# Final Recommendation for the
# Maryland Hospital Acquired Conditions Program
# for Rate Year 2021

March 13, 2019

Health Services Cost Review Commission

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This document contains the final staff recommendations for the Maryland Hospital Acquired Conditions Program for RY 2021.

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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

These are the final recommendations for the Maryland Rate Year (RY) 2021 Hospital-Acquired Conditions (MHAC) policy:

   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 performance range to better differentiate hospital 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 with a maximum penalty at 2 percent and maximum reward at 1 percent and continuous linear scaling with a hold harmless zone between 60 and 70 percent.~~

Commission approved the following amendment to the staff recommendation:
   D. Convert weighted PPC scores to revenue adjustments using a prospective revenue adjustment scale with a maximum penalty at 2 percent and maximum reward at 2 percent and continuous linear scaling with a hold harmless zone between 60 and 70 percent.


This final MHAC policy provides updates to methodology and modeling in the assessment section, and responds to stakeholder input.  Staff appreciates the stakeholder input that was received on the draft MHAC policy at the performance measurement workgroup meetings and through two rounds of comment letters.  In general the workgroup members and comment letters were supportive of the process for selecting complication measures, the attainment only approach, and use of 3M cost weights as proxies for patient harm.  However, as is outlined in this final recommendation, there was no consensus on the linear versus non-linear scaling options for revenue adjustments.  Based on the stakeholder input and additional staff analysis, staff is recommending to continue with the linear scaling with the hold harmless zone because we believe that hospital concerns regarding case-mix adjustment are mediated with the narrowed down list of PPCs and other methodology changes being proposed, and take very seriously the input that the non-linear scaling reduces incentives drastically.  The non-linear scaling option and hospital concerns are presented for Commissioner consideration and staff is prepared to implement either scale.  Last, staff thanks stakeholders who participated over the last year to redesign the MHAC program and believe that these final recommendations represent substantial improvements to the MHAC policy.

# 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.[1]

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

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[1]  In the fall of 2017, HSCRC Commissioners with staff support 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.

provide suggestions for evaluating hospital performance.  The Clinical Adverse Event Measures (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 final 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 final policy also recommends the use of a prospective linear scale with a hold harmless zone, as staff believes this provides the appropriate level of financial incentives for hospitals to address complications.  However, included in this recommendation for reference is the modeling of the non-linear, continuous scale, which is supported by Maryland Hospital Association and Johns Hopkins Health System because of their continued concerns on the case-mix adjustment and lack of national norms.  Staff believe that the narrowed down PPC list and use of two years of data for establishing normative values largely addresses the case-mix concerns, but will continue in future iterations of the MHAC policy to develop methodologies that strengthen case-mix adjustment and 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**

| **HACRP Domain 1 – Recalibrated Patient Safety Indicator (PSI) measure:^** |
| --- |
| Recalibrated PSI 90 Composite |
| **HACRP Domain 2 – National Healthcare Safety Network (NHSN) Healthcare-Associated Infection (HAI) measures:^*** |
| 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) |

^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[2], 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 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.

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[2] 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

**Figure 2. Overview Rate Year 2020 MHAC Methodology**



**Potentially Preventable Complication Measures**

RY 2020: Restrict to diagnosis and PPC pairings where >80% of complications occurred in base.

Tier 1 100% Weight 16 PPCs
Tier 2 50% Weight 28 PPCs

Global Exclusions:
- Palliative care
- Discharges >6 PPCs
- APR-DRG SOI cells with less than 31 at-risk discharges

Hospital PPC Exclusions:
- <10 at-risk discharges
- <1 expected PPC

**Step 1**

**Case-Mix Adjustment and Standardized Scores**

PPC scores (0-10 points) calculated using observed to expected ratios.

Expected calculated by applying statewide average PPC rates by APR-DRG-SOI to hospitals case-mix (i.e., indirect standardization).

Threshold: State Median (O/E=1)

Benchmark: Top performing hospitals w/ 25% discharges

Attainment Points:
Threshold — Benchmark
0  2  4  6  8  10

Improvement Points:
Hist. Perf — Benchmark
0  2  4  6  8  10

Final Points are Better of Improvement or Attainment

**Step 2**

**Hospital MHAC Score & Revenue Adjustments**

Hospital MHAC Score is Sum of Earned Points / Possible Points with Tier Weights Applied

Scores Range from 0-100%, with revenue neutral zone 45-55%

Max Penalty 2% & Reward +1%

| Abbreviated Preset Scale | MHAC Score | Financial Adjustment |
|---|---|---|
| Max Penalty | 0% | -2.00% |
|  | 10% | -1.56% |
|  | 20% | -1.11% |
|  | 30% | -0.67% |
|  | 40% | -0.22% |
| Penalty/Reward Cut Point (Range) | 45-55% | 0.00% |
|  | 60% | 0.11% |
|  | 70% | 0.33% |
|  | 80% | 0.56% |
|  | 90% | 0.78% |
| Max Reward | 100% | 1.00% |

**Step 3**

## 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. These changes are supported by many stakeholders, however there was no consensus on the linear versus non-linear scaling options for revenue adjustments. Based on the stakeholder input and additional staff analysis, staff is recommending to continue with the linear scaling with the hold harmless zone because we believe that hospital concerns regarding case-mix adjustment are mediated with the narrowed down list of PPCs and other methodology changes being proposed, and take very seriously the input that the non-linear scaling reduces incentives drastically.

# 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 51.19 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 September 2018**



| Case-Mix Adjusted PPC Rate | All-Payer | Medicare FFS |
|---|---|---|
| CY16 over CY13 % Change | **-45.29%** | **-47.36%** |
| CY 2016 YTD Sep | 0.58 | 0.64 |
| CY 2018 YTD Sep | 0.52 | 0.57 |
| CY18 over CY16 YTD % Change | -10.79% | -10.76% |
| **Compounded % Change** | **-51.19%** | **-53.03%** |
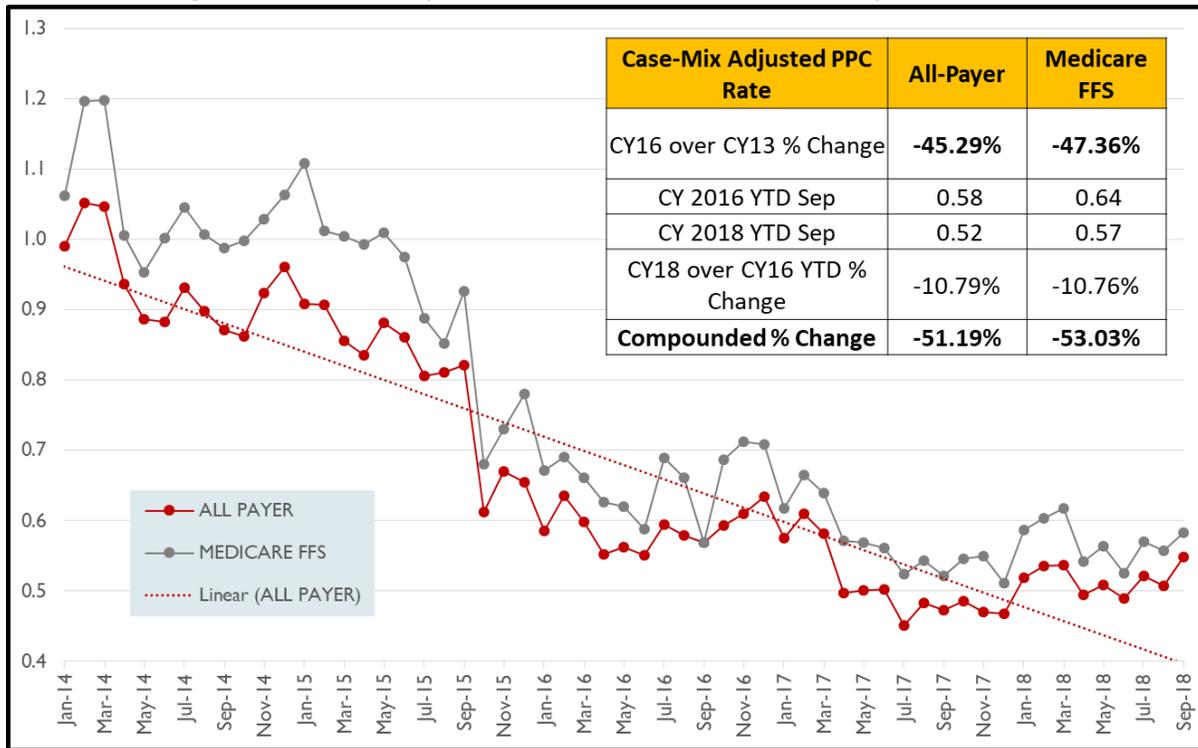
**Note:  Line graph based on v32 prior to October 2015; and v35 October 2015 to June 2018; all data are final, but are subject to validation.**

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)**
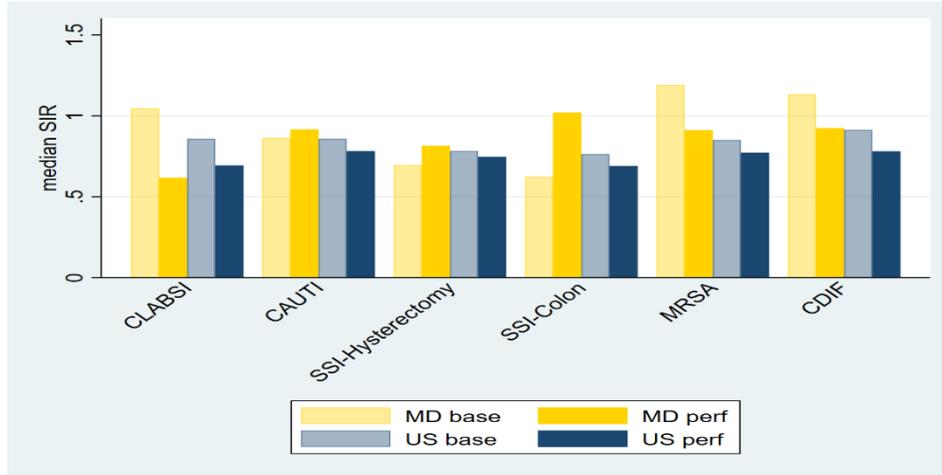


While the CAEM subgroup and PMWG members all agree that Maryland must improve performance on NHSN measures relative to the nation, the consensus was that including the same measures in two programs would confuse clinicians and hospital administrators because the results and revenue adjustments may differ 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.[3]  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.[4] 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 or "topped off", 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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[3] 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.

