Medicare Value-Based Purchasing (VBP) program is requested annually. Furthermore, because Maryland sets all-payer rates and has all acute hospitals under all-payer global budgets, Maryland is also exempt from the Federal Deficit Reduction Act Hospital-Acquired Condition program (DRA HAC). This program eliminates additional fee-for-service payments associated with select hospital-acquired conditions. These exemptions from national quality programs are important because the State of Maryland's all-payer global budget system benefits from having autonomous, quality-based measurement and payment initiatives that set consistent quality incentives across all-payers.

The Maryland Hospital Acquired Conditions (MHAC) program, one of three core quality programs that the HSCRC administers, was first implemented in state fiscal year 2011 (FY 2011). For the Rate Year 2020, it places 2 percent of revenue at-risk by scoring a hospital's performance based on a broad set of Potentially Preventable Complication (PPC) measures developed by 3M Health Information Systems. One of the requirements under the current Agreement is for Maryland to reduce the incidence of PPCs for all-payers by 30 percent by 2018. As noted in the RY 2020 MHAC policy recommendations, this goal was achieved within the first two years of the Agreement - the cumulative reduction as of June 2017 is 47.05 percent. However, it should be noted that this progress must be sustained through the five-year term of the Agreement in order to satisfy the State's contractual obligation. For RY 2020, which encompasses the performance results from the final year of the Agreement (CY 2018), staff recommended minimal changes to the MHAC policy, with the notable exception of focusing the pay-for-performance incentives on the subset of patients for whom most complications occur (> 80 percent of PPC).

For RY 2021 and beyond, staff has begun to focus on future policy development to establish quality strategies and performance goals under the new Total Cost of Care (TCOC) Model, effective beginning in the CY 2019 performance period. Staff has begun work with key stakeholders to develop new approaches for reducing HACs in Maryland to support the goals of the TCOC Model. Specifically, this entails considering new approaches to evaluate Maryland hospital performance relative to the nation, while at the same time affording the State the opportunity to be aggressive and progressive in its program(s).

For the MHAC program updates, staff convened a Clinical Adverse Events Measures (CAEM) subgroup of the Performance Measurement Workgroup (PMWG) to: 1) consider a broad array of clinically relevant and preventable hospital patient safety measures including PPC, CMS HAC





measures and other complication measures that cover important all-payer clinical areas that may not be addressed by the CMS HAC programs; and 2) provide input into stakeholder concerns regarding the methodology for risk adjustment, scoring and scaling impacting performance linked payment adjustments. Medisolv was retained as a contractor to assist HSCRC staff in convening the CAEM subgroup and to provide subject matter expertise.

### **CAEM Subgroup**

A call for nominations was issued and members selected from respondents based on their experience and interest. A list of the CAEM Subgroup members included in Appendix A.

### **Measures Selection Process**

A formal measure selection process was developed in conformance with processes followed by national consensus organizations such as the National Quality Forum (NQF). The CAEM workgroup approved and followed the process listed below to select Patient Safety Measures for performance year 2019 impacting payment year 2021.

- a) A preliminary MHAC Measures Under Consideration (MHAC MUC) list was created from measures currently implemented across a variety of patient safety programs including MHAC, the patient safety domain of QBR and the CMS programs including DRA HAC, HACRP, HVBP and the HHS/CMS Measures inventory.
- b) Measure selection criteria, listed in Appendix B, were developed and approved for use by the CAEM subgroup. Measures associated with high-priority, preventable, hospital-safety events that could be addressed through changes in clinical best practices were identified and reviewed by the CAEM subgroup through this measure evaluation framework.
- c) CAEM subgroup, with assistance from HSCRC staff, applied the measure selection criteria to the MHAC MUC list in order to produce a final consensus recommendation for consideration in the MHAC program CY 2019/PY 2021 displayed in Appendix C. Results of measure performance with statistical analysis based on actual historical data from Maryland hospitals were made available to supplement other information including NQF endorsements when available. Additional details in some of the key considerations are discussed in Appendix D.



## Payment Methodology Review

The group discussed overall principles and specific methodology components for the MHAC program.

The group concurred with the following overall principles that should guide methodology decisions:

1. Overall transparency in measure selection and payment adjustment methodology.
2. Visibility in alignment or harmonization with national pay-for-performance programs especially CMS.
3. Measures selected should be actionable and effective in achieving better performance.
4. Measures selected should be balanced and fair to various stakeholders.
5. Measures selected should support the State's commitments under the TCOC Waiver.

The CAEM subgroup came to consensus on recommending a narrowed list of PPCs for the RY 2021 MHAC program. The group raised concerns about duplicating the NHSN infection measures in the QBR and MHAC programs and did not recommend inclusion of these measures in the MHAC program. The group also acknowledged that the AHRQ PSI measures would not be viable for the RY 2021 since all-payer risk adjustment was not available for these measures. Staff presented to the CAEM subgroup methodology components that could potentially impact performance results and payment determinations. After review and further discussion, the subgroup recommended an "Attainment" only framework for payment determination in order to further align with the CMS HAC Reduction Program.

For the PPCs, the group concurred that risk adjustment of observed performance rates is necessary, especially for outcomes measures, in order to account for variation in patient populations across hospitals. Indirect standardization is a commonly-used method and is currently incorporated in the 3M PPC methodology utilizing the 3M APR-DRG Severity of Illness (SOI) subclass categorization.

Some concern was expressed regarding the 3M methodology for risk adjustment using PPC/APR DRG/SOI cells which have only the State of Maryland as the normative reference database to generate Numerator Expected values. Stakeholders have expressed concern with the "Zero Norm" issue, which arises because the risk adjustment process segments Maryland's relatively small inpatient population into a large number of unique combinations of PPC, APR-DRG and SOI groups. Many of these unique combinations have a statewide mean event rate of zero. It is difficult to differentiate between a true zero as the expected value versus one resulting simple from data sparsity. Examples of data analyzed by UMMS and JHH shows significant numbers of such cells resulting in potentially unexpected results when payment adjustments are applied. Recommendations to address this issue include increasing the minimum cell size for "At risk" patients to 30 and to limit the cells to where at least 80 percent of the PPCs occur.

These recommendations will be analyzed further using historical data and are expected to reduce the number of zero norm cells. Results will be discussed further at the HSCRC Performance Measurement Work Group meetings. 3M proposed, and the group accepted, the use of the 3M Relative Cost Weights to assign relative weights across PPCs in order to generate overall scores for each hospital.



## Future Considerations

The following ideas are included in this report for future consideration by the HSCRC in order to maintain Maryland's leadership nationally under the TCOC Model more broadly and more specifically to improve patient safety through the use of payment adjustments aligned with CMS programs while also striving towards more aggressive and progressive measurements.

1. Track and share with Maryland hospitals their performance on both the all payer and CMS-specific Patient Safety and Adverse Events (PSI 90) composite and the ten component PSIs individually in parallel to the PPCs used for payment determination in CY 2019. Should variance in performance of "overlapping" PPC/PSI combinations persist to the extent seen in the MPR analysis, HSCRC could undertake an in-depth analysis to fully understand the reasons for this variance. Ideally this analysis could also be used for validation to determine which set of measures (PSI or PPC) more accurately reflects actual adverse events. Finally, "parallel tracking" of PSIs would also provide direct comparability with CMS national rates.
2. Analysis of the Maryland 2016-2017 PSI data suggests areas of possible interest for tracking individual PSIs beyond PSI 90 measures representing additional patient safety concerns:
  - a. Death Rate among Surgical Inpatients with Serious Treatable conditions (PSI 4) of 106 per 1,000 discharges with a total of 334 Numerator cases. These are potentially preventable post-op complications and CMS has communicated their intent to undertake the re-endorsement process at the NQF.
  - b. Another area of potential safety concern is PSI 18 (OB trauma rate – vaginal delivery with instrument) rate of 107 per 1,000 discharges (545 Numerator events) and 1,336 total numerator events for PSI 19 (OB trauma rate – vaginal delivery without instrument) with a rate of 16.26 per 1000 discharges. Analysis of the potential overlap of these two PSIs with PPC 60 and 61 may be helpful in understanding any potential gaps in OB patient safety coverage within MHAC. Safety related to childbirth is an important area to cover in the all-payer models (compared to CMS programs) and is currently a major topic of national conversation as shown in this ProPublica/NPR study link <https://www.propublica.org/article/die-in-childbirth-maternal-death-rate-health-care-system>.

The Joint Commission has added the following measures to its Perinatal Care (PC) Core Measure Set for reporting in its ORYX® hospital accreditation requirements and has indicated additional measures related to childbirth will be introduced:



**Set Measure ID: PC-06**

Set Measure ID	Performance Measure Name
PC-06.0	Unexpected Complications in Term Newborns - Overall Rate
PC-06.1	Unexpected Complications in Term Newborns - Severe Rate
PC-06.2	Unexpected Complications in Term Newborns - Moderate Rate

- HSCRC should consider development of an Electronic Clinical Quality Measure (eCQM) strategy more broadly and specifically to support future patient safety measures. CMS continues to develop new measures including eCQMs in patient safety which is a key domain within the CMS meaningful measures framework with Hospital Acquired Infections and Preventable Harms/Complications being the two main areas of focus. Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) has been contracted to develop four hospital-level, outcome eCQMs in patient harm or adverse patient safety events that can be improved with high quality care. The contract name is Development, Reevaluation, and Implementation of Outcome/Efficiency Measures for Hospital and Eligible Clinicians, Option Year 4. The contract number is HHSM-500-2013-13018I, Task Order HHSM-500-T0001. The specific goal of this project is to develop hospital harm eCQMs for potential future use in CMS quality reporting programs. Specifically, CORE has developed four new eCQMs in the areas of hypoglycemia, opioid-related adverse events, hospital-acquired pressure injury, and acute kidney injury which are currently undergoing testing.

The following two measures were open for public comment through October 30, 2018.

- Hospital Harm – Severe Hyperglycemia
- Hospital Harm – Medication-Related Bleeding

More information on these measures can be found at this link.

<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/PC-Updates-on-Previous-Comment-Periods.html#Hospital%20Harm>

While these measures are still under development HSCRC should proactively consider enhancing its data management capability including consumption of standardized EHR datasets for quality reporting from hospitals and having the ability to compute measure results from these data. This important capability would be important as EHR data becomes more available and is used increasingly by CMS and other payers for both eCQMs and risk adjustment of claims-based hybrid measures in the future.



**Appendix A: CAEM Members**

<p>Richard M. Day  <b>Senior Director, Systems Engineering and Quality Improvement</b>  <i>The Johns Hopkins Hospital and Health System</i>            Armstrong Institute for Patient Safety and Quality</p>
<p>Terry Fairbanks, MD, MS  <b>Assistant Vice President, Ambulatory Quality &amp; Safety, MedStar Health</b>  <i>Founding Director, National Center for Human Factors in Healthcare, MedStar Institute for Innovation</i></p>
<p>Kristen Geisler  <b>Managing Director</b>  <i>Berkeley Research Group, LLC</i></p>
<p>Joy Gill  <b>Sr. Manager, Clinical Data Analysis</b>  <i>Adventist HealthCare, Inc.</i></p>
<p>Tina Gionet  <b>Patient Safety Officer</b>  <i>Sinai Hospital of Baltimore</i></p>
<p>Lisa Grubb  <b>Senior Director of Quality Management</b>  <i>Howard County General Hospital</i>            Johns Hopkins Medicine</p>
<p>Abel Joy, MD  <b>Assistant Professor, Director of Inpatient Hospitalist Services Operations</b>  <i>University of Maryland Medical Center</i></p>
<p>Stephanie Klapper  <b>Deputy Director for Community Outreach</b>  <i>Maryland Citizens' Health Initiative</i></p>
<p>Traci LaValle  <b>Vice President, Financial Policy &amp; Advocacy</b>  <i>Maryland Hospital Association</i></p>
<p>Sheila McLean  <b>Vice President</b>  <i>Health Quality Innovators</i></p>
<p>Stephen T. Michaels, MD  <b>Chief Operating Officer, Chief Medical Officer</b>  <i>MedStar St. Mary's Hospital</i></p>
<p>Dale N. Schumacher, MD, MPH  <b>President</b>  <i>Rockburn Institute</i></p>
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Theresa Lee <b>Director, Center for Quality Measurement and Reporting</b> <i>MHCC</i>



**Appendix B: CAEM Measure Selection Process**

Assessment Criteria	Definition	Decision Logic
<b>1) The measure addresses a critical MHAC program objective.</b>	A. Patient safety measures used in current CMS payment or public reporting programs OR The measure reflects Adverse Events performance in key clinical areas within acute care hospital setting AND is currently endorsed by the NQF.	Yes: Support inclusion of Measure in MHAC 2021.
	B. The measure reflects Adverse Events performance in key clinical areas within acute care hospital setting but is NOT currently endorsed by the NQF.	Yes: Review can continue No: Measure will receive a Do Not Support
<b>2) The measure is evidence-based and is strongly linked to a specific safety challenge or outcome.</b>	The measure has a strong scientific evidence-base to demonstrate that when implemented can lead to the desired outcome(s) and addresses unwarranted or significant variation in care that is evidence of a patient safety challenge.	Yes: Review can continue No: Measure will receive a Do Not Support
<b>3) The measure contributes to efficient use of measurement resources and/or supports alignment of measurement across programs.</b>	The measure is superior to an existing measure in the MHAC program; OR Captures a broad population (e.g. All-Payer vs. Medicare only); OR Contributes to alignment between measures in other reporting programs)	Yes: Review can continue No: Highest rating can be Refine and Reconsider.
<b>4) The measure can be feasibly reported without adding significant reporting burden</b>	The measure can be operationalized for MHAC 2021 i.e. the measure is currently in “production” for at least one year and will be available by Sept 30, 2018 for use in CY 2019 discharges AND The value to patients/consumers outweighs any burden of implementation for hospitals.	Yes: Review can continue No: Highest rating can be Refine and Reconsider.