[4] 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.

*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).[5]

**Figure 5. Criteria for PPC Inclusion**

| Clinical Criteria | <ul><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><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[6]. 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 the PPC rates and histograms that CAEM reviewed used PPC Grouper Version 35; updated PPC rates under Version 36 in Appendix V show similar statewide rates.

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[5] 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.

[6] 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 V35 | 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 PSI 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 V35 | Eligible Hospitals/ At Risk Discharges (2 yrs) | Obs/At-Risk*1,000 Rate >1.0 per 1,000 / Rate >0.5 per 1,000 | CAEM, PMWG, HSCRC Staff Recommendation |
|---|---|---|---|---|
| 41 | Post-Operative Hemorrhage & Hematoma w/ Hemorrhage Control Procedure or I&D | 32 hospitals<br><br>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.<br>Include in payment program. |
| 42 | Accidental Puncture/ Laceration During Invasive Procedure | 43 hospitals<br><br>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.<br>Include in the payment program. |
| 49 | Iatrogenic Pneumothorax | 40 hospitals<br><br>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.<br>Include in the payment program. |
| 60 | Major Puerperal Infection and Other Major Obstetric Complications | 27 hospitals<br><br>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.<br>Include in the payment program. |
| 61 | Other Complications of Obstetrical Surgical & Perineal Wounds | 25 hospitals<br><br>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.<br>Include in the payment program. |
| 67 | Pneumonia Combo (with and without aspiration) | 47 hospitals<br><br>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.<br>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[7].  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.  However, as discussed in the stakeholder feedback section, the industry would like for clinicians to have opportunity to review version 36 weights before implementation.

**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 Pneumothorax | 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 |

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[7] Currently the 3M cost weights are under an older version 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 review updated weights and if similar implement these new cost weights for CY 2019 (otherwise the current cost weights will be used)..

## 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 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[8].  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[9].  In RY 2020, two changes were made to the program were approved by the Commission to address this zero-norm concern:

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.  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.

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[8] 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.

[9] 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.

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.

Staff does not recommend the 80 percent exclusion for RY 2021 because it was designed as an interim solution when the program had 45+ PPCs and the RY 2020 YTD results (through June) show that only 73 percent[10] of PPCs are included in the payment program, with only eleven hospitals having > 80 percent of PPCs included. In other words, because of the variation in PPC occurrences each year, staff's interim solution results in a higher proportion of PPCs being excluded than the desired 20 percent.

In addition to concerns that the 80 percent approach removes too large a 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 8 shows the reduction in the zero norm cells with the paired down PPC list and the by PPC percent of cells with zero norms[11]. 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 8. Percent Zero Norms Statewide and for Select PPCs



| PPC Number | PPC Description | Percent "Zero Norms" | Total Diagnosis and Severity of Illness Cells |
|---|---|---|---|
| 28 | In-Hospital Trauma and Fractures | 96% | 713 |
| 49 | Iatrogenic Pneumothrax | 94% | 685 |
| 42 | Accidental Puncture/Laceration During Invasive Procedure | 86% | 745 |
| 16 | Venous Thrombosis | 85% | 712 |
| 7 | Pulmonary Embolism | 84% | 712 |
| 41 | Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc | 79% | 285 |
| 9 | Shock | 74% | 731 |
| 4 | Acute Pulmonary Edema and Respiratory Failure w/ Ventilation | 72% | 655 |
| 37 | Post-Operative Infection & Deep Wound Disruption Without Procedure | 69% | 226 |
| 35 | Septicemia & Severe Infections | 67% | 537 |
| 3 | Acute Pulmonary Edema and Respiratory Failure without Ventilation | 65% | 655 |
| 67 | Combined Pneumonia (PPC 5 and 6) | 59% | 645 |
| 61 | Other Complications of Obstetrical Surgical & Perineal Wounds | 54% | 13 |
| 60 | Major Puerperal Infection and Other Major Obstetric Complications | 8% | 13 |

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[10] The draft policy erroneously claimed that only 65% of PPCs were captured in the performance period.
[11] Figure 9 is based on data from the draft policy comparing all PPCs and the 14 PPCs in CY 2016 and differs from the zero norms presented for the actual base period.

An additional consideration proposed in the draft policy was to increase the time period for determining norms from 1 year to 2 years. As shown in Figure 9, using 2 years for calculating norms lowers percentage of zero norms for the 14 PPCs (from 81 percent to 73 percent under the updated version 36 modeling) and increases the number of diagnosis and severity of illness cells included in payment program because the minimum number of at-risk discharges per cell is kept at 31. The use of the two years norms reduces the percentage of zero norms to a value similar to what was seen with the 80 percent exclusion (70 percent). It also potentially raises normative values because it averages across time periods where improvements have been achieved, and thus staff believes the use of this longer time period provides more stable values given the small numbers. Based on these analyses staff believes that the RY 2021 policy should use state fiscal year 2017 and 2018 to calculate statewide normative values and that this methodology change significantly reduces case-mix adjustment concerns.

### Figure 9. Percent Zero Norms Using 1 Year vs 2 Years of Data

| PPC Number | PPC Description | 2 Year Norms (FY17 & 18) | | 1 Year Norms (FY18) | |
|---|---|---|---|---|---|
| | | Percent "Zero Norms" | Total Diagnosis and Severity of Illness Cells | Percent "Zero Norms" | Total Diagnosis and Severity of Illness Cells |
| 3 | Acute Pulmonary Edema and Respiratory Failure without Ventilation | 58% | 755 | 69% | 665 |
| 4 | Acute Pulmonary Edema and Respiratory Failure w/ Ventilation | 64% | 768 | 73% | 676 |
| 7 | Pulmonary Embolism | 78% | 819 | 86% | 727 |
| 9 | Shock | 66% | 817 | 75% | 718 |
| 16 | Venous Thrombosis | 81% | 819 | 91% | 719 |
| 28 | In-Hospital Trauma and Fractures | 93% | 829 | 96% | 720 |
| 35 | Septicemia & Severe Infections | 60% | 662 | 70% | 521 |
| 37 | Post-Operative Infection & Deep Wound Disruption Without Procedure | 64% | 275 | 73% | 215 |
| 41 | Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc | 70% | 336 | 80% | 288 |
| 42 | Accidental Puncture/Laceration During Invasive Procedure | 82% | 853 | 88% | 752 |
| 49 | Iatrogenic Pneumothrax | 91% | 789 | 93% | 699 |
| 60 | Major Puerperal Infection and Other Major Obstetric Complications | 8% | 13 | 31% | 13 |
| 61 | Other Complications of Obstetrical Surgical & Perineal Wounds | 57% | 14 | 54% | 13 |
| 67 | Combined Pneumonia (PPC 5 and 6) | 52% | 747 | 64% | 656 |
| | Total | 73% | 6163 | 81% | 5957 |

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 VI 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 value of the observed to expected ratio at the 10th percentile of hospital performance, moving the benchmark to the value of the observed to expected ratio at the 90th percentile of hospital performance, and assigning 0 to 100 points for each PPC between these two percentile values. Appendix VII provides the thresholds and benchmarks under the current methodology and this revised methodology based on 2016 data to show the impact of this methodology change. Appendix VIII provides the actual FY 2017 and FY 2018 for which CY 2019 performance will be compared, along with a comparison of what the thresholds and benchmarks would have been with just one year (FY 2018) of data for the normative values. .

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, i.e. at the value of the 10th percentile, 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.

**Figure 10.  Expanded Scoring Example**
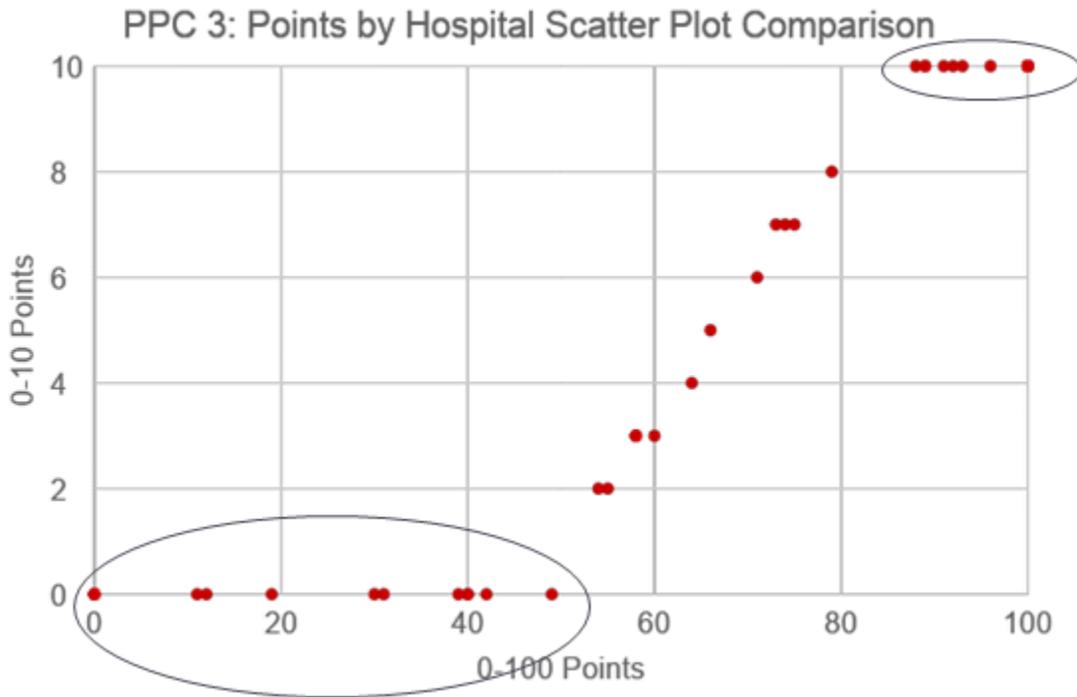


Appendix IX provides an example of the points based scoring approach with the 3M cost weights. Hospital scores across PPCs are calculated by summing the total weighted points awarded to a hospital, divided by the total possible weighted points (100 per PPC * 3M cost weight).  This results in a percent score (e.g., 85 points earned /100 possible points = 85%) and should not be interpreted as the percentile of hospital performance.