Assessment Criteria	Definition	Decision Logic
<b>5) The measure is reliable and valid for reporting and analysis at the Hospital level</b>	The measure is fully developed, and specifications including Risk Adjustment methodology, if needed, are provided; AND Measure testing has demonstrated Reliability and Validity OR Case occurrences indicate clinical face validity. AND Comparative Benchmarks, preferably National are available	Yes: Measure could be Supported No: Highest rating can be Refine and Resubmit.
<b>6) The measure has high Usability</b>	Measure is clinically actionable at the Hospital level AND Shows enough variation in risk adjusted performance to be usable by HSCRC for Payment Adjustments AND/OR usable by consumers in public reporting programs	Yes: Measure could be Supported No: Highest rating can be Refine and Resubmit.
<b>7) If a measure is in current use, no unreasonable implementation issues that outweigh the benefits of the measure have been identified.</b>	Feedback from implementers or end users has not identified: Any unreasonable implementation issues that outweigh the benefits of the measure; OR Any negative unintended consequences (e.g., premature discharges, overuse or inappropriate use of care or treatment, limiting access to care);	Yes: Measure can be Supported No: The highest rating can be Conditional Support.





### Decision Category Assignment Guide

Decision Category	Evaluation Criteria
<b>Support to Include in MHAC</b>	The measure meets all the required CAEM SG Measure Evaluation Criteria.
<b>Conditional Support for Inclusion in MHAC</b>	The measure is fully developed and tested and meets Criteria 1 B - 6 but not Criteria 7. PMWG has the discretion to propose the measure.
<b>Refine and Resubmit for Inclusion in MHAC</b>	<p>The measure meets Criteria 1B-3 but needs modifications. A designation of this decision category assumes at least one Criteria 3-6 is not met. CAEM SG will provide a rationale that outlines each suggested refinement</p> <p>Modifications suggested by CAEM SG would be made before the deadline for acceptance in the MHAC 2021 program.</p>
<b>Do Not Support for Inclusion in MHAC</b>	The measure under consideration does not meet Measure Selection Criteria 1 and 2.



**Appendix C: PPC Candidate and Final Measure Recommendations**

**CAEM Subgroup Initial PPC Analysis and Recommendation:  
CY 2016-CY 2017 PPC data with >1 expected and >10 at-risk^**

PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
25	Renal Failure with Dialysis	27	X	70	597,324	0.12	Slight	Low	
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	47	X	936	707,294	1.32	Substantial	Adequate	include
9	Shock	46		1042	840,672	1.24	Substantial	Adequate	include
16	Venous Thrombosis	44	X	306	830,067	0.37	Substantial	Adequate	include
35	Septicemia & Severe Infections	47	X	868	298,994	2.90	Substantial	Adequate	include
7	Pulmonary Embolism	44	X	426	831,445	0.51	Moderate	Low	Consider
5	Pneumonia & Other Lung Infections	47		843	384,744	2.19	Substantial	Low	include as Combined PPC 67
6	Aspiration Pneumonia	47		537	720,408	0.75	Moderate	Adequate	
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	47	X	1313	707,296	1.86	Substantial	Adequate	include
49	Iatrogenic Pneumothorax	41	X	162	844,412	0.19	Fair	Low	include



PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
42	Accidental Puncture/Laceration During Invasive Procedure	44	X	459	908,377	0.51	Moderate	Low	include
31	Decubitus Ulcer	47	X	76	251,790	0.30	Moderate	Adequate	include
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	41		341	133,289	2.56	Moderate	Low	include
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	36	X	183	250,945	0.73	Moderate	Adequate	include
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Proc	44		1103	315,393	3.50	Moderate	Adequate	Do not include
28	In-Hospital Trauma and Fractures	39	X	116	848,033	0.14	Fair	Low	include
60	Major Puerperal Infection and Other Major Obstetric Complications	27		124	125,707	0.99	Moderate	Adequate	Include
61	Other Complications of Obstetrical Surgical & Perineal Wounds	28		104	128,344	0.81	Moderate	Low	Include
14	Ventricular Fibrillation/Cardiac Arrest.	47		1342	740,927	1.81	Substantial	Adequate	monitoring



PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
1	Stroke & Intracranial Hemorrhage	46		675	861,638	0.78	Moderate	Low	monitoring
8	Other Pulmonary Complications	47		568	588,283	0.97	Moderate	Low	monitoring
11	Acute Myocardial Infarction	46		607	848,365	0.72	Moderate	Low	monitoring
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	41		148	817,454	0.18	Moderate	Adequate	
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	47		391	846,085	0.46	Substantial	Adequate	
63	Postoperative Respiratory Failure with Tracheostomy	16		48	3,961	12.12	Slight	Low	
54	Infections due to Central Venous Catheters	28		72	761,808	0.09	Slight	Low	
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	15	?	38	165,445	0.23	Moderate	Low	
51	Gastrointestinal Ostomy Complications	42		179	863,404	0.21	Fair	Low	
21	Clostridium Difficile Colitis	47		783	141,260	5.54	Substantial	Adequate	
48	Other Complications of Medical Care	37		157	840,758	0.19	Moderate	Low	



PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
34	Moderate Infectious	31		85	295,818	0.29	Fair	Low	
2	Extreme CNS Complications	32		100	691,152	0.14	Fair	Adequate	
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	41		271	804,867	0.34	Fair	Low	
39	Reopening Surgical Site	36		331	230,628	1.44	Moderate	Low	
50	Mechanical Complication of Device, Implant & Graft	44		469	862,621	0.54	Moderate	Low	
15	Peripheral Vascular Complications except Venous Thrombosis	34		160	806,577	0.20	Fair	Low	
44	Other Surgical Complication - Mod	30		80	231,235	0.35	Slight	Low	
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection	47		597	871,769	0.68	Substantial	Adequate	
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions	39		131	849,265	0.15	Substantial	Adequate	



PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
19	Major Liver Complications	34		139	798,285	0.17	Fair	Low	
47	Encephalopathy	38		173	572,155	0.30	Substantial	Adequate	
66	Catheter-Related Urinary Tract Infection	0							
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	43		537	641,587	0.84	Excellent	Adequate	
26	Diabetic Ketoacidosis & Coma	29		57	753,939	0.08	Moderate	Low	
33	Cellulitis	44		352	728,231	0.48	Slight	Low	
65	Urinary Tract Infection without Catheter	32		94	694,707	0.14	Excellent	Adequate	
23	GU Complications Except UTI	35		119	807,671	0.15	Fair	Low	
45	Post Procedure Foreign Body	47		27	300,859	0.09	Slight	Low	
13	Other Cardiac Complications	39		161	787,985	0.20	Substantial	Low	
10	Congestive Heart Failure	42		225	725,467	0.31	Substantial	Low	
64	Other In-Hospital Adverse Events	45		303	885,064	0.34	Excellent	Adequate	
36	Acute Mental Health Changes	0							



PPC #	PPC Description	Eligible Hospitals	PSI-90	Observed PPCs	At Risk Discharges	Obs/At-Risk*1,000	Reliability Assessment~	Predictive Validity Assessment~	Suggest
29	Poisonings except from Anesthesia	34		90	764,985	0.12	Slight	Low	
59	Medical & Anesthesia Obstetric Complications	32		222	132,493	1.68	Moderate	Low	
68	Gastrointestinal Complications: PPC 17 and 18	47		542	846,085	0.64	Substantial	Adequate	
67	General Combination PPC: PPC 25, 26, 63, 64	47		497	902,336	0.55	Excellent	Adequate	
71	Infection combination: PPC 34, 54,66	42		177	919,882	0.19	Moderate	Low	

^This data based on preliminary analysis; final numbers may vary slightly.

~Calculated by Mathematica Policy Research. Given large improvements over time, some measures may have low predictive validity or reliability; however, input regarding content and face validity by clinicians was also used to determine PPC inclusion.

### Key

PPC #	Obs/At-Risk Discharges*1,000	Reliability Assessment	Predictive Validity Assessment
Monitor only	Rate >1.0 per 1,000	Excellent or Substantial	Adequate
	Rate >0.5 per 1,000	Moderate	



### Updated PPC Analysis; Final PPC List Recommendations with Rationale

PPC #	PPC Description	Eligible Hospitals	Observed PPCs (2 yrs)	At Risk Discharges (2 yrs)	3M v33 PPC Wt-Based Marginal Cost	HSCRC Staff Recommendation
3	Acute Pulmonary Edema and Resp Failure w/o Ventilation	46	1238	696950	0.7958	Meets rate and variation criteria. Clinically supported. Small overlap with PSI 11 Postoperative Respiratory Failure. PSI is limited to post-operative patients but PPC applies to broader patient population. Include in payment program
4	Acute Pulmonary Edema, Resp Failure w/ventilation	47	848	698946	2.7409	Meets rate and variation criteria. Clinically supported. Small overlap with PSI 11 Postoperative Respiratory Failure. PSI is limited to post-operative patients but PPC applies to broader patient population. Include in payment program
7	Pulmonary Embolism	44	407	824106	1.3671	Nearly meets rate criteria and has variation. Clinically preventable with well-defined interventions. Overlap 25% with PSI 12 Perioperative Pulmonary Embolism and Deep Vein Thrombosis but PPC includes broader patient population. DRA HAC is measured only in patients with total knee or hip replacements. Include in payment program.
9	Shock	46	984	833605	1.5133	Meets rate criteria and has variation Clinically preventable. Include in payment program.





PPC #	PPC Description	Eligible Hospitals	Observed PPCs (2 yrs)	At Risk Discharges (2 yrs)	3M v33 PPC Wt-Based Marginal Cost	HSCRC Staff Recommendation
16	Venous Thrombosis	44	297	822712	1.4346	Below rate threshold but has variation. Clinically preventable with well-defined interventions. Some overlap with PPC 12 but PPC rate is lower but with applicability to a broader population. DRA HAC is measured only in patients with total knee or hip replacements. Include in the payment program.
28	In-Hospital Trauma and Fractures	38	110	827456	0.3353	In hospital injuries are highly preventable and serious. PPC includes more injury types than PSI 08 In Hospital Fall with Hip Fracture Rate but PPC rate is lower as it is applicable to a broader patient population. DRA HAC applies to a broader set of in hospital injuries. Include in payment program.
35	Septicemia & Severe Infections	47	801	289205	1.3722	Meets rate and variation criteria. Clinically important. Include in payment program.
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	39	319	128674	1.2701	Meets rate and variation criteria. Clinically preventable. Overlaps slightly with PSI 14- Postop Wound Dehiscence, and with NHSN SSI and with DRA HAC but PPC is broader in scope. Include in payment program.



PPC #	PPC Description	Eligible Hospitals	Observed PPCs (2 yrs)	At Risk Discharges (2 yrs)	3M v33 PPC Wt-Based Marginal Cost	HSCRC Staff Recommendation
41	Post-Operative Hemorrhage & Hematoma w/ Hemorrhage Control Procedure or I&D	32	167	241162	1.0951	Meets rate and variation criteria. Clinically preventable. Overlap with PSI 09- Perioperative Hemorrhage or Hematoma Rate with PSI having similar applicability but higher rate. Include in payment program.
42	Accidental Puncture/Laceration During Invasive Procedure	43	440	897351	0.4466	Meets rate and variation criteria. Clinically supported. Overlap with PSI 15 Unrecognized Abdominopelvic Accidental Puncture or Laceration Rate. PPC is applicable to a much broader patient population so has a lower rate. Include in the payment program.
49	Iatrogenic Pneumothorax	40	154	829953	0.6090	Does not meet rate criteria but observed events are >100. This is an important clinical measure with national focus. There is hospital variation in performance, some PSI 06 Iatrogenic Pneumothorax Rate overlap and DRA HAC is applicable to patients with infusion catheter insertion procedures only. Include in the payment program.



PPC #	PPC Description	Eligible Hospitals	Observed PPCs (2 yrs)	At Risk Discharges (2 yrs)	3M v33 PPC Wt-Based Marginal Cost	HSCRC Staff Recommendation
60	Major Puerperal Infection and Other Major Obstetric Complications	27	123	125667	0.1729	Meets rate and variation criteria; 3M believes clinical concerns are addressed in the risk adjustment, and will address this PPC's overlap with other PPCs in v. 36. Obstetric morbidity is clinically important in an all-payer environment. Include in the payment program.
61	Other Complications of Obstetrical Surgical & Perineal Wounds	25	100	122183	0.1172	Meets rate and variation criteria; 3M believes clinical concerns are addressed in the risk adjustment, and will address this PPC's overlap with other PPCs in v. 36. Obstetric morbidity is clinically important in an all-payer environment. Include in the payment program.
67	Pneumonia Combo	47	1282	713219	1.3002	Meets rate and variation criteria. Clinically supported in combined PPC. Include in payment program.