## 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 continues 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[12].

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 value of the observed to expected ratio for each PPC at a desired percentile of performance for rewards for all PPCs (e.g., the values at the 50th or 75th percentile) and then calculating the percent score that would be associated with that performance.

Based on all of these approaches staff believes 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 have suggested that the hold harmless zone reduces incentives to improve for those with performance in this range.  It should be noted though that the CMS HACRP program, which only penalizes the lowest quartile of hospitals, has ostensibly a very large hold harmless zone.

In the draft policy, staff considered non-linear scaling of penalties and rewards, to 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.  However, as previously noted staff is recommending to continue with the linear scaling with the hold harmless zone because we believe that hospital concerns regarding case-mix adjustment are mediated with the narrowed down list of PPCs and other methodology changes being proposed, and take very seriously the input that the non-linear scaling reduces incentives drastically.

Figure 11 shows the linear scale with a hold harmless zone between 60 and 70 percent, non-linear with cut point at 65 percent.

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[12] 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.

**Figure 11: Linear versus Non-Linear Scaling[13]**



| Abbreviated Scales | | |
|---|---|---|
| Score | Linear | Non-Linear |
| 0% | -2.000% | -2.000% |
| 5% | -1.833% | -1.573% |
| 10% | -1.667% | -1.212% |
| 15% | -1.500% | -0.910% |
| 20% | -1.333% | -0.664% |
| 25% | -1.167% | -0.466% |
| 30% | -1.000% | -0.312% |
| 35% | -0.833% | -0.197% |
| 40% | -0.667% | -0.114% |
| 45% | -0.500% | -0.058% |
| 50% | -0.333% | -0.025% |
| 55% | -0.167% | -0.007% |
| 60% | 0.000% | -0.003% |
| 65% | 0.000% | 0.000% |
| 70% | 0.000% | 0.003% |
| 75% | 0.167% | 0.023% |
| 80% | 0.333% | 0.079% |
| 85% | 0.500% | 0.187% |
| 90% | 0.667% | 0.364% |
| 95% | 0.833% | 0.630% |
| 100% | 1.000% | 1.000% |
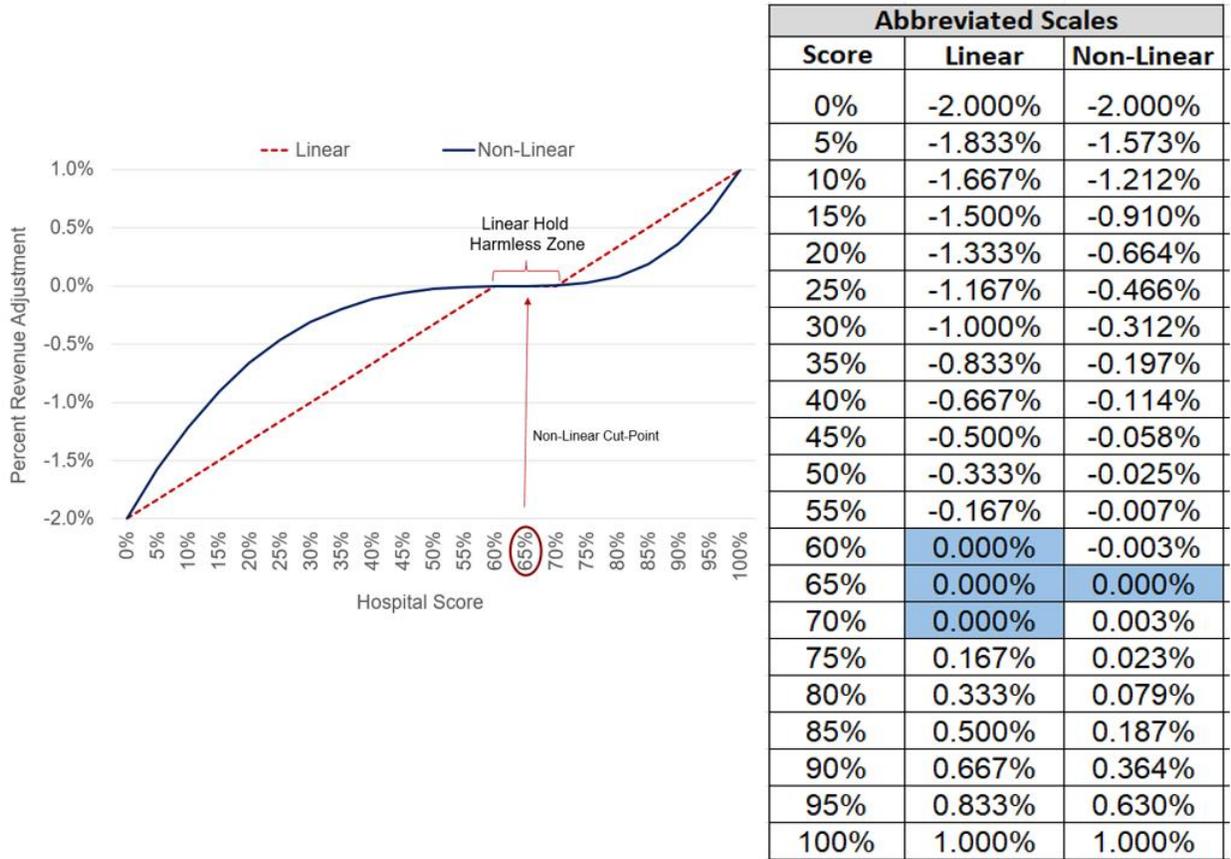
# Modeling of Scores and Revenue Adjustments

*Scoring Models*

Three models were first analyzed to test the impact of moving to an attainment only system. These models use FY 2017 and FY 2018 for normative values and performance standards (i.e., threshold and benchmark) and October 2017 to September 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 51 percent to 43 percent. Under the wider performance standards (Model 3) scores increase to a median of 63 percent since hospitals

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[13] At the March meeting, Commissioners voted to amend the linear revenue adjustment scale to have potential rewards of up to 2%. The amended scale is provided in Appendix XIII.

can begin to score points at a lower percentile of hospital performance, i.e. for performance that is better than the value of the 10th percentile; this represents a 24 percent increase in the median score when compared to Model 1.  By hospital scores under the three models are shown in Appendix X.

**Figure 12.  Hospital Score Models**

| Hospital Scores | Model 1: Imp & Att | Model 2: Att Only | Model 3: Expanded | Percent Change Model 1 and Model 3 |
|---|---|---|---|---|
| Median | 51% | 43% | 63% | 24% |
| Average | 49% | 45% | 62% | 27% |
| Min | 20% | 4% | 17% | -15% |
| Max | 100% | 100% | 100% | 0% |
| 25th | 28% | 27% | 47% | 68% |
| 75th | 66% | 63% | 76% | 15% |

*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 Adjusted 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[14]
3. **Non-Linear Scale with Adjusted 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.  Staff recommends that the linear scale with the hold harmless zone be used for RY 2021, but are providing the non-linear option outlined in the draft policy as well.   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 XI 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 21 hospitals penalized, 6 hospitals in the hold harmless zone, and 20 hospitals rewarded and a negative net statewide revenue adjustment of $24.5 million ($31.2 M in penalties/$6.7 M in

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[14] Staff recommends that the average score under the attainment only expanded performance range with an improvement factor should be used as the cut point for rewards and penalties.

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 $36.8 million ($42.1 M in penalties/$5.3 M in rewards). The staff believes that an attainment only system with the 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 $18.0 million ($4.6 M in penalties/$22.6 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 | | | Staff Recommendation | MHA/JHHS Recommendation |
|---|---|---|---|---|---|
| | 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 | 21 | 24 | 8 | 20 | 24 |
| # Hospitals No Adjustment | 6 | 6 | 8 | 9 | 2 |
| # Hospitals Rewarded | 20 | 17 | 31 | 18 | 21 |
| | | | | | |
| Net Revenue Statewide | -$24,476,914 | -$36,825,615 | $18,008,476 | -$7,041,420 | -$668,994 |
| | -0.27% | -0.40% | 0.20% | -0.08% | -0.007% |
| Total Penalties | -$31,165,676 | -$42,101,658 | -$4,602,874 | -$15,701,800 | -$3,139,074 |
| % Inpatient Revenue | -0.34% | -0.46% | -0.05% | -0.17% | -0.034% |
| Total Rewards | $6,688,762 | $5,276,043 | $22,611,350 | $8,660,380 | $2,470,080 |
| % Inpatient Revenue | 0.07% | 0.06% | 0.25% | 0.09% | 0.027% |
| Average % Adjustment | -0.17% | -0.31% | 0.17% | -0.09% | -0.001% |
| Realized Risk | 0.43% | 0.53% | 0.35% | 0.28% | 0.113% |

Model 3 scores using the linear scale and hold harmless zone between 60 and 70 percent results in negative net revenue adjustment statewide of $7.0 million ($15.7 M in penalties/$8.6 M in rewards). When this is converted to percent of total inpatient revenue the net change is only -0.08 percent. The reason that staff does not recommend the non-linear scaling is that it drastically reduces the revenue adjustments statewide with a negative net revenue adjustment statewide of $700 thousand ($3.1 M in penalties/$2.5 million in rewards), which is a net change of of -0.007% of revenue. While staff indicated in the draft policy that 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.

# 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 believes 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.

# Stakeholder Feedback and Staff Response

HSCRC received written stakeholder feedback from Anne Arundel Medical Center (AAMC), Johns Hopkins Health System (JHHS), Maryland Hospital Association (MHA), Medstar Health, Inc., and CareFirst BCBS. Staff also continued to vet the draft MHAC policy with stakeholders at the January and February Performance Measurement Workgroup (PMWG) meetings.