## Appendix D: Additional Details and Key Considerations

Three sets of measures in the MHAC MUC list were evaluated in more detail. These include 3M PPCs used in the current MHAC program and two sets of patient safety measures used in the CMS HACRP and HVBP programs; AHRQ Patient Safety Indicators (PSI) and select CDC/NHSN Hospital Acquired Infection measures (HAI).

CDC calculates standardized infection ratios (SIRs) and CMS includes Central Line Associated Blood Stream Infection (CLABSI), Catheter Associated Urinary Tract Infection (CAUTI), Colon and Abdominal Hysterectomy Surgical Site Infections (SSI), Methicillin Resistant Staphylococcus Aureus (MRSA) bacteremia, and Clostridium Difficile Infection (CDI) measures in both the HACRP and patient safety domain of the HVBP pay-for-performance programs. SIRs are ratios of observed-to-predicted numbers of healthcare-associated infections (HAIs). The number of predicted infections is calculated using multivariable regression models generated from nationally aggregated data during a baseline time period. These models are applied to a facility's denominator and risk-factor data to generate a predicted number of infections. The CLABSI and CAUTI measures are risk adjusted at the hospital level and patient care unit level. The SSI measures are risk adjusted at the procedure level. MRSA bacteremia and CDI measures are risk-adjusted at the hospital level. The CLABSI, CAUTI, and SSI measures use NHSN chart-abstracted surveillance data. MRSA bacteremia and CDI measures use NHSN laboratory-identified surveillance data, which hospitals report to NHSN. If the predicted number of HAIs is less than one, the CDC will not calculate an SIR for CLABSI, CAUTI, SSI, MRSA bacteremia, or CDI. The CDC will also not calculate an SIR if the hospital has insufficient data. The CDC will not calculate an SIR for CDI if the community-onset prevalence rates are within outlier bounds and CMS will not include any such measures in the Domain 2 or Total HAC score calculations. CDC encourages hospitals to report data monthly within 30 days of the close of a month. Hospitals can however review and correct the CDC NHSN HAI chart-abstracted or laboratory-identified data for the full 4.5 months following the end of the reporting quarter data submitted from NHSN to the CMS Hospital Inpatient Quality Reporting (IQR) Program. Immediately following the submission deadline, the CDC creates a data file for CMS to use in quality reporting and pay-for-performance programs.

CMS had proposed to remove these measures from the HVBP program in order to reduce duplication of measures in its various programs. In its final rule for 2019 performance year CMS reversed this proposal in light of multiple stakeholder comments against this proposal. Stakeholders expressed concern that since CMS was not increasing revenue at-risk in the HACRP to offset the reduction in revenue at-risk related to patient safety in the HVBP program, it would in effect be reducing the total revenue at-risk inpatient safety. CMS also considered performance-based penalties and rewards as desirable features of the HVBP program as opposed to the HACRP being a penalty only program. In order to avoid duplication of HAI patient safety measures in multiple Maryland pay-for-performance programs and in view of HSCRC's ability to increase weights assigned to these measures in the Quality Based Reimbursement (QBR) program it was decided not to include these measures in the MHAC program at this time.

Although most of the AHRQ PSIs met key measure selection criteria by virtue of their NQF endorsement and PSI 90 would have aligned MHAC more directly to CMS HAC Reduction Program they were nonetheless considered infeasible for the CY 2019 performance period due to unavailability of the All-Payer Risk Adjusted Version 2018 AHRQ software using one full year of ICD 10 hospital discharge data reference data (HCUP and SID) from CY 2016. AHRQ has released an All-

Payer 2018 Version of the PSI software producing only Observed PSI rates without risk adjustment. A Medicare only Risk Adjusted Version 8 PSI 90 software is currently available from CMS but would not have met the MHAC all-payer requirement.

Ten individual PSIs are included in the AHRQ PSI 90 composite measure. Performance of individual PPCs considered “overlapping” with PSI 90 component measures and recommended for their clinical importance, volumes, variation in performance across Maryland hospitals and at least moderate reliability were compared by Mathematica Policy Research (MPR) using the Maryland hospital discharge data that was most recently available. Results of this analysis in the Table below show significant variability in the Numerator and Denominator populations and their performance rates for each matched set of PSI/PPC combinations.

### Comparison of PSI 90 Component PSI vs. matching PPC Categorization of Discharges from Acute Maryland Hospitals in 2016-2017

Measures Compared	Measure Inclusion	Numerator Cases		Denominator Cases	
		Frequency	Percent	Frequency	Percent
PSI 03: Pressure Ulcer PPC 31: Pressure Ulcers	PSI and PPC	78	5%	232,044	40%
	PSI Only	1,580	95%	347,286	59%
	PPC Only	0	0%	4,511	1%
PSI 06: Iatrogenic Pneumothorax Rate PPC 49: Iatrogenic Pneumothorax	PSI and PPC	62	26%	678,312	67%
	PSI Only	85	35%	174,105	17%
	PPC Only	95	39%	158,280	16%
PSI 08: In Hospital Fall with Hip Fracture Rate PPC 28: In-Hospital Trauma and Fractures	PSI and PPC	46	24%	639,474	66%
	PSI Only	71	37%	76,032	8%
	PPC Only	77	40%	252,146	26%
PSI 09: Perioperative Hemorrhage or Hematoma Rate PPC 41: Peri-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	PSI and PPC	124	21%	186,281	65%
	PSI Only	407	69%	34,501	12%
	PPC Only	62	10%	65,793	23%
PSI 10: Postoperative Acute Kidney Injury Requiring Dialysis Rate PPC 25: Renal Failure with Dialysis	PSI and PPC	18	11%	117,181	16%
	PSI Only	86	51%	17,122	2%
	PPC Only	66	39%	610,198	82%
PSI 11: Postoperative Respiratory Failure Rate PPC 03: Acute Pulmonary	PSI and PPC	79	5%	103,100	14%
	PSI Only	411	24%	12,119	2%
	PPC Only	1,234	72%	603,232	84%

Edema and Respiratory Failure without Ventilation					
PSI 11: Postoperative Respiratory Failure Rate	PSI and PPC	122	9%	103,282	14%
	PSI Only	368	28%	11,937	2%
PPC 04: Acute Pulmonary Edema and Respiratory Failure with Ventilation					
	PPC Only	819	63%	603,420	84%
PSI 12: Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate	PSI and PPC	327	25%	193,929	22%
	PSI Only	876	67%	41,913	5%
PPC 07: Pulmonary Embolism	PPC Only	104	8%	646,464	73%
PSI 12: Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate	PSI and PPC	136	10%	193,882	22%
	PSI Only	1,067	77%	41,960	5%
PPC 16: Venous Thrombosis					
	PPC Only	174	13%	646,632	73%
PSI 13: Postoperative Sepsis Rate	PSI and PPC	132	11%	25,838	6%
	PSI Only	305	26%	104,487	26%
PPC 35: Septicemia & Severe Infections	PPC Only	727	62%	270,936	68%
PSI 14: Postoperative Wound Dehiscence Rate	PSI and PPC	9	8%	44,734	16%
	PSI Only	56	53%	25,974	10%
PPC 38: Post-Procedural Infection and Deep Wound Disruption with Procedure					
	PPC Only	41	39%	201,391	74%
PSI 15: Unrecognized Abdominopelvic Accidental Puncture or Laceration Rate	PSI and PPC	102	19%	118,342	13%
	PSI Only	89	16%	35,575	4%
PPC 42: Accidental Puncture/Laceration During Invasive Procedure	PPC Only	351	65%	770,804	83%

Known differences in populations and logic of specifications account for some of these results. As an example, both PSI 13 and PPC 38 address Sepsis, however PSI 13 covers only postoperative Sepsis while PPC 38 is for all inpatients. Other differences include Age and Major Diagnostic Category (MDC) variables. Overall, these data suggest the measure specifications are not sufficiently aligned for PSIs and PPCs to be considered comparable across most of the “overlapping” measure sets. Instead measures within each measure set would be compared to their own historical performance rates in order to understand trends. This may have implications if the PSIs were to replace PPCs in the future and would require generating historical performance data for the PSIs. A more thorough analysis to more fully understand these differences at a case level were out of scope in the current project. While PPCs are more comprehensive in some of their constructs they lack national comparative performance data and benchmarks.

AHRQ Patient Safety Indicators (PSI):

NQF endorsement status of individual PSIs is listed below. Some measures are not endorsed individually but are included in the Patient Safety and Adverse events (PSI 90) measure which is endorsed as a composite of ten individual PSI measures:

Measure ID	NQF	Measure Title	NQF Endorsed
PSI 02	0347	Death Rate in Low-Mortality Diagnosis Related Groups (DRGs)	? Yes*
PSI 03		Pressure Ulcer Rate	No - Composite
PSI 04		Death Rate among Surgical Inpatients with Serious Treatable Conditions	No - Removed
PSI 05	0363	Retained Surgical Item or Unretrieved Device Fragment Count	Yes
PSI 06	0346	Iatrogenic Pneumothorax Rate	Yes
PSI 07		Central Venous Catheter-Related Blood Stream Infection Rate	No - Removed
PSI 08		In Hospital Fall with Hip Fracture Rate	No - Composite
PSI 09	2909	Perioperative Hemorrhage or Hematoma Rate	Yes
PSI 10		Postoperative Acute Kidney Injury Requiring Dialysis	No - Composite
PSI 11	0533	Postoperative Respiratory Failure Rate	Yes
PSI 12	0450	Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate	Yes
PSI 13		Postoperative Sepsis Rate	No - Composite
PSI 14		Postoperative Wound Dehiscence Rate	No - Composite
PSI 15	0345	Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate	? Yes*
PSI 16	0349	Transfusion Reaction Count	Yes
PSI 17		Birth Trauma Rate - Injury to Neonate	No - Removed
PSI 18		Obstetric Trauma Rate - Vaginal Delivery with Instrument	No
PSI 19		Obstetric Trauma Rate - Vaginal Delivery without Instrument	No

\* Unable to confirm endorsement status from NQF database (QPS)

PSI 04 was submitted to the National Quality Forum (NQF) for continued endorsement. After three rounds of intensive review at both the NQF Surgery Standing Committee and the NQF Consensus Standards Approval Process (CSAC), AHRQ withdrew the measure from further consideration at NQF. AHRQ states it conducted rigorous testing which demonstrated that the measure is valid and reliable. Findings were included in the materials submitted and reviewed at NQF

([http://www.qualityforum.org/Publications/2017/04/Surgery\\_2015-2017\\_Final\\_Report.aspx](http://www.qualityforum.org/Publications/2017/04/Surgery_2015-2017_Final_Report.aspx)).

However, AHRQ has chosen not to continue with the NQF review process, pending a review of competing priorities. As with any measure withdrawn from consideration at NQF, endorsement was removed from the measure. In the 2019 IPPS proposed rule CMS has indicated it plans to continue use of this measure in CMS programs and to undertake the NQF endorsement process again under its own stewardship.

The most recent ICD 10 version 2018 of the AHRQ PSI software is available for individual PSIs without risk adjustment. The All-payer Risk adjusted version of the software is expected to be released by AHRQ in late spring/early summer of 2019 and will be released as Version2019.

Patient Safety and Adverse Events Indicator (PSI 90):

ICD-9-CM/PCS version (v6.0) of PSI 90 composite measure received final endorsement from the NQF on December 10, 2015 and retained its prior NQF endorsement number 0531. The modified patient and adverse events composite (PSI 90) measure includes the following ten PSIs:

- PSI 03 – Pressure Ulcer Rate
- PSI 06 – Iatrogenic Pneumothorax Rate
- PSI 08 – In-Hospital Fall with Hip Fracture Rate
- PSI 09 – Perioperative Hemorrhage or Hematoma Rate
- PSI 10 – Postoperative Acute Kidney Injury Requiring Dialysis Rate
- PSI 11 – Postoperative Respiratory Failure Rate
- PSI 12 – Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate
- PSI 13 – Postoperative Sepsis Rate
- PSI 14 – Postoperative Wound Dehiscence Rate
- PSI 15 – Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate

An ICD 10 Version of the All-payer PSI 90 measure software is currently unavailable. Per guidance from AHRQ it is expected to be released in mid-2019. CMS has created a CMS version of the patient safety and adverse events composite (PSI 90) measure. The most recent CMS Recalibrated v8.0 Patient Safety Indicator (PSI) software (CMS PSI software) uses ICD-10-CM/PCS codes to identify specific patient safety events and includes risk- and reliability-adjustment models and composite weights developed from Medicare fee-for service (FFS) discharge data. The CMS v8.0 software can only calculate PSIs from ICD-10-CM/PCS data and is not compatible with ICD-9-CM. It is available upon request through the QualityNet Help Desk in the SAS version only. Parameters of CMS v8.0 PSI software differ from those of the AHRQ all-payer PSI software and include risk-adjustment model coefficients, signal variance, reference population rates used as smoothing targets, and composite weights. Composite weights include two components: harm and volume. The harm components between CMS v8.0 and CMS v6.0 PSI software are consistent however updates to the volume component were based on the number of safety-related events for the component indicators in the October 1, 2015–September 30, 2016 Medicare FFS reference population. Details of the harm components and weights used in the composite for CMS PSI 90 are shown in the table below.



Description of patient harms captured in the AHRQ Patient Safety and Adverse Events Composite (modified version of PSI 90)

Outcome	Description of events captured	Applicable Patient Safety Indicator (PSI)
Pressure ulcer treatment	Debridement of a pressure ulcer and/or surgical skin flap procedure during the hospitalization when the pressure ulcer developed, due to tissue damage.	PSI 03
180-day hospital readmission for a pressure ulcer related complication	Readmission to an acute care hospital within 180 days of discharge after a PSI03 event for any of the following conditions that were present on admission (POA): recurrent pressure ulcer, cellulitis, pyoderma, infection, bacteremia, sepsis, acute or chronic osteomyelitis, septic arthritis, necrotizing fasciitis, gangrene, or flap failure.	PSI 03
30-day all-cause mortality	Death due to any cause within 30-days of the discharge after a PSI triggering event.	PSI 06, PSI 09, PSI 15
30-day all-cause readmission	Readmission to an acute care hospital within 30 days of the discharge after a PSI triggering event (excluding any readmissions categorized separately below).	All
180-day all-cause mortality	Death due to any cause within 180-days of the discharge after the PSI triggering event.	PSI 03, PSI 08, PSI 10, PSI 11, PSI 12, PSI 13, PSI 14
Pneumothorax treatment	Acute treatment of an iatrogenic pneumothorax by needle aspiration or chest tube placement.	PSI 06
Intubation and ventilation	Intubation and/or mechanical ventilation as result of respiratory failure resulting from an iatrogenic pneumothorax.	PSI 06

Outcome	Description of events captured	Applicable Patient Safety Indicator (PSI)
Pulmonary embolus or bleeding within 30-days of hip fracture	Pulmonary embolism (PE) or surgical site bleeding during the admission when the fracture occurred or within 30 days thereafter.	PSI 08
90-day non-surgical hip fracture complication	Hospital readmission within 90-days of the discharge after a PSI08 event for a mechanical or infectious hip fracture complication not requiring surgery.	PSI 08
Hip reoperation within 90 days	Hospital readmission for reoperation on the hip within 90-days of the discharge after a PSI 08 event.	PSI 08
Avascular necrosis	Admission to the hospital within 365 days of the discharge after a PSI 08 event with aseptic or avascular necrosis.	PSI 08
30-day readmission for wound infection	Hospital readmission for wound infection within 30-days of the discharge after a PSI09 event.	PSI 09
Anoxic brain damage or shock	Development of brain (cerebral) anoxia and or shock associated with a hemorrhage or hematoma event.	PSI 09
Acute renal failure requiring dialysis	Development of acute kidney injury/failure (stage V) requiring dialysis while hospitalized after a PSI triggering event.	PSI 09, PSI 13
Dialysis post-discharge for up to 6-months.	Ongoing need for dialysis for up to 6-months after discharge following a PSI event.	PSI 09, PSI 10, PSI 13
One-year all-cause hospital readmission	All cause hospital readmission within 365-days of the discharge after a PSI10 triggering event.	PSI 10
Extended ventilation or re-intubation	Delay in extubation or need for reintubation because of renal failure.	PSI 10
Tracheostomy	Received a tracheostomy due to extended need for mechanical ventilation and/or a complication from intubation.	PSI 11
30-day hospital readmission for pneumonia	Readmitted to an acute care hospital within 30 days of the discharge after a PSI11 event for a pulmonary complication such as pneumonia.	PSI 11
6-month hospital readmission for a bleeding complication	Hospital readmission within 180 days of the discharge after due to a bleeding complication related to anticoagulation.	PSI 12

Outcome	Description of events captured	Applicable Patient Safety Indicator (PSI)
30-day hospital readmission due to a pneumothorax complication	Readmission to an acute care hospital within 30 days of discharge after the PSI 06 event for: recurrent pneumothorax, empyema with/without fistula, bronchopulmonary or tracheoesophageal fistula, pneumomediastinum, pneumoperitoneum, pyopneumothorax, infection of the pleural space, septic pulmonary embolus, pneumonia, and or soft tissue infection at the thoracotomy site.	PSI 06
Medical complication within 7 days of hip fracture	Acute myocardial infarction, pneumonia, or sepsis during the admission when the fracture occurred or within 7 days of the fracture event.	PSI 08
Emergency department visits within 180-days for a thrombotic complication	Emergency department visits related to a thrombotic event such as pulmonary embolus, deep vein thrombosis, or postphlebotic syndrome within 180-days of discharge after a PSI12 event.	PSI 12
180-day hospital readmission due to thrombotic event	Hospital readmission within 180-days of discharge after a PSI 12 event, related to recurrent or extended thrombosis.	PSI 12
30-day hospital readmission for an infectious complication	Hospital readmission for an infectious event such as a wound infection, sepsis, or bacteremia within 30-days of discharge after a PSI13 event.	PSI 13
180-day hospital readmission for an enterocutaneous fistula	Readmitted to an acute care hospital for intra-abdominal abscess or enterocutaneous fistula within 180-days of the discharge after a PSI14 event.	PSI 14
180-day hospital readmission for an incisional hernia	Readmitted to an acute care hospital (including observational stays) for incisional hernia or reclosure of postoperative disruption of the abdominal wall within 180-days of the discharge after a PSI14 event.	PSI 14
Peritonitis or a hemoperitoneum	Development of peritonitis or a hemoperitoneum during the hospitalization associated with the PSI15 event.	PSI 15
180-day hospital readmission for an intra-abdominal abscess or enterocutaneous fistula	Development of an intra-abdominal abscess or enterocutaneous fistula up to 180 days of discharge after a PSI15 event.	PSI 15
30 day reoperation	An additional surgery within 30-days of discharge for a complication such as intra-abdominal abscess related to a PSI15 event.	PSI 15

## Summary of composite weights in CMS PSI 90, CMS v6.0 and CMS v8.0 PSI

PSI	Indicator	Composite weight PSI 90 (CMSv6.0)	Composite weight PSI90 (CMSv8.0)	Percentage difference in weights
PSI 03	Pressure ulcer rate	0.0504	0.1034	105
PSI 06	Iatrogenic pneumothorax rate	0.0531	0.0428	-19
PSI 08	In-hospital fall with hip fracture rate	0.0109	0.0150	38
PSI 09	Perioperative hemorrhage and hematoma rate	0.0691	0.0430	-38
PSI 10	Postoperative acute kidney injury rate	0.0575	0.0764	33
PSI 11	Postoperative respiratory failure rate	0.3045	0.2304	-24
PSI 12	Perioperative pulmonary embolism or deep vein thrombosis rate	0.1839	0.1867	2
PSI 13	Postoperative sepsis rate	0.2552	0.2569	1
PSI 14	Postoperative wound dehiscence rate	0.0104	0.0090	-13
PSI 15	Unrecognized abdominopelvic accidental puncture/laceration rate	0.0052	0.0364	600

Source: Weights presented are based on Medicare FFS discharges. Weights for CMS v6.0 software are based on harm weights using January 2012–December 2013 Medicare FFS discharges to determine the harm component and July 2013–June 2015 Medicare FFS discharges to determine the volume component. Weights for CMS v8.0 PSI software are based on harm weights using January 2012–December 2013 Medicare FFS discharges to determine the harm component and October 2015–September 2016 Medicare FFS discharges to determine the volume component.

## Appendix II. Additional National and Maryland Complication Programs Background

### **Hospital-Acquired Conditions Present on Admission Indicator (HAC POA)<sup>12</sup>**

Medicare's system for the payment of inpatient hospital services is called the inpatient prospective payment system. Under this system, patients are assigned to a payment category called a Diagnosis Related Group (DRG), which are based on a patient's primary diagnosis and the presence of other conditions. An average cost is calculated for each Diagnosis Related Group relative to the average cost for all Medicare hospital stays, and these relative costs (or Diagnosis Related Group weights) are used to calculate Medicare's payment to the hospital; patients with more co-morbidities or complications generally are categorized into higher-paying Diagnosis Related Groups. Historically, Medicare payments under this system were based solely on the Diagnosis Related Group weights and the volume of services.

In February 8, 2006, the President signed the Deficit Reduction Act (DRA) of 2005. Section 5001(c) of DRA requires the Secretary to identify conditions that are: (a) high cost or high volume or both, (b) result in the assignment of a case to a DRG that has a higher payment when present as a secondary diagnosis, and (c) could reasonably have been prevented through the application of evidence-based guidelines. Section 5001(c) provides that CMS can revise the list of conditions from time to time, as long as it contains at least two conditions.

For discharges occurring on or after October 1, 2008, hospitals do not receive additional payment for cases in which one of the selected conditions was not present on admission. That is, the case would be paid as though the secondary diagnosis were not present.

CMS also required hospitals to report present on admission information for both primary and secondary diagnoses when submitting claims for discharges on or after October 1, 2007.

### **Hospital-Acquired Condition Reduction Program (HACRP)**

The HAC Reduction Program is a Medicare pay-for-performance program that supports CMS's long-standing effort to link Medicare payments to healthcare quality in the inpatient hospital setting. Section 1886(p)(6)(B) of the Social Security Act established the statutory requirements for the HAC Reduction Program. Beginning with Fiscal Year FY 2015 discharges (i.e., effective October 1, 2014), the HAC Reduction Program requires the Secretary of Health and Human Services (HHS) to adjust payments to hospitals that rank in the worst-performing 25 percent of all subsection (d) hospitals with respect to HAC quality measures. Hospitals with a Total HAC Score greater than the 75th percentile of all Total HAC Scores (i.e., the worst-performing quartile) will be subject to a 1 percent

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<sup>12</sup> For more information on the DRA HAC POA program refer to <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/index.html>.

payment reduction. This payment adjustment applies to all Medicare discharges between October 1, 2018 and September 30, 2019 (i.e., FY 2019). The payment reduction occurs when CMS pays hospital claims.

CMS finalized measures and scoring methodology (vol 78, FR 50717) for this program in the FY 2014 Inpatient Prospective Payment System/Long-Term Care Hospital Prospective Payment System (IPPS/LTCH PPS) Final Rule. CMS uses the Total HAC Score to determine the worst-performing quartile of all subsection (d) hospitals. For FY 2019, the Total HAC Score is based on data for six quality measures in two domains<sup>13</sup>. CMS sends confidential Hospital-Specific Reports (HSRs) to hospitals. CMS gives hospitals 30 days to review their HAC Reduction Program data, submit questions about the calculation of their results, and request corrections to the scoring. Following the Scoring Calculations Review and Corrections period, CMS will next publicly report hospitals' HAC Reduction Program data on *Hospital Compare* in January 2019.

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<sup>13</sup> For more information on the HACRP program refer to <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Downloads/HAC-Reduction-Program-Fact-Sheet.pdf>