There was stakeholder agreement in voicing support for the narrowed down list of PPC measures proposed for RY 2021, and the use of a wider, attainment only performance scale. There was also conditional support for weighting PPCs differentially in hospitals' scores using 3M cost weights, provided the updated weights are evaluated when issued by 3M to ensure they continue to match clinicians' expectation of patient harm.

There was not consensus among stakeholders regarding the issues outlined below.

***Risk Adjustment***
MHA and JHHS both express concerns related to the adequacy of the risk adjustment of the PPCs. JHHS argues that the lack of corrective factors for the indirect standardization used in the methodology introduces a degree of randomness and instability that can result in a hospital's expected values being underestimated. They note further that their concern is heightened with the discontinuation in RY 2021 of the adjustment applied in RY2020 known as the "80 percent rule," an adjustment that restricts the possible combinations of PPCs and diagnoses in the MHAC program to those where 80% of PPCs occur statewide in the base year. JHHS further supports implementation of a Bayesian adjustment which adjusts for or smooths small volume events, making them more statistically stable. MHA also supports continued pursuit of ways to address risk adjustment concerns. CareFirst BCBS alternatively argues that applying the 80 percent exclusion adjustment removed a significant percentage of the actual PPCs that occurred in the previous year. In addition, they assert that focusing on the narrower list of fourteen PPCs and increasing the number of at risk discharges required for each diagnosis and severity of illness level statewide from 2 to 31 sufficiently addresses the zero-norm concerns.

**Staff Response:**

**Staff concurs with the CareFirst assessment that the zero norm issue has been minimized by narrowing down the list to the fourteen clinically significant PPCs, increasing the statewide at risk number from 2 to 31 for each diagnosis and severity of illness level, and using a two year period to establish the normative values. Specifically the new rate of zero norms of 73 percent is similar to the 71 percent modeled in the approved RY 2020 policy under the 80 percent exclusion. Furthermore, staff conducted analyses where we ran hospital scores multiple times with one additional observed PPC being added in each iteration to each of the PPCs, and found that the percent revenue adjustments did not vary substantially as discussed in Appendix XII.**

*National Benchmarks*

Both MHA and JHHS note their concerns about the non-availability of national benchmarks for PPCs. MHA recommends that HSCRC staff evaluates Maryland's hospitals' performance relative to the 3M national data set of hospital PPC performance under ICD 10 when it is released to inform opportunities for continued improvement and risk adjustment. CareFirst supports staff efforts to consider national norms for calibrating the MHAC methodology in the future, but cautions that we also consider the program's impact on coding and documentation related to PPCs in the state as compared with the nation where the program and incentives are different.

**Staff Response:**

**Staff agrees that national benchmarks should be explored when available, and agrees with the concerns that PPC-specific incentives within Maryland may impact coding and documentation patterns and ultimately how Maryland hospital performance may appear relative to national norms.**

*Reward Penalty Scale*

MHA and JHHS both support use of a non-linear payment scale in order to focus on outliers because of concerns with case-mix adjustment and lack of national standards. CareFirst supports the use of a continuous linear scale with no "hold harmless" zone, and does not understand why scores around the middle part of the scale are any less precise than the other portions of the distribution.

At the February PMWG meeting, some non-hospital stakeholders expressed concerns when staff indicated that they were strongly considering the non-linear scale. They stated they felt that the non-linear scale revenue adjustments were not substantial enough to lead to improvement or sustained strong performance. They felt that the function of the proposed non-linear scale was a much wider hold harmless zone, and recommended that staff use the proposed linear scale, consider an alternative non-linear function, or continue with linear scaling but with wider hold harmless zone.

**Staff Response:**

**Staff agrees that transitioning to a non-linear scale, with the drastic reduction in revenue adjustments, would dilute incentives and therefore potentially impede continued PPC improvements. This would run counter to the effort that has been undertaken to narrow the PPC list to those that are clinically significant and amenable to improvement through interventions. Also, staff believes that any additional scaling options would require a delay in the policy and that the modeled**

**revenue adjustments under the linear scale are reasonable, and further cautions that additional emphasis on the performance outliers may accentuate reliability concerns. These are issues that should continue to be evaluated and staff us amenable to trying to develop a prospective approach for Bayesian smoothing/reliability adjustment should reliability concerns still exist. And last, while the revenue at-risk test is across all quality programs, CMMI may look at individual programs when granting waivers from the CMS programs, especially programs that have significantly reduced at-risk due to non-linear scaling that is unwarranted.**

*Symmetrical Rewards/Penalties*

HSCRC Commissioners and the JHHS and MHA letters also recommend that the reward potential be balanced with the penalty risk at 2% of revenue.

> **Staff Response**
>
> **Staff does not agree with increasing the rewards to 2% at this time. This is based on the fact that the national program is a penalty only program. Furthermore, staff does not believe symmetry is necessary or warranted to strengthen the incentives given the large hospital improvements and rewards historically under the program.**

*Reward/Penalty Cut Point*

JHHS notes in their letter that the proposed penalty/reward cut point at 65 percent is a substantial increase from 55 percent, and recommends the cut point remain at or near 55 percent based on a variety of modelling, sensitivity analyses, and their concerns raised about risk adjustment. CareFirst supports the staff proposed cut point of 65 percent, as it is based on the statewide average/median score (62 percent) in modeling and that it builds in improvement based

> **Staff Response:**
>
> **As presented in the modeling section, the majority of hospitals would be rewarded if the cut point for penalties and rewards was not adjusted to take into account the higher percent scores under the wider and more continuous scoring methodology. Staff believes that the modeling that JHHS has done indicating lower average scores, and hence a request for a lower cut point, used FY 2018 as both base and performance. This is potentially a circular reference or rather tautological because it does not allow for improvement. Staff further notes that its modeling uses performance period data that overlaps for 3 quarters with the base period data used for generating performance standards. Thus, staff may be underestimating the improvement factor that should be applied to the cut point. Since the latest modeling is consistent with previous modeling where there was no overlap in the base and performance periods, staff does not recommend increasing the cut point.**

*PPC Appeals*

JHHS suggests that an appeals process be established for the MHAC program where HSCRC convenes clinicians to review individual PPC cases in dispute.

> **Staff Response:**
>
> **Staff does not support a process for individual PPC cases to be disputed by clinicians. Staff notes the MHAC program is rate-based, and acknowledges that not all PPCs are completely preventable. Staff further notes that we undertake with MHA, hospital clinicians and 3M an annual process to review the PPC clinical assignment and exclusion logic, which results in annual changes to the PPC methodology that 3M**

**implements and has also resulted in changes that HSCRC has made outside the PPC grouping software. Therefore, staff believes the current process for clinical vetting with the industry and 3M is adequate. Finally, staff notes that we accept hospital feedback and input throughout the year regarding specific issues related to coding assignment and exclusion logic and work with 3M to resolve the issues as they occur.**

## Recommendations

These are the final recommendations for the Maryland Rate Year (RY) 2021 Hospital-Acquired Conditions (MHAC) policy:

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 performance range scale to better differentiates hospital 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 with a maximum penalty at 2 percent and maximum reward at 1 percent and continuous linear scaling with a hold harmless zone between 60 and 70 percent.~~

<span style="color:red">Commission approved the following change to the staff recommendation:</span>

D. Convert weighted PPC scores to revenue adjustments using a prospective revenue adjustment scale with a maximum penalty at 2 percent and maximum reward at 2 percent and continuous linear scaling with a hold harmless zone between 60 and 70 percent.

# Appendix I. Clinical Adverse Events Measure Subgroup Report



**Health Services Cost Review Commission**

**Clinical Adverse Events Measure Subgroup Report**

**TABLE OF CONTENTS**

**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).

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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 Appendices C and D. 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 E.

**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 3 M APR-DRG Severity of Illness (SOI) subclass categorization.

Some concern was expressed regarding the 3 M 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 |

3. 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**

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

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|---|
| **Chief Operating Officer, Chief Medical Officer**<br>*MedStar St. Mary's Hospital* |
| Dale N. Schumacher, MD, MPH<br>**President**<br>*Rockburn Institute* |
| Kristin L. Seidl, PhD<br>**Clinical Data Scientist**<br>*University of Maryland Medical Center* |
| Michael Sokolow<br>**Director of Quality Management Business Intelligence**<br>*University of Maryland Medical System* |
| James Trumble, MD, MBA<br>**Medical Director, Physician Utilization**<br>*Frederick Regional Health System* |
| Harold Tucker, MD<br>**Chief Medical Officer**<br>*GBMC HealthCare System* |
| Stephen Winn<br>**Senior Director, Encounter Infometrics and Operations**<br>*Mid-Atlantic Permanente* |
| David A. Zolet, MD<br>**Physician Advisor**<br>*Sinai Hospital of Baltimore* |

**CAEM Project Contractor, HSCRC, MHCC Staff**

| |
|---|
| Zahid Butt, MD<br>**CEO**<br>*Medisolv* |
| Dianne Feeney<br>**Associate Director, Quality Initiatives**<br>*HSCRC* |
| Alyson Schuster, PhD<br>**Associate Director, Performance Measurement**<br>*HSCRC* |
| Theressa Lee<br>**Director, Center for Quality Measurement and Reporting**<br>*MHCC* |