### APPENDIX III: RY 2020 PPCs, BENCHMARKS, AND TIERS

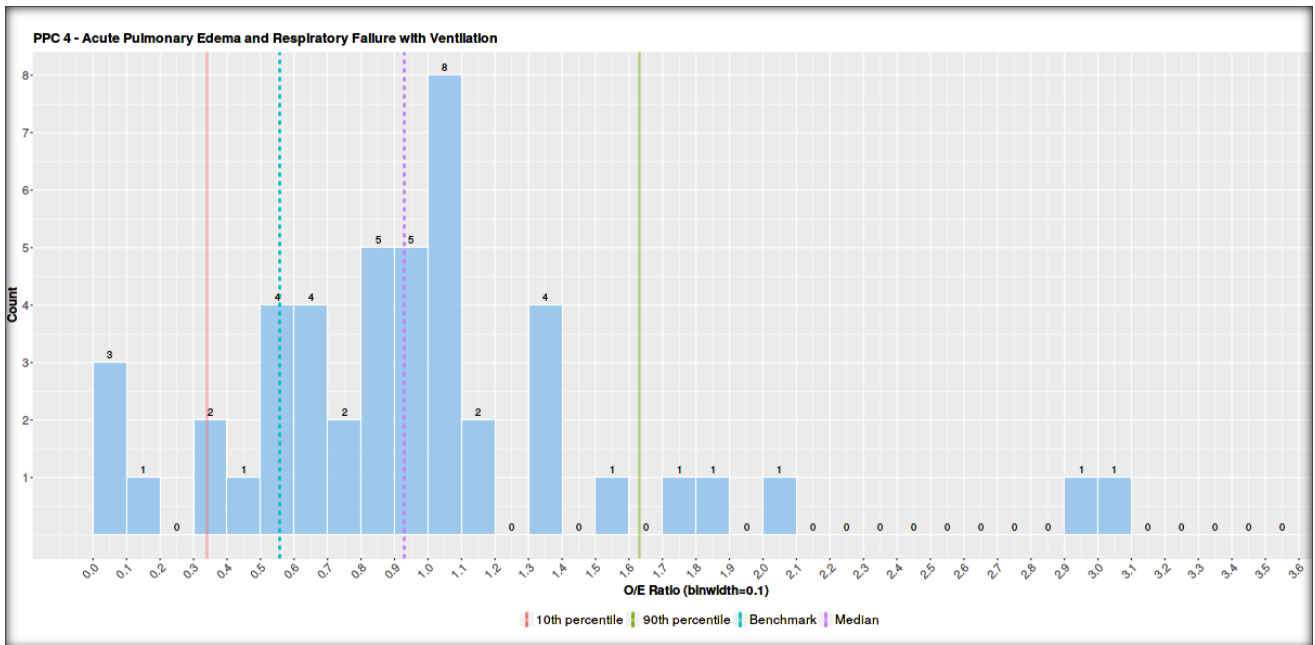
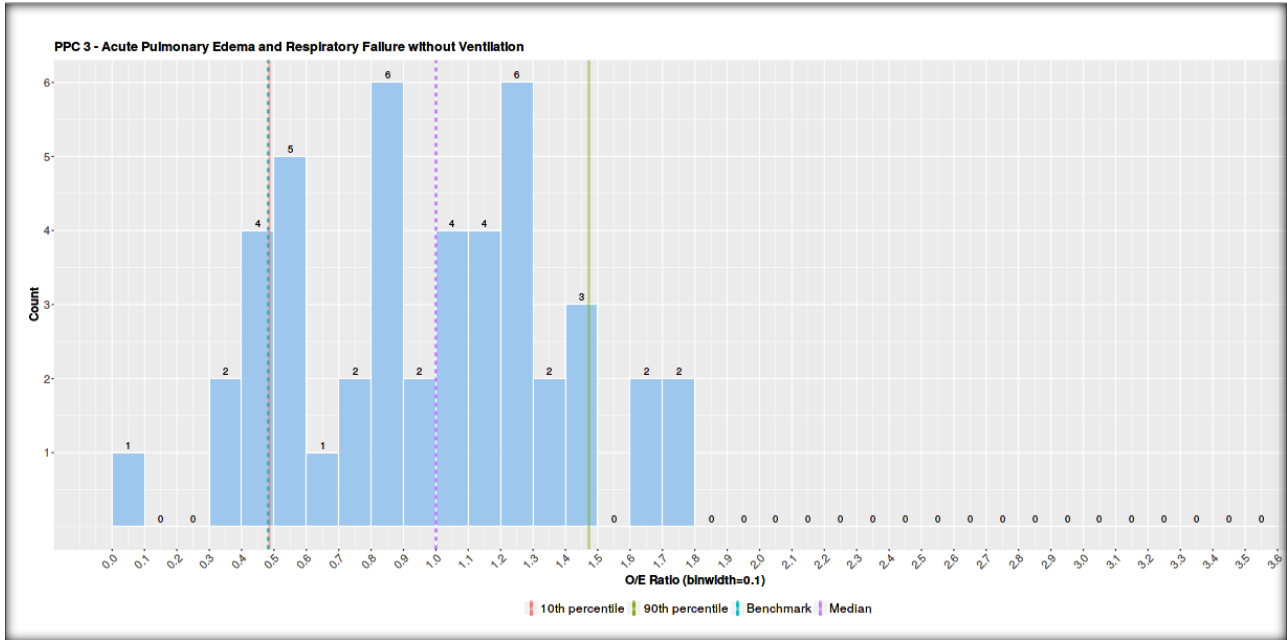
PPC Number	PPC Description	Threshold	Benchmark	Tier
1	Stroke & Intracranial Hemorrhage	1	0.4126	2
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	1	0.5466	1
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	1	0.5705	1
5	Pneumonia & Other Lung Infections	1	0.631	1
6	Aspiration Pneumonia	1	0.4287	1
7	Pulmonary Embolism	1	0.1406	1
8	Other Pulmonary Complications	1	0.2265	2
9	Shock	1	0.4131	1
10	Congestive Heart Failure	1	0.1354	2
11	Acute Myocardial Infarction	1	0.2907	2
13	Other Cardiac Complications	1	0.1521	2
14	Ventricular Fibrillation/Cardiac Arrest	1	0.5517	1
16	Venous Thrombosis	1	0.1799	1
19	Major Liver Complications	1	0	2
23	GU Complications Except UTI	1	0	2
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	1	0.2655	1
28	In-Hospital Trauma and Fractures	1	0	2
30	Poisonings due to Anesthesia	0	0	2
31	Decubitus Ulcer	0	0	2
32	Transfusion Incompatibility Reaction	0	0	2
35	Septicemia & Severe Infections	1	0.4468	1
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	1	0.2917	1
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	1	0	1
39	Reopening Surgical Site	1	0.2615	2
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Proc	1	0.5499	1

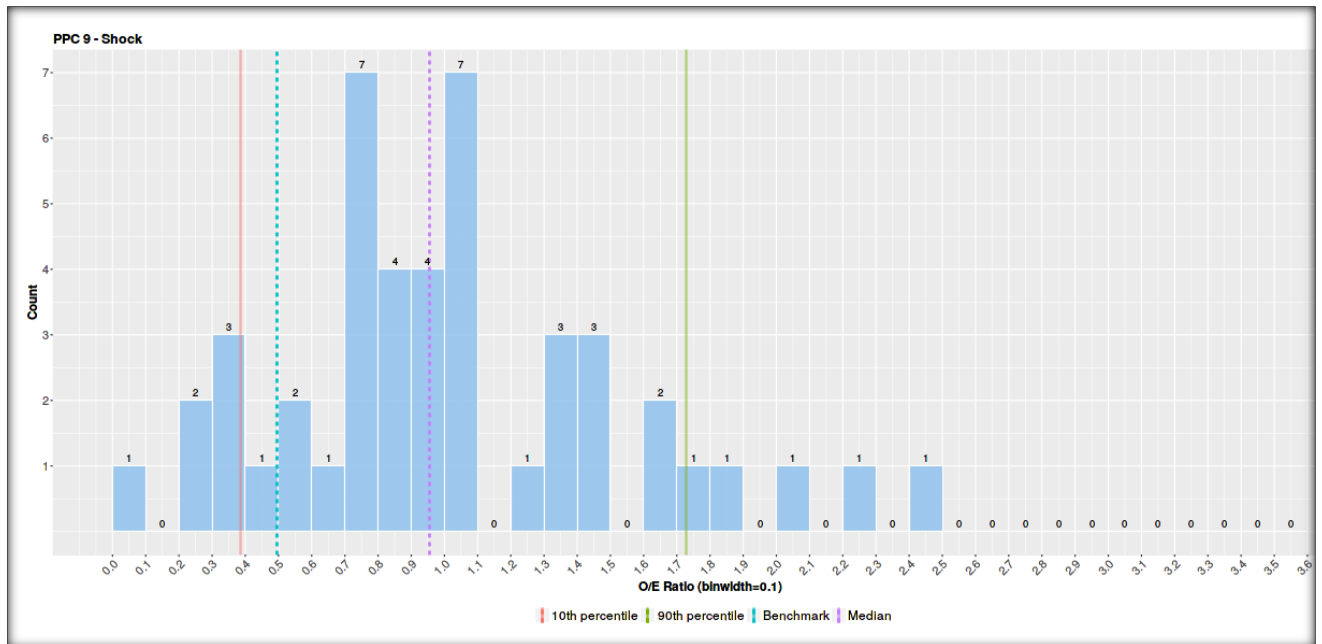
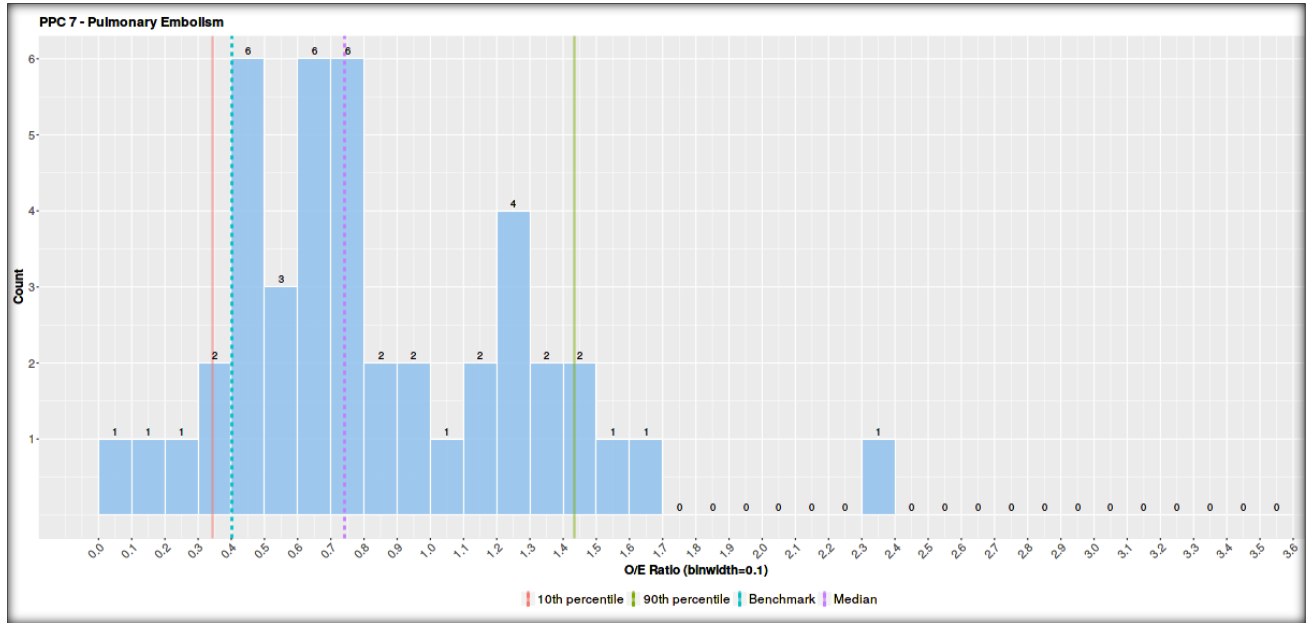
PPC Number	PPC Description	Threshold	Benchmark	Tier
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	1	0.1541	1
42	Accidental Puncture/Laceration During Invasive Procedure	1	0.385	1
44	Other Surgical Complication - Mod	1	0	2
45	Post-procedure Foreign Bodies	0	0	2
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	0	0	2
47	Encephalopathy	1	0.0925	2
48	Other Complications of Medical Care	1	0.0904	2
49	Iatrogenic Pneumothrax	1	0.0758	1
50	Mechanical Complication of Device, Implant & Graft	1	0.4843	2
51	Gastrointestinal Ostomy Complications	1	0.1983	2
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection	1	0.4197	2
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions	1	0	2
59	Medical & Anesthesia Obstetric Complications	1	0.2625	2
60	Major Puerperal Infection and Other Major Obstetric Complications	1	0.1321	2
61	Other Complications of Obstetrical Surgical & Perineal Wounds	1	0.1592	2
65	Urinary Tract Infection without Catheter	1	0	2
67	Combined PPC 1 (PPC 25, 26, 63, 64 )	1	0.0669	2
68	Combined PPC 2 (PPC 17, 18)	1	0.2354	2
71	Combined PPC 3 (PPC 34, 54, 66)	1	0.1234	2

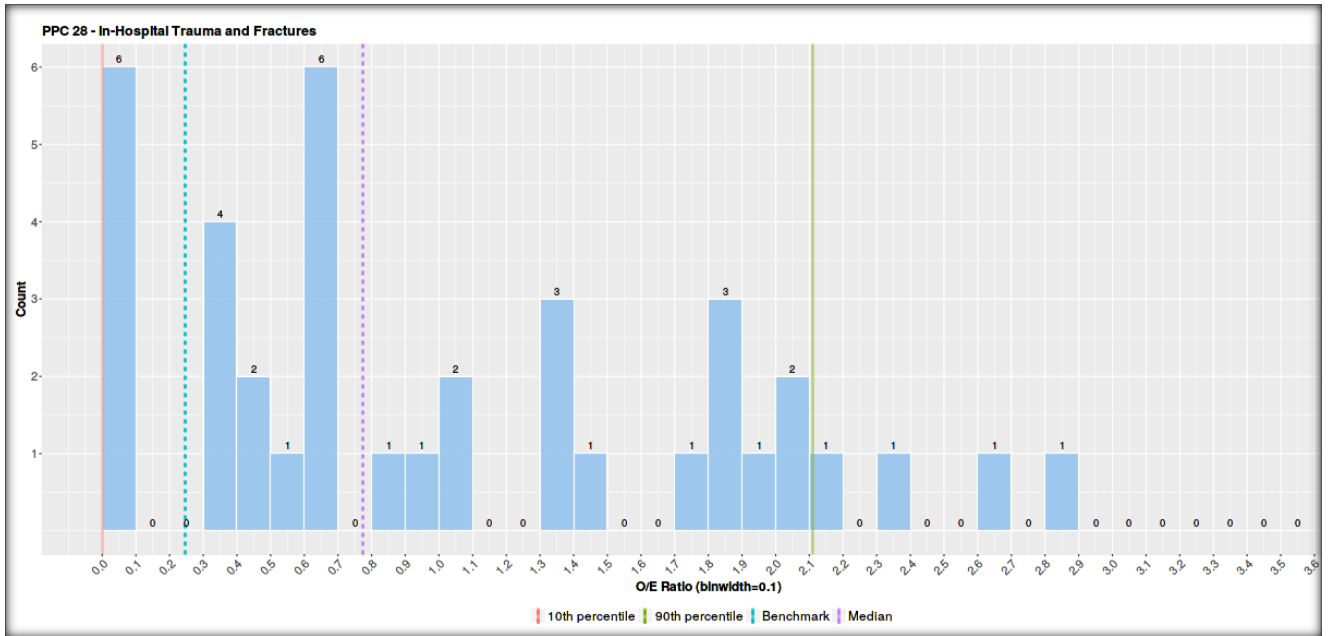
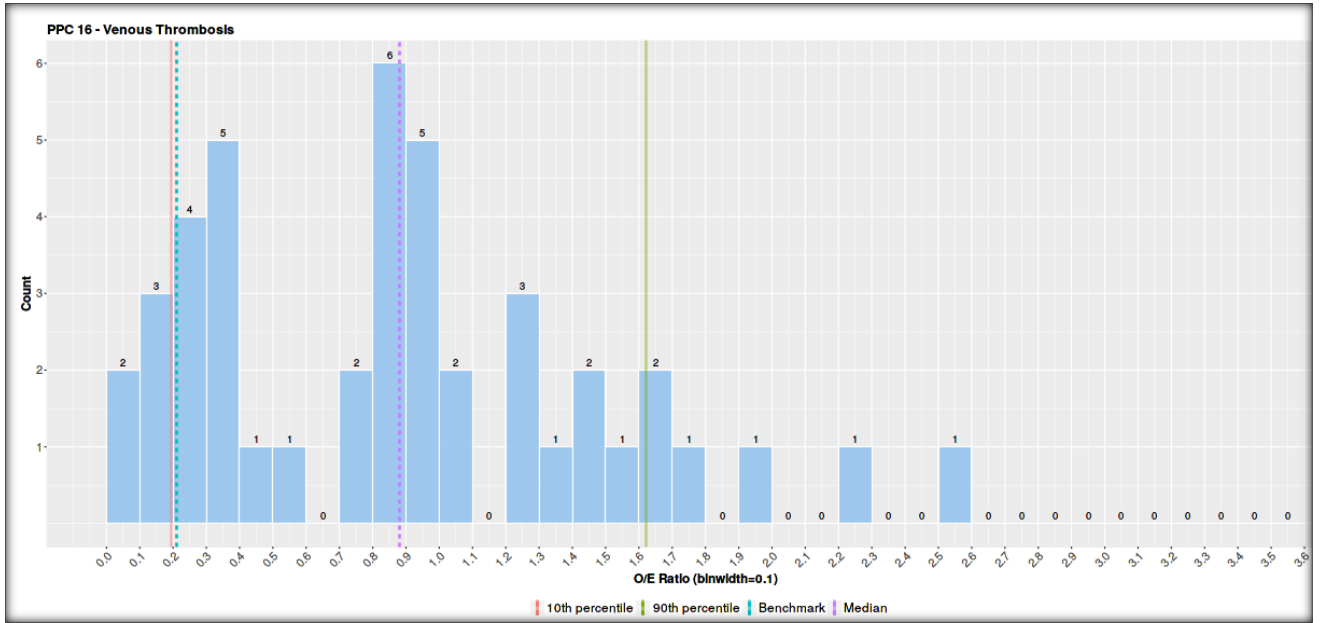


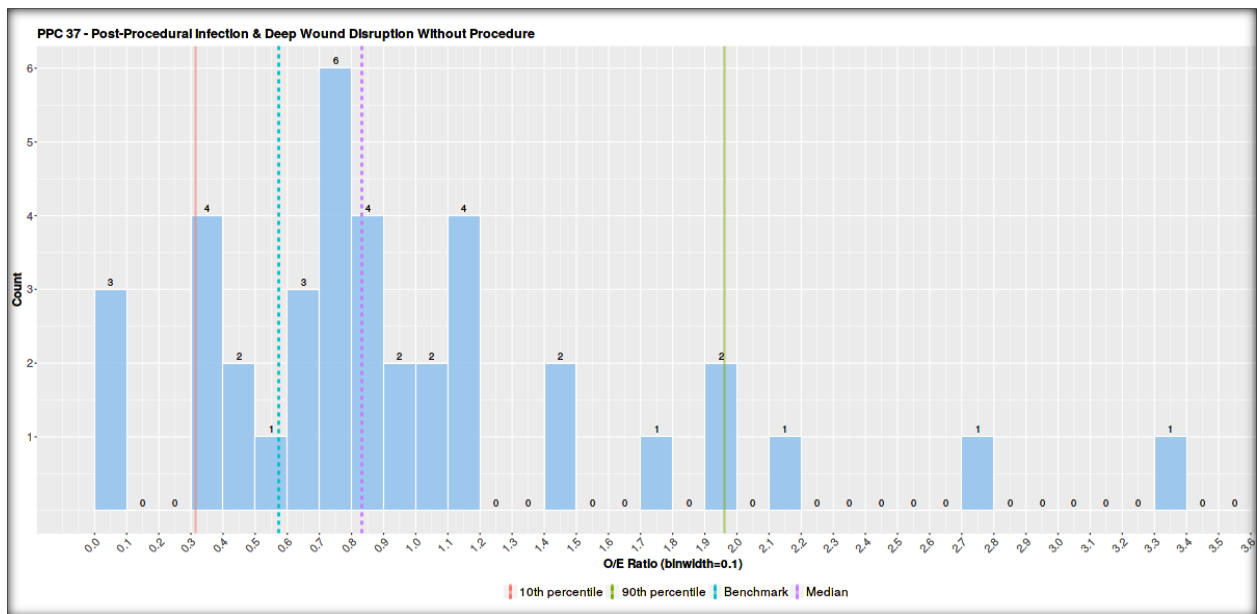
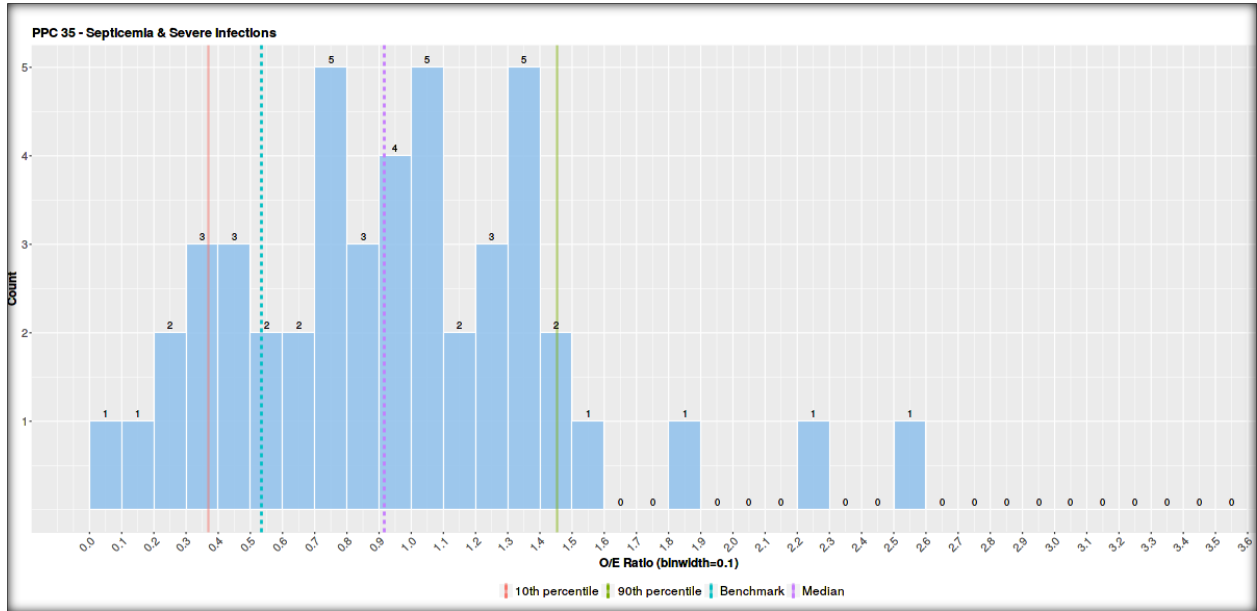
# Appendix IV. Select PPC Histograms

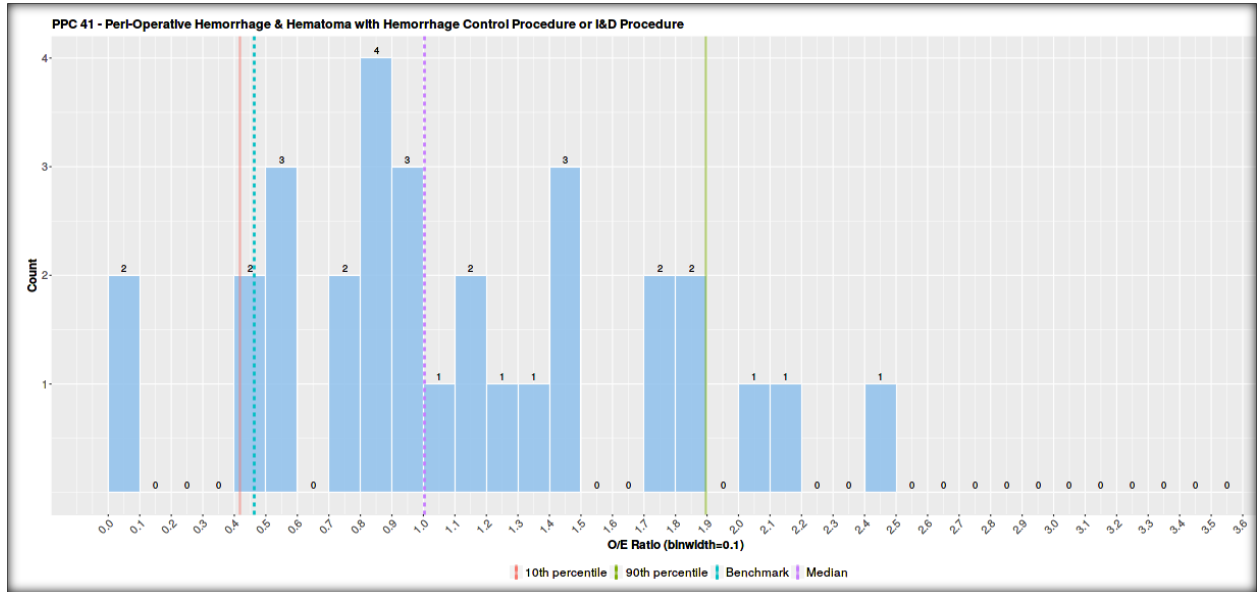
## Frequency Histograms of PPCs Selected for MHAC