**Appendix B: CAEM Measure Selection Process**

| Assessment Criteria | Definition | Decision Logic |
|---|---|---|
| **1) The measure addresses a critical MHAC program objective.** | 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 |
| **2) The measure is evidence-based and is strongly linked to a specific safety challenge or outcome.** | 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 |
| **3) The measure contributes to efficient use of measurement resources and/or supports alignment of measurement across programs.** | 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. |

| Assessment Criteria | Definition | Decision Logic |
|---|---|---|
| **4) The measure can be feasibly reported without adding significant reporting burden** | 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<br>AND<br>The value to patients/consumers outweighs any burden of implementation for hospitals. | Yes: Review can continue<br>No: Highest rating can be Refine and Reconsider. |
| **5) The measure is reliable and valid for reporting and analysis at the Hospital level** | The measure is fully developed, and specifications including Risk Adjustment methodology, if needed, are provided;<br>AND<br>Measure testing has demonstrated Reliability and Validity<br>OR<br>Case occurrences indicate clinical face validity.<br>AND<br>Comparative Benchmarks, preferably National are available | Yes: Measure could be Supported<br>No: Highest rating can be Refine and Resubmit. |
| **6) The measure has high Usability** | Measure is clinically actionable at the Hospital level<br>AND<br>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<br>No: Highest rating can be Refine and Resubmit. |

| Assessment Criteria | Definition | Decision Logic |
|---|---|---|
| **7) If a measure is in current use, no unreasonable implementation issues that outweigh the benefits of the measure have been identified.** | 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 |
|---|---|
| **Support to Include in MHAC** | The measure meets all the required CAEM SG Measure Evaluation Criteria. |
| **Conditional Support for Inclusion in MHAC** | 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. |
| **Refine and Resubmit for Inclusion in MHAC** | 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<br><br>Modifications suggested by CAEM SG would be made before the deadline for acceptance in the MHAC 2021 program. |
| **Do Not Support for Inclusion in MHAC** | 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 | | 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 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 844,412 | | | | |
| 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 |

| PPC # | PPC Description | Eligible Hospitals | PSI-90 | Observed PPCs | At Risk Discharges | Obs/At-Risk*1,000 | Reliability Assessment~ | Predictive Validity Assessment~ | Suggest |
|---|---|---|---|---|---|---|---|---|---|
| 14 | Ventricular Fibrillation/Cardiac Arrest. | 47 | | 1342 | 740,927 | 1.81 | Substantial | Adequate | monitoring |
| 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 | | 5.54 | 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 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 141,260 | | | | |
| 48 | Other Complications of Medical Care | 37 | | 157 | 840,758 | 0.19 | Moderate | Low | |
| 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 | |

| PPC # | PPC Description | Eligible Hospitals | PSI-90 | Observed PPCs | At Risk Discharges | Obs/At-Risk*1,000 | Reliability Assessment~ | Predictive Validity Assessment~ | Suggest |
|---|---|---|---|---|---|---|---|---|---|
| 53 | Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions | 39 | | 131 | 849,265 | 0.15 | Substantial | Adequate | |
| 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 | |

| PPC # | PPC Description | Eligible Hospitals | PSI-90 | Observed PPCs | At Risk Discharges | Obs/At-Risk*1,000 | Reliability Assessment~ | Predictive Validity Assessment~ | Suggest |
|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | |
| 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 | |

## Appendix D. 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.<br>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.<br>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 E: 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% |

| Measures Compared | Measure Inclusion | Numerator Cases | | Denominator Cases | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| PSI 10: Postoperative Acute Kidney Injury Requiring Dialysis Rate | PSI and PPC | 18 | 11% | 117,181 | 16% |
| | PSI Only | 86 | 51% | 17,122 | 2% |
| PPC 25: Renal Failure with Dialysis | PPC Only | 66 | 39% | 610,198 | 82% |
| PSI 11: Postoperative Respiratory Failure Rate | PSI and PPC | 79 | 5% | 103,100 | 14% |
| | PSI Only | 411 | 24% | 12,119 | 2% |
| PPC 03: Acute Pulmonary Edema and Respiratory Failure without Ventilation | PPC Only | 1,234 | 72% | 603,232 | 84% |
| 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 - |

| Measure ID | NQF | Measure Title | NQF Endorsed |
|---|---|---|---|
|  |  |  | 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). 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 postphlebitic 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)[15]**

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

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[15] For more information on the DRA HAC POA program refer to **http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/index.html**.

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 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[16].  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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[16] 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 |

| PPC Number | PPC Description | Threshold | Benchmark | Tier |
|---|---|---|---|---|
| 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 |
| 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 Pneumothorax | 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**
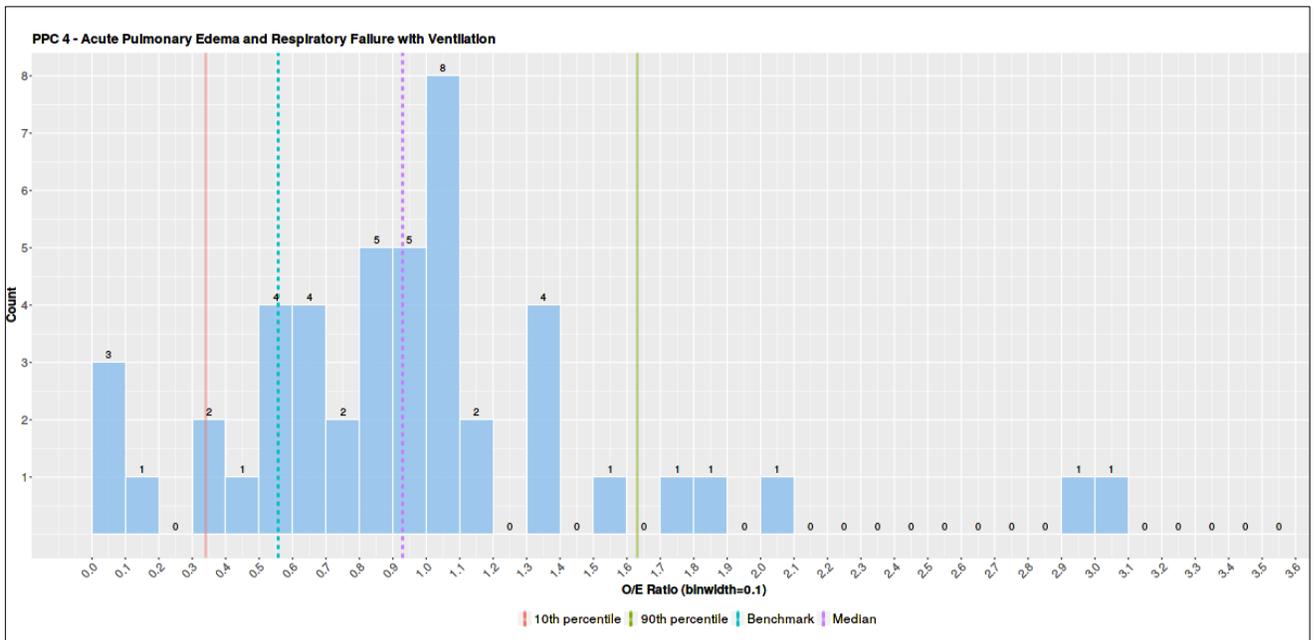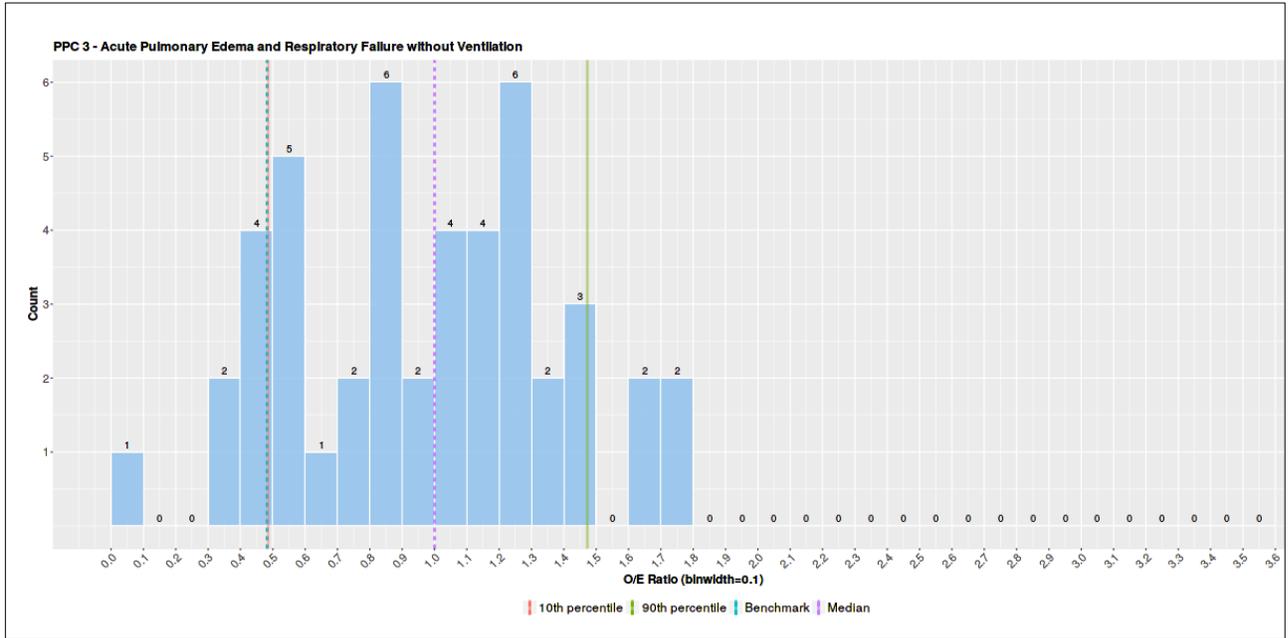
PPC 16 - Venous Thrombosis



PPC 28 - In-Hospital Trauma and Fractures
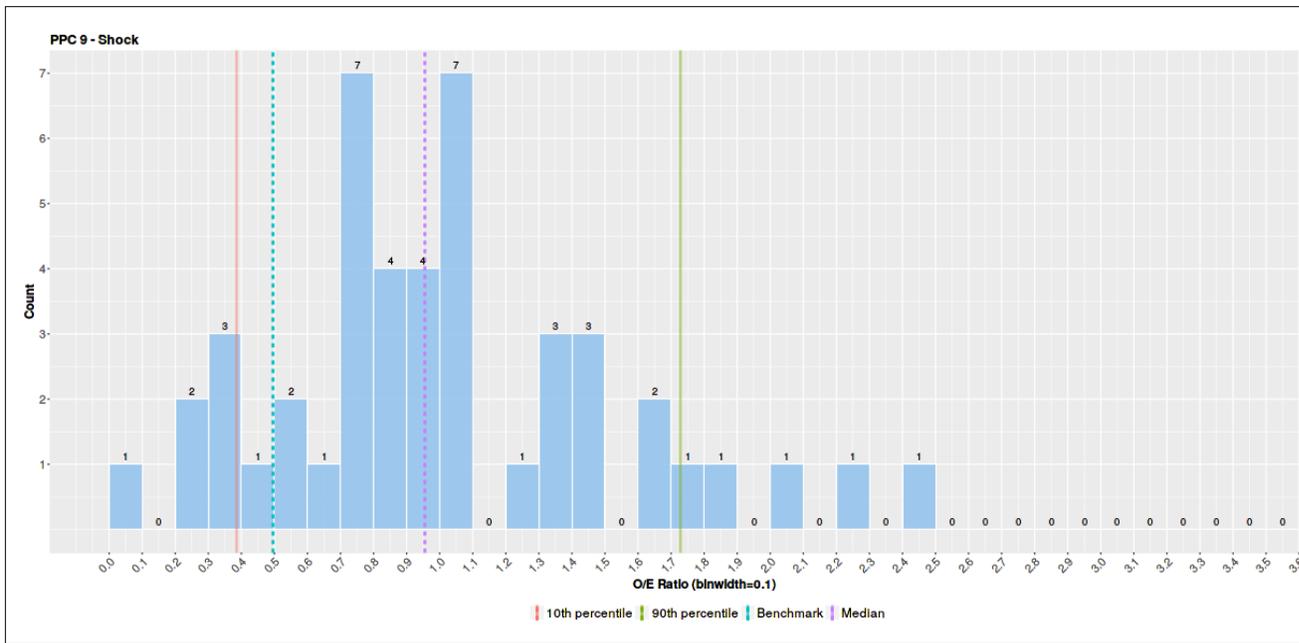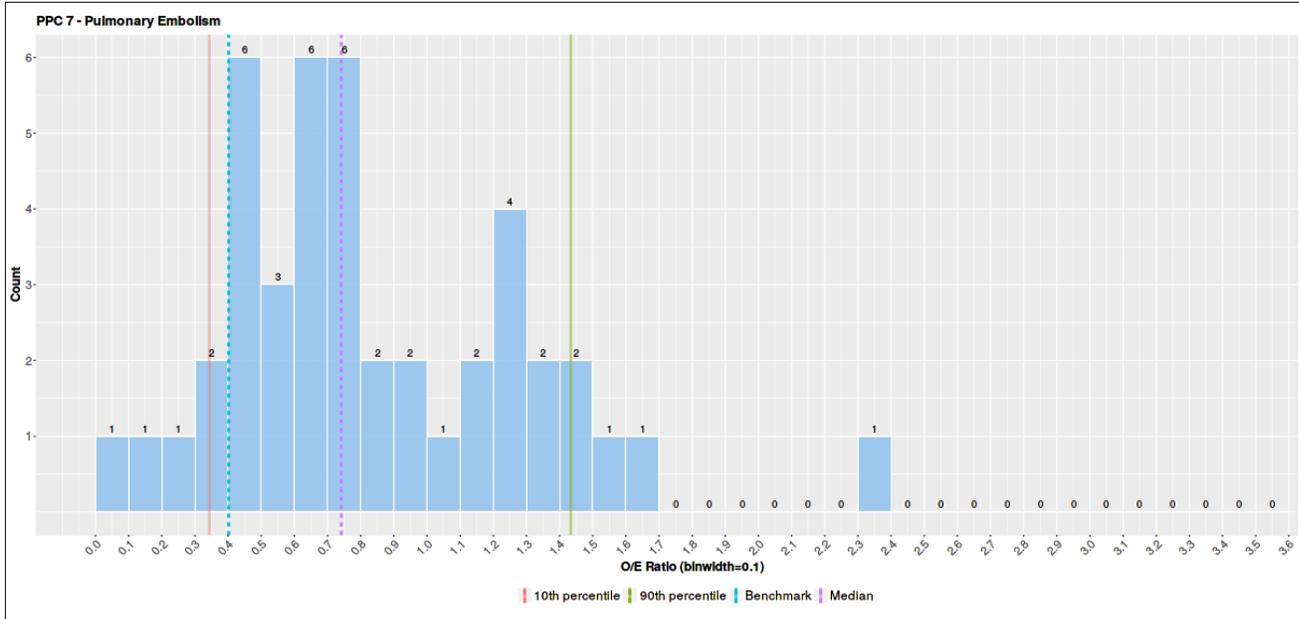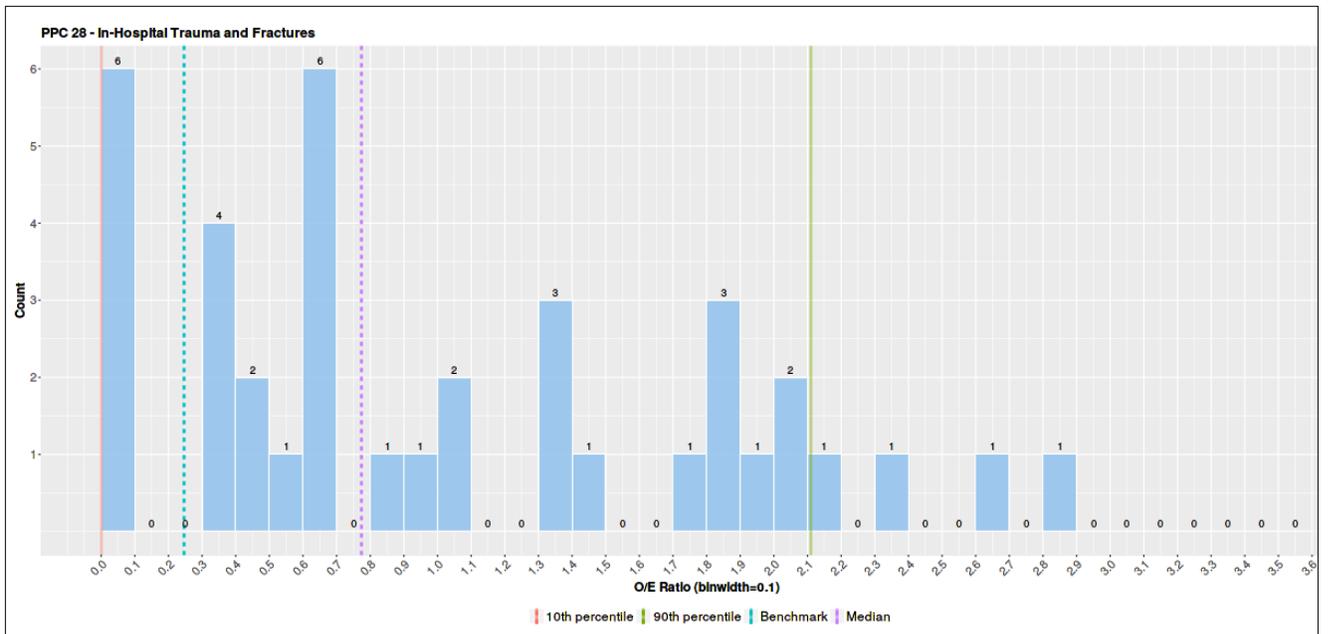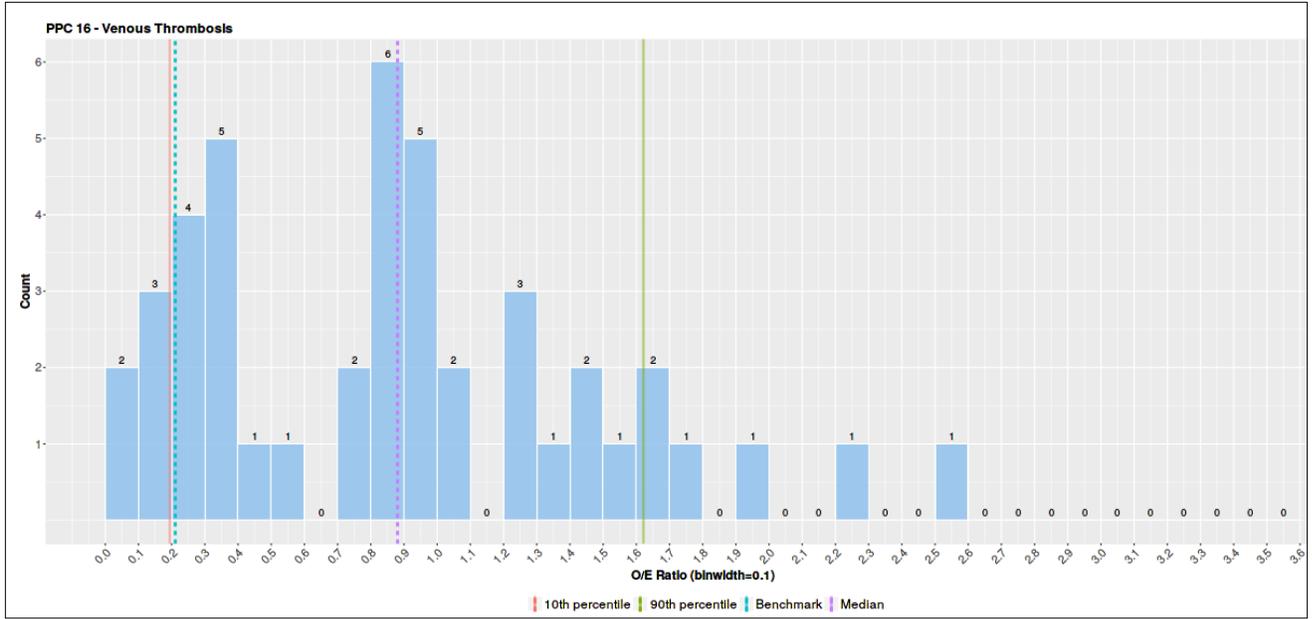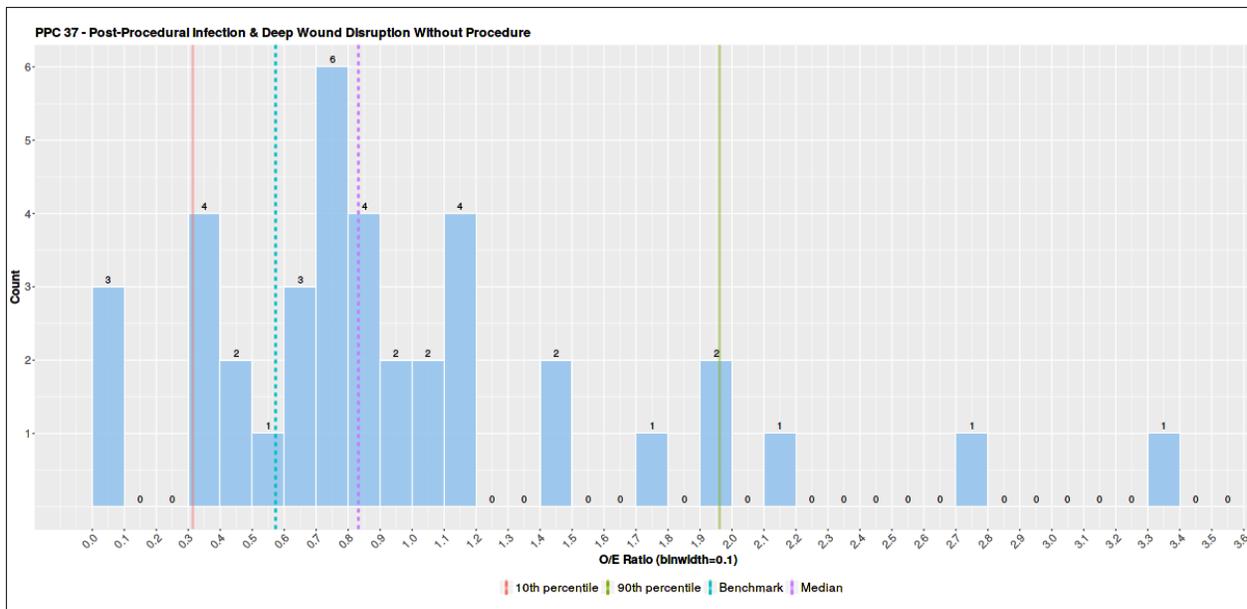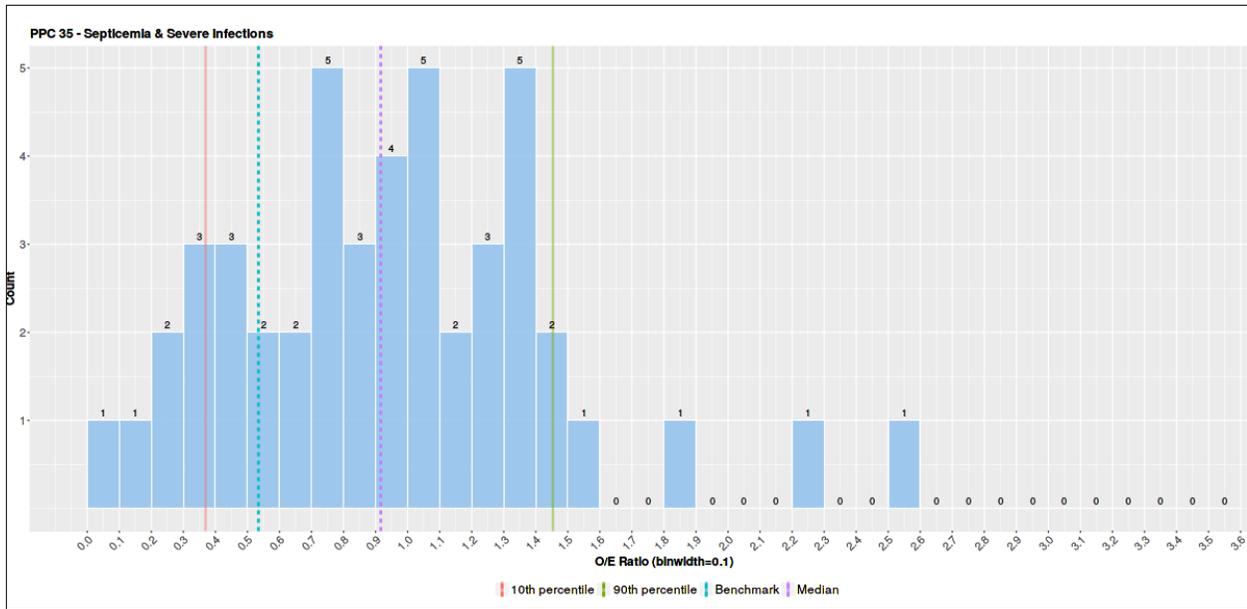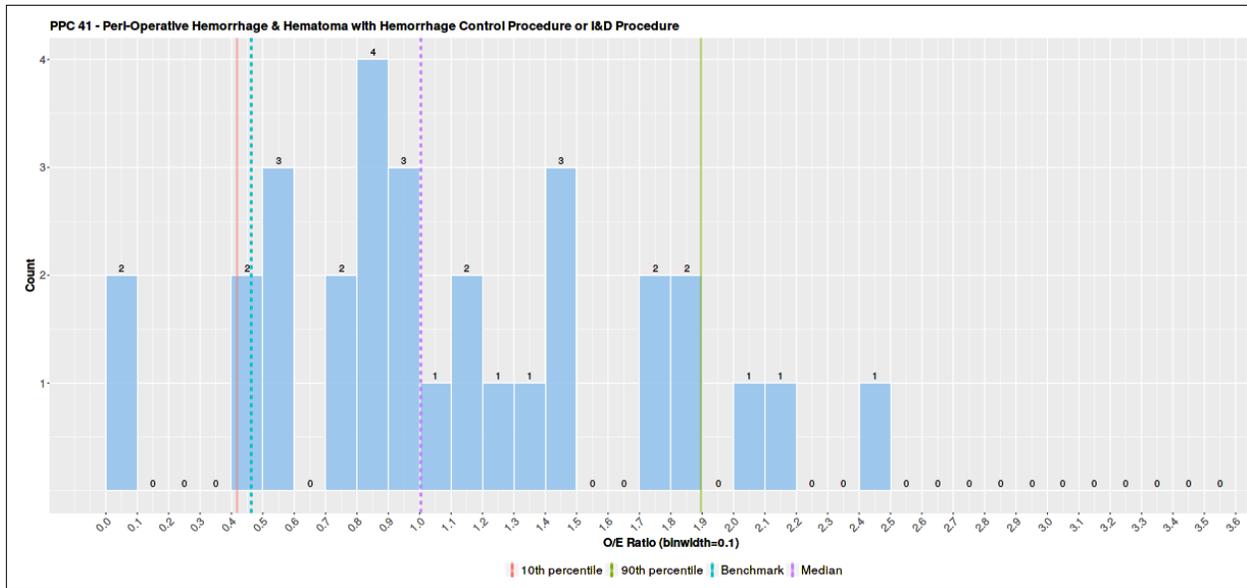
*MedStar Union Memorial (210024) removed as outlier with O/E of 4.988