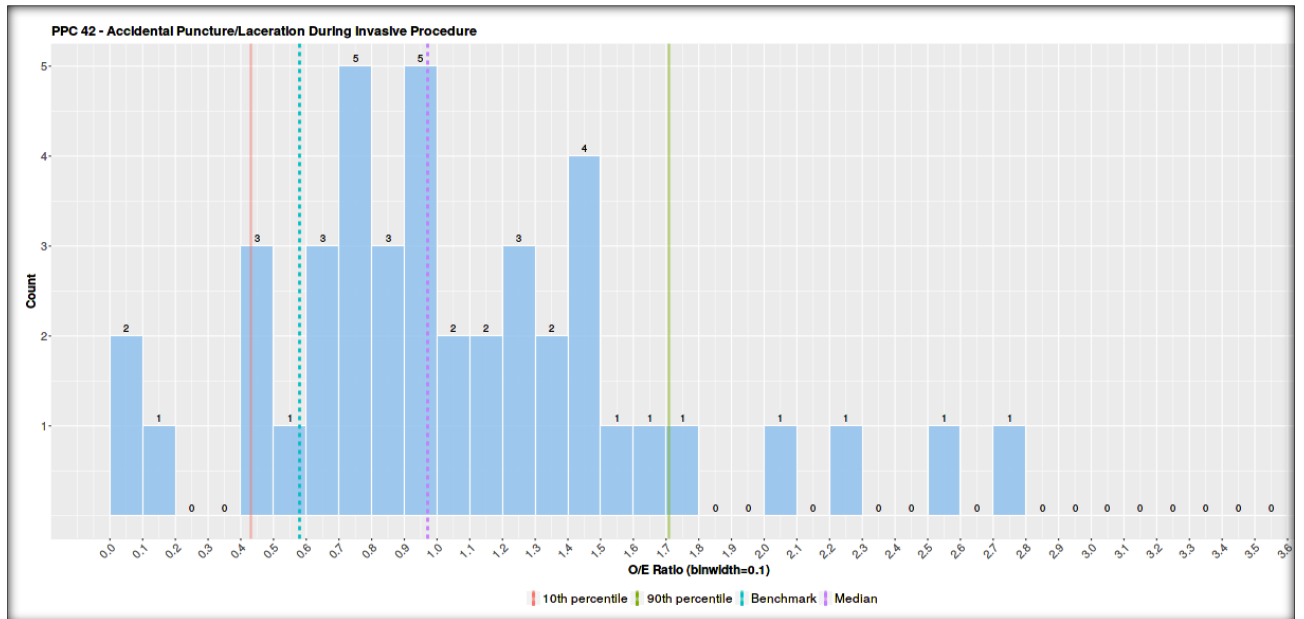


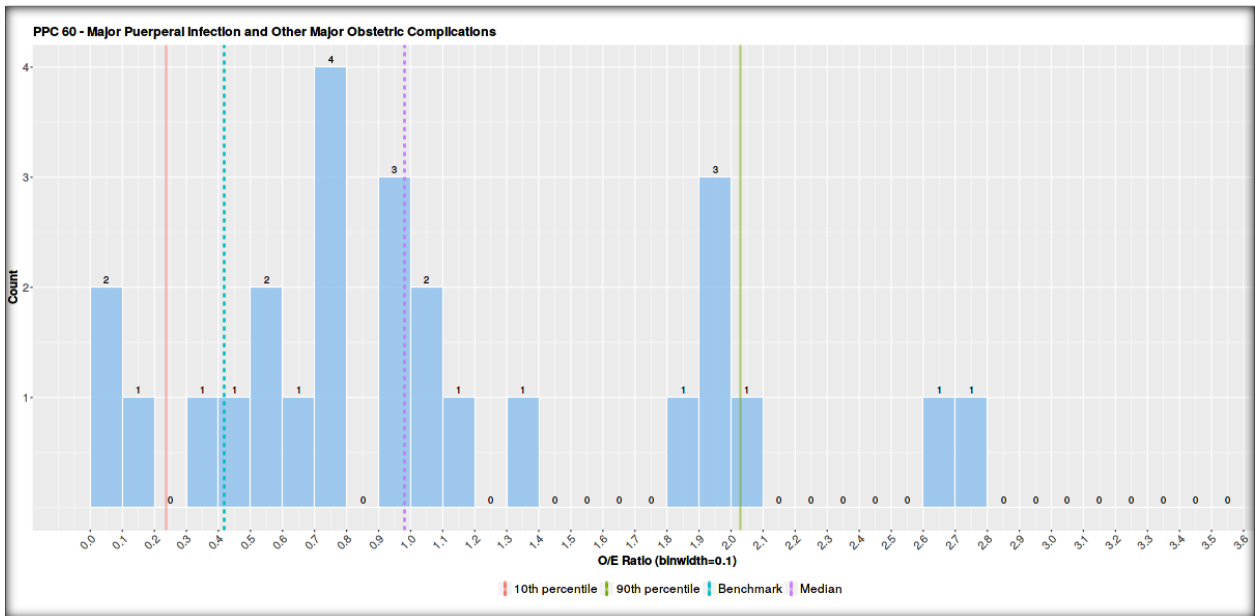
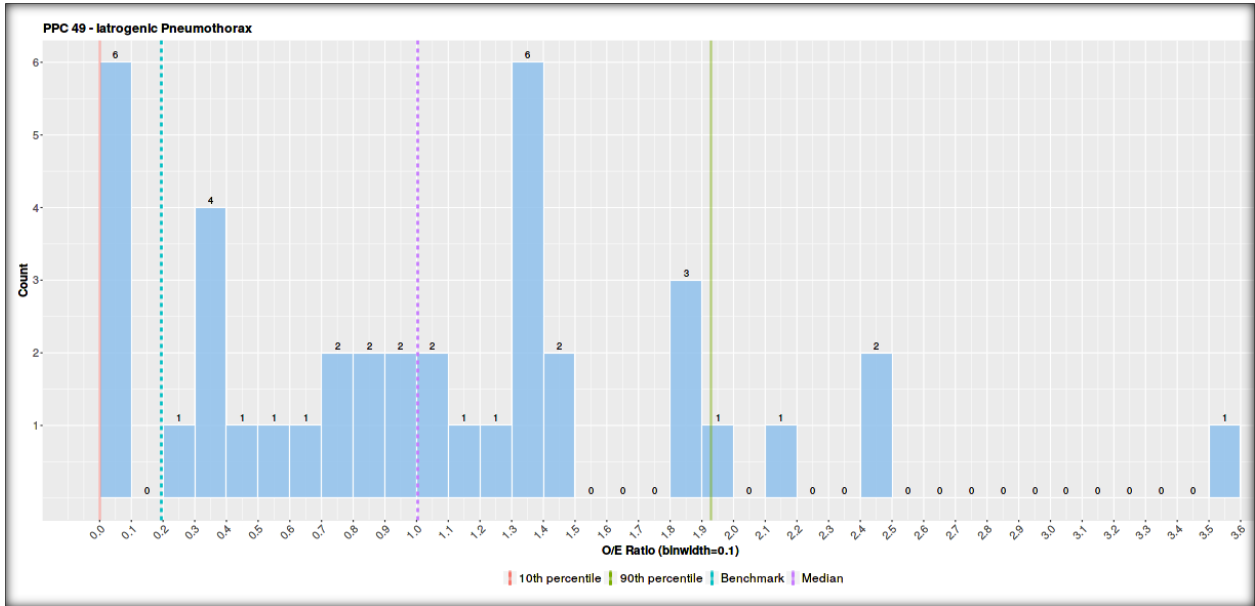




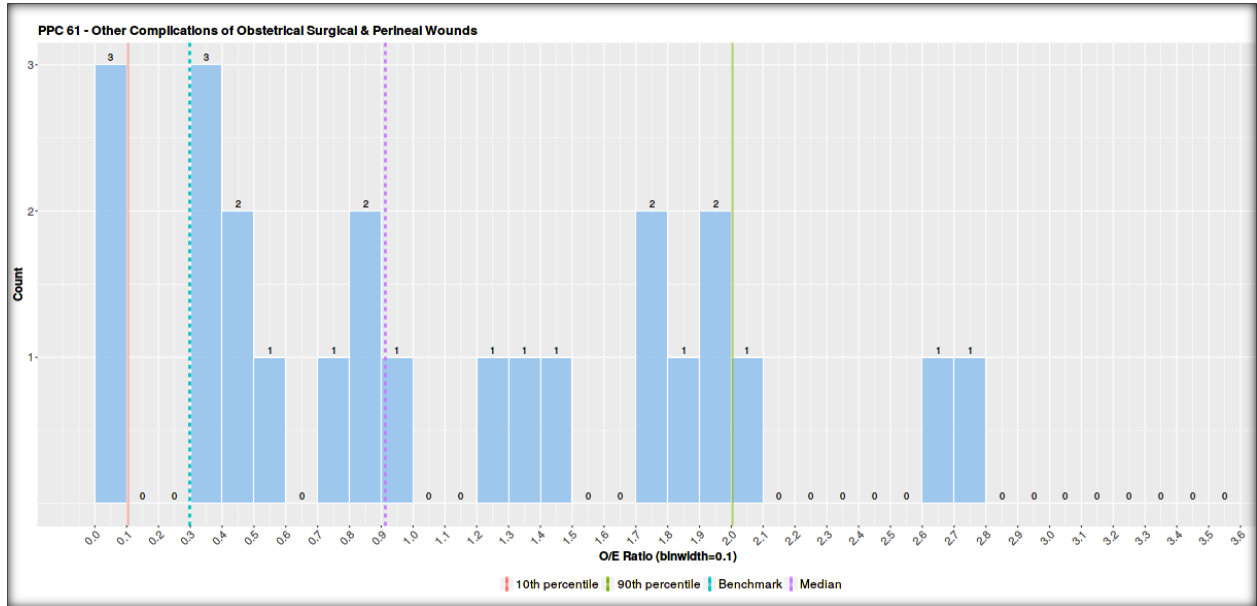


\*MedStar Union Memorial (210024) removed as outlier with O/E of 4.988

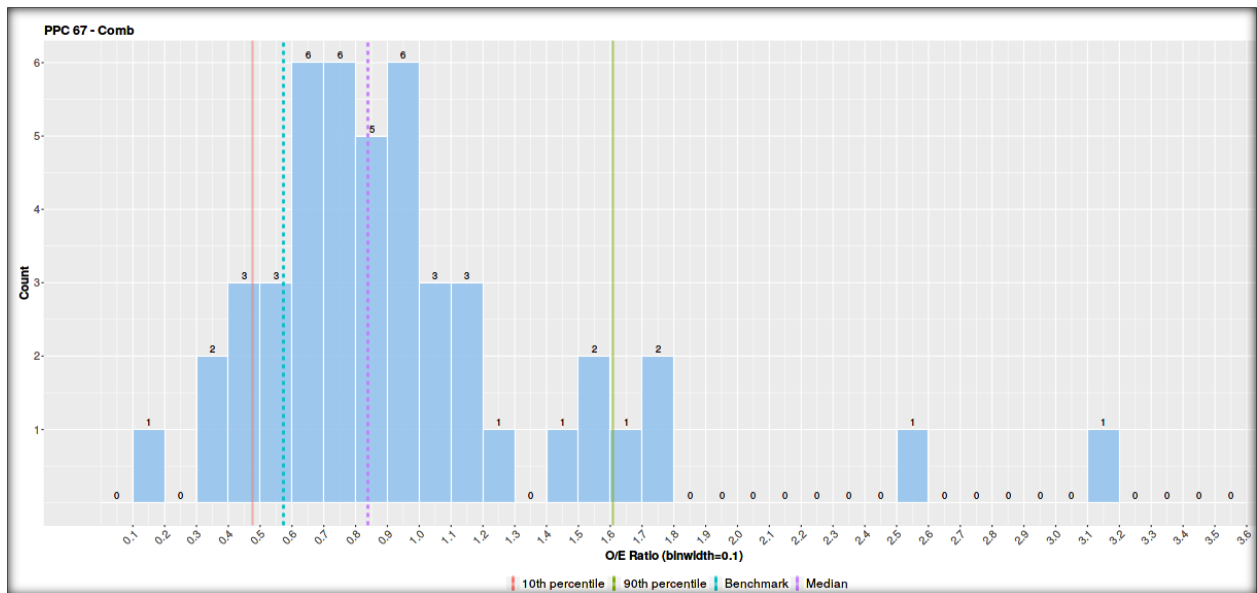




\*Washington Adventist (210016) removed as outlier with O/E of 3.988



\*UM-Charles Regional (210035) removed as outlier with O/E of 3.615



## Appendix V: HACRP Z-Score Description

The CAEM subgroup considered using the HACRP Z-Score calculation but adapted for a prospective system where the mean measure result and standard deviation were from a historical time period. It should be noted that the expanded points based scoring system proposed by staff has set the threshold and benchmark at similar percentiles of performance as the Winsorized scores.

Below is excerpt from the FY 2019 HACRP Fact Sheet (<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Downloads/HAC-Reduction-Program-Fact-Sheet.pdf>):

### Scoring Methodology

The FY 2017 IPPS/LTCH PPS Final Rule finalized the adoption of the Winsorized z-score methodology, beginning with the FY 2018 HAC Reduction Program. The Winsorized z-score methodology replaced the decile-based scoring methodology used in FY 2015 through FY 2017.

### Winsorized z-Score Calculation

For each measure, CMS calculates Winsorized measure results for each hospital based on raw measure results and the 5th and 95th percentile result for all eligible hospitals. If a hospital's measure result falls between the minimum and 5th percentile, CMS sets the hospital's measure result equal to the 5th percentile. If a hospital's measure result falls between the 95th percentile and maximum, CMS sets the hospital's measure results equal to the 95th percentile.

Winsorization does not affect hospitals with measure results between the 5th percentile and 95th percentile. These hospitals' Winsorized measure results equal the hospital's raw measure result.

CMS subtracts the mean Winsorized measure result for all eligible hospitals from a hospital's Winsorized measure result, and divides by the standard deviation of Winsorized measure results for all eligible hospitals.

The Winsorized z-score formula for "Hospital i" is:

$$\frac{X_i - \bar{X}}{SD(x)}$$

- $X_i$  is hospital i's Winsorized measure result.
- $\bar{X}$  is the mean of Winsorized measure results calculated across all Maryland and subsection (d) hospitals.
- $SD(x)$  is the standard deviation of Winsorized measure results calculated across all Maryland and subsection (d) hospitals.

CMS grants exceptions for new hospitals for CLABSI, CAUTI, SSI, MRSA, and CDI; hospitals that submit approved HAI measure exception forms for CLABSI, CAUTI, and SSI; or outliers for CDI only.



## Appendix VI. PPC Benchmarks and Thresholds under Current and Expanded Methodology

PPC Number	PPC Description	Current		Expanded	
		Threshold (50th)	Benchmark (top performers 25% discharges)	Threshold (10th)	Benchmark (90th)
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	1	0.5659	1.6406	0.3483
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	1	0.4785	1.6835	0.2530
7	Pulmonary Embolism	1	0.4724	1.9392	0.4070
9	Shock	1	0.4696	1.7393	0.2069
16	Venous Thrombosis	1	0.1658	2.1356	0.0000
28	In-Hospital Trauma and Fractures	1	0.1651	2.6935	0.0000
35	Septicemia & Severe Infections	1	0.4578	1.8121	0.2603
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	1	0.3684	1.5768	0.0000
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	1	0.2930	1.9154	0.0000
42	Accidental Puncture/Laceration During Invasive Procedure	1	0.4195	1.8772	0.4281
49	Iatrogenic Pneumothrax	1	0.1077	2.0963	0.0000
60	Major Puerperal Infection and Other Major Obstetric Complications	1	0.5005	1.9099	0.2944
61	Other Complications of Obstetrical Surgical & Perineal Wounds	1	0.1710	1.7274	0.0000
67	Combined Pneumonia (PPC 5 and 6)	1	0.4822	1.8745	0.3419

## Appendix VII. By hospital Score Modeling

RY 2021 MHAC Modeling by Hospital		Model 1: Improvement and Attainment	Model 2: Attainment Only	Model 3: Wider Performance Standards, Attainment Only
Hospital ID	Hospital Name	MHAC score	MHAC score	MHAC score
210001	MERITUS	41%	32%	58%
210002	UNIVERSITY OF MARYLAND	44%	35%	59%
210003	PRINCE GEORGE	38%	29%	53%
210004	HOLY CROSS	59%	58%	73%
210005	FREDERICK MEMORIAL	77%	72%	78%
210006	HARFORD	51%	42%	61%
210008	MERCY	48%	41%	57%
210009	JOHNS HOPKINS	68%	60%	74%
210010	DORCHESTER	67%	42%	62%
210011	ST. AGNES	55%	54%	70%
210012	SINAI	47%	45%	63%
210013	BON SECOURS	33%	17%	24%
210015	FRANKLIN SQUARE	24%	22%	46%
210016	WASHINGTON ADVENTIST	40%	34%	56%
210017	GARRETT COUNTY	69%	63%	82%
210018	MONTGOMERY GENERAL	62%	56%	74%
210019	PENINSULA REGIONAL	56%	50%	65%
210022	SUBURBAN	57%	55%	69%
210023	ANNE ARUNDEL	82%	82%	82%
210024	UNION MEMORIAL	18%	15%	35%

RY 2021 MHAC Modeling by Hospital		Model 1: Improvement and Attainment	Model 2: Attainment Only	Model 3: Wider Performance Standards, Attainment Only
Hospital ID	Hospital Name	MHAC score	MHAC score	MHAC score
210027	WESTERN MARYLAND HEALTH SYSTEM	18%	17%	32%
210028	ST. MARY	61%	61%	69%
210029	HOPKINS BAYVIEW MED CTR	48%	44%	68%
210030	CHESTERTOWN	43%	18%	34%
210032	UNION HOSPITAL OF CECIL COUNTY	74%	45%	62%
210033	CARROLL COUNTY	49%	40%	55%
210034	HARBOR	37%	34%	44%
210035	CHARLES REGIONAL	74%	69%	79%
210037	EASTON	68%	64%	75%
210038	UMMC MIDTOWN	58%	58%	71%
210039	CALVERT	35%	32%	51%
210040	NORTHWEST	67%	65%	71%
210043	BALTIMORE WASHINGTON MEDICAL CENTER	42%	39%	56%
210044	G.B.M.C.	36%	35%	53%
210048	HOWARD COUNTY	49%	40%	61%
210049	UPPER CHESAPEAKE HEALTH	58%	56%	69%
210051	DOCTORS COMMUNITY	63%	62%	74%
210055	LAUREL REGIONAL	80%	74%	80%
210056	GOOD SAMARITAN	25%	25%	50%
210057	SHADY GROVE	21%	14%	37%

RY 2021 MHAC Modeling by Hospital		Model 1: Improvement and Attainment	Model 2: Attainment Only	Model 3: Wider Performance Standards, Attainment Only
Hospital ID	Hospital Name	MHAC score	MHAC score	MHAC score
210058	REHAB & ORTHO	45%	41%	61%
210060	FT. WASHINGTON	100%	100%	100%
210061	ATLANTIC GENERAL	72%	67%	76%
210062	SOUTHERN MARYLAND	13%	7%	16%
210063	UM ST. JOSEPH	44%	42%	59%
210064	LEVINDALE	77%	70%	74%
210065	HC-Germantown	91%	85%	91%

Median	51%	44%	62%
Average	53%	47%	62%
Min	13%	7%	16%
Max	100%	100%	100%
25th	40%	34%	53%
75th	68%	62%	74%

## Appendix VIII. By hospital Revenue Modeling

RY 2021 MHAC Revenue Adjustment Modeling by Hospital			Model 3: Wider Performance Standards, Attainment Only					
			Linear 60-70% Cutpoint			Non-Linear 65% Cutpoint		
Hospital ID	Hospital Name	RY18 estimated Permanent Inpatient Revenue	MHA C score	% Adjustment	\$ Adjustment	MHA C score	% Adjustment	\$ Adjustment
210001	MERITUS	\$190,799,459	58%	-0.07%	-\$127,200	58%	-0.0025%	-\$4,770
210002	UNIVERSITY OF MARYLAND	\$919,253,797	59%	-0.03%	-\$306,418	59%	-0.0016%	-\$14,708
210003	PRINCE GEORGE	\$215,464,625	53%	-0.23%	-\$502,751	53%	-0.0126%	-\$27,149
210004	HOLY CROSS	\$340,412,069	73%	0.10%	\$340,412	73%	0.0037%	\$12,595
210005	FREDERICK MEMORIAL	\$220,972,343	78%	0.27%	\$589,260	78%	0.0160%	\$35,356
210006	HARFORD	\$48,557,781	61%	0.00%	\$0	61%	-0.0005%	-\$243
210008	MERCY	\$223,932,822	57%	-0.10%	-\$223,933	57%	-0.0037%	-\$8,286
210009	JOHNS HOPKINS	\$1,378,259,901	74%	0.13%	\$1,837,680	74%	0.0053%	\$73,048
210010	DORCHESTER	\$26,021,222	62%	0.00%	\$0	62%	-0.0002%	-\$52
210011	ST. AGNES	\$237,889,236	70%	0.00%	\$0	70%	0.0009%	\$2,141
210012	SINAI	\$398,036,508	63%	0.00%	\$0	63%	-0.0001%	-\$398
210013	BON SECOURS	\$65,798,042	24%	-1.20%	-\$789,577	24%	-0.5019%	-\$330,240
210015	FRANKLIN SQUARE	\$300,623,972	46%	-0.47%	-\$1,402,912	46%	-0.0500%	-\$150,312

RY 2021 MHAC Revenue Adjustment Modeling by Hospital			Model 3: Wider Performance Standards, Attainment Only					
			Linear 60-70% Cutpoint			Non-Linear 65% Cutpoint		
Hospital ID	Hospital Name	RY18 estimated Permanent Inpatient Revenue	MHA C score	% Adjustment	\$ Adjustment	MHA C score	% Adjustment	\$ Adjustment
210016	WASHINGTON ADVENTIST	\$158,337,604	56%	-0.13%	-\$211,117	56%	-0.0053%	-\$8,392
210017	GARRETT COUNTY	\$21,075,334	82%	0.40%	\$84,301	82%	0.1146%	\$24,152
210018	MONTGOMERY GENERAL	\$77,808,657	74%	0.13%	\$103,745	74%	0.0053%	\$4,124
210019	PENINSULA REGIONAL	\$241,466,813	65%	0.00%	\$0	65%	0.0000%	\$0
210022	SUBURBAN	\$197,431,392	69%	0.00%	\$0	69%	0.0005%	\$987
210023	ANNE ARUNDEL	\$299,264,995	82%	0.40%	\$1,197,060	82%	0.1146%	\$342,958
210024	UNION MEMORIAL	\$235,346,415	35%	-0.83%	-\$1,961,220	35%	-0.1966%	-\$462,691
210027	WESTERN MARYLAND HEALTH SYSTEM	\$171,000,183	32%	-0.93%	-\$1,596,002	32%	-0.2617%	-\$447,507
210028	ST. MARY	\$76,303,058	69%	0.00%	\$0	69%	0.0005%	\$382
210029	HOPKINS BAYVIEW MED CTR	\$357,620,585	68%	0.00%	\$0	68%	0.0002%	\$715

RY 2021 MHAC Revenue Adjustment Modeling by Hospital			Model 3: Wider Performance Standards, Attainment Only					
			Linear 60-70% Cutpoint			Non-Linear 65% Cutpoint		
Hospital ID	Hospital Name	RY18 estimated Permanent Inpatient Revenue	MHA C score	% Adjustment	\$ Adjustment	MHA C score	% Adjustment	\$ Adjustment
210030	CHESTERTOWN	\$21,139,936	34%	-0.87%	-\$183,213	34%	-0.2170%	-\$45,874
210032	UNION HOSPITAL OF CECIL COUNT	\$66,514,320	62%	0.00%	\$0	62%	-0.0002%	-\$133
210033	CARROLL COUNTY	\$132,801,017	55%	-0.17%	-\$221,335	55%	-0.0073%	-\$9,694
210034	HARBOR	\$112,526,840	44%	-0.53%	-\$600,143	44%	-0.0674%	-\$75,843
210035	CHARLES REGIONAL	\$75,199,112	79%	0.30%	\$225,597	79%	0.0200%	\$15,040
210037	EASTON	\$105,222,295	75%	0.17%	\$175,370	75%	0.0233%	\$24,517
210038	UMMC MIDTOWN	\$117,217,727	71%	0.03%	\$39,073	71%	0.0050%	\$5,861
210039	CALVERT	\$63,677,722	51%	-0.30%	-\$191,033	51%	-0.0200%	-\$12,736
210040	NORTHWEST	\$133,828,758	71%	0.03%	\$44,610	71%	0.0016%	\$2,141
210043	BALTIMORE WASHINGTON MEDICAL CENTER	\$229,151,792	56%	-0.13%	-\$305,536	56%	-0.0053%	-\$12,145
210044	G.B.M.C.	\$225,145,722	53%	-0.23%	-\$525,340	53%	-0.0126%	-\$28,368

RY 2021 MHAC Revenue Adjustment Modeling by Hospital			Model 3: Wider Performance Standards, Attainment Only					
			Linear 60-70% Cutpoint			Non-Linear 65% Cutpoint		
Hospital ID	Hospital Name	RY18 estimated Permanent Inpatient Revenue	MHAC score	% Adjustment	\$ Adjustment	MHAC score	% Adjustment	\$ Adjustment
210048	HOWARD COUNTY	\$183,348,539	61%	0.00%	\$0	61%	-0.0005%	-\$917
210049	UPPER CHESAPEAKE HEALTH	\$130,150,364	69%	0.00%	\$0	69%	0.0005%	\$651
210051	DOCTORS COMMUNITY	\$144,686,192	74%	0.13%	\$192,915	74%	0.0053%	\$7,668
210055	LAUREL REGIONAL	\$58,931,276	80%	0.33%	\$196,438	80%	0.0787%	\$46,379
210056	GOOD SAMARITAN	\$140,674,848	50%	-0.33%	-\$468,916	50%	-0.0246%	-\$34,606
210057	SHADY GROVE	\$231,939,525	37%	-0.77%	-\$1,778,203	37%	-0.1599%	-\$370,871
210058	REHAB & ORTHO	\$69,966,359	61%	0.00%	\$0	61%	-0.0005%	-\$350
210060	FT. WASHINGTON	\$19,548,527	100%	1.00%	\$195,485	100%	1.0000%	\$195,485
210061	ATLANTIC GENERAL	\$37,316,219	76%	0.20%	\$74,632	76%	0.0097%	\$3,620
210062	SOUTHERN MARYLAND	\$163,844,003	16%	-1.47%	-\$2,403,045	16%	-0.8568%	-\$1,403,815



RY 2021 MHAC Revenue Adjustment Modeling by Hospital			Model 3: Wider Performance Standards, Attainment Only					
			Linear 60-70% Cutpoint			Non-Linear 65% Cutpoint		
Hospital ID	Hospital Name	RY18 estimated Permanent Inpatient Revenue	MHA C score	% Adjustment	\$ Adjustment	MHA C score	% Adjustment	\$ Adjustment
210063	UM ST. JOSEPH	\$237,924,618	59%	-0.03%	-\$79,308	59%	-0.0016%	-\$3,807
210064	LEVINDALE	\$56,105,767	74%	0.13%	\$74,808	74%	0.0053%	\$2,974
210065	HC-Germantown	\$60,632,167	91%	0.70%	\$424,425	91%	0.1280%	\$77,609

<b>State Total</b>	<b>\$9,219,170,455</b>
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<b>State Total</b>	<b>-\$8,081,391</b>
Penalty	<b>\$13,877,202</b>
% Inpatient	<b>-0.15%</b>
Reward	<b>\$5,795,811</b>
% Inpatient	<b>0.06%</b>
Count penalty	19
Count \$0	12
Count reward	16

<b>State Total</b>	<b>\$2,575,505</b>
Penalty	<b>\$3,453,907</b>
% Inpatient	<b>-0.04%</b>
Reward	<b>\$878,402</b>
% Inpatient	<b>0.01%</b>
Count penalty	25
Count \$0	1
Count reward	21