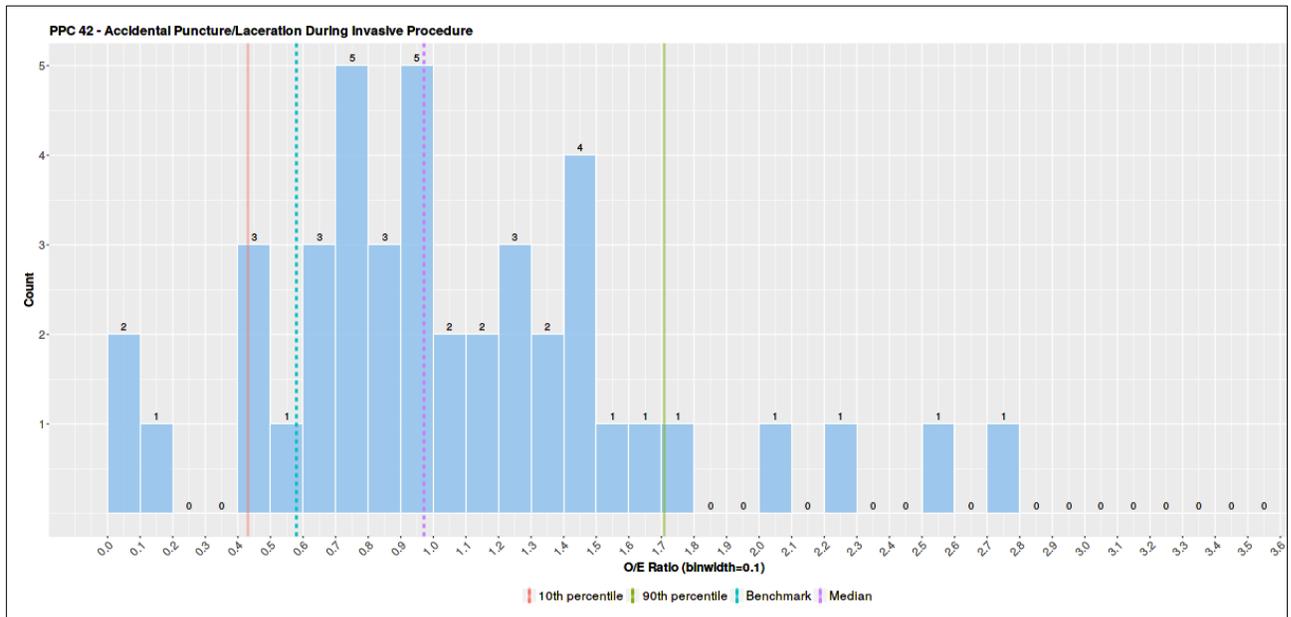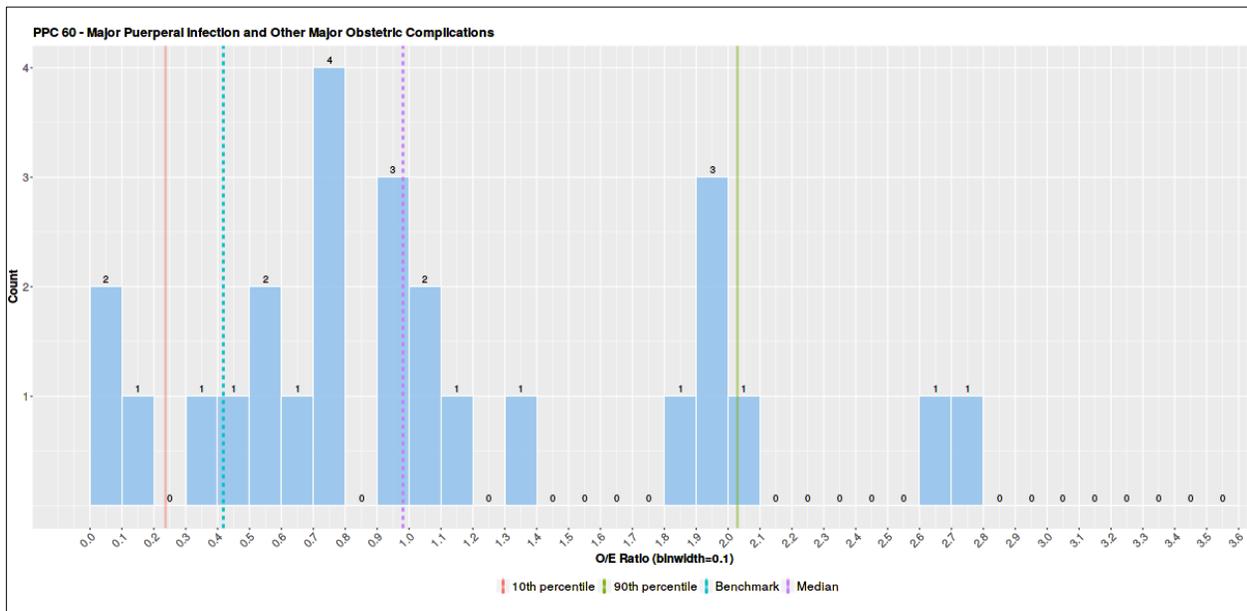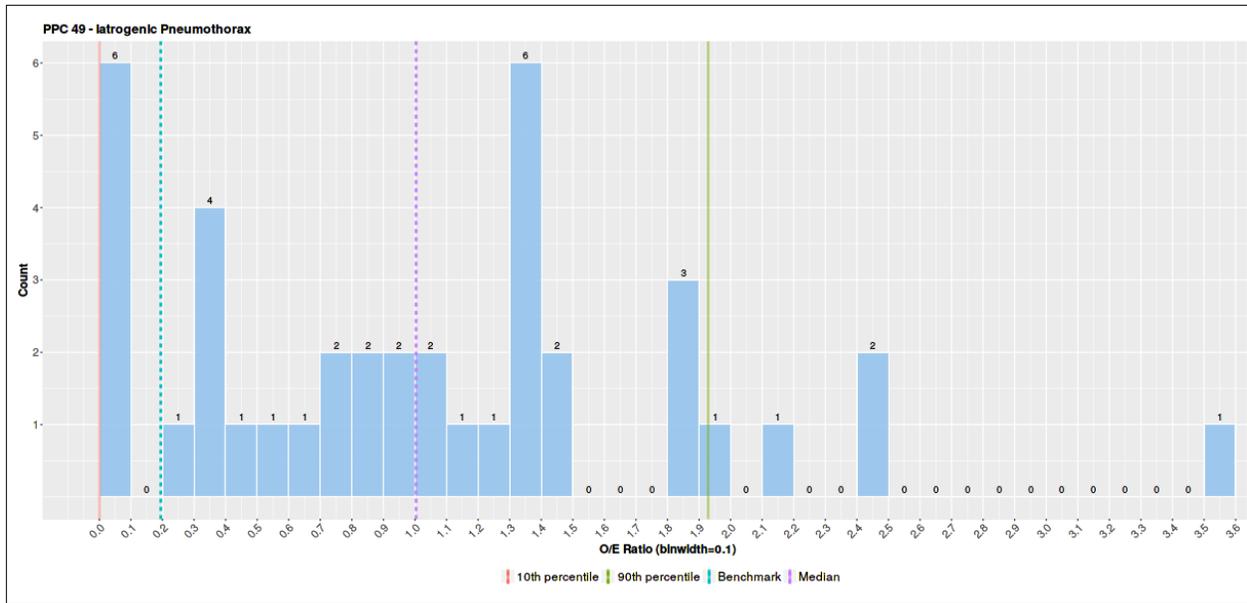
*Washington Adventist (210016) removed as outlier with O/E of 3.988
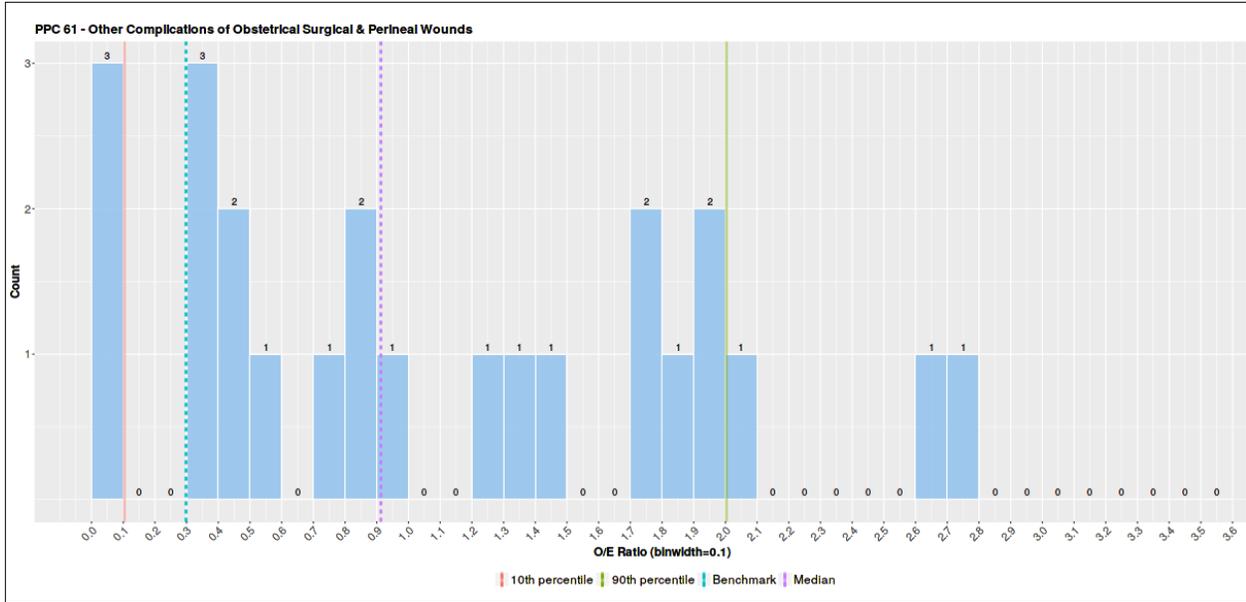
*UM-Charles Regional (210035) removed as outlier with O/E of 3.615
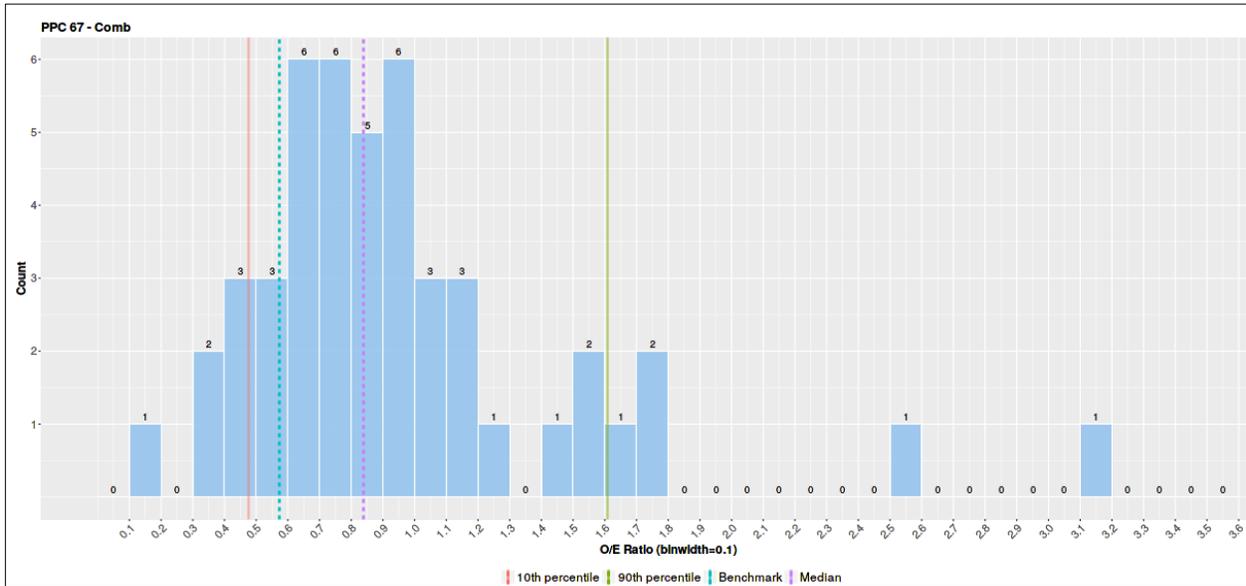
# Appendix V: Comparison of PPC Rates under Version 35 and Version 36

| PPC# | PPC DESCRIPTION | v35 | v36 |
|---|---|---|---|
| 3 | Acute Pulmonary Edema and Respiratory Failure without Ventilation | 1.78 | 1.77 |
| 4 | Acute Pulmonary Edema and Respiratory Failure with Ventilation | 1.21 | 1.28 |
| 7 | Pulmonary Embolism | 0.49 | 0.56 |
| 9 | Shock | 1.18 | 1.05 |
| 16 | Venous Thrombosis | 0.36 | 0.40 |
| 28 | In-Hospital Trauma and Fractures | 0.13 | 0.13 |
| 35 | Septicemia & Severe Infections | 2.77 | 2.90 |
| 37 | Post-Operative Infection & Deep Wound Disruption Without Procedure | 2.48 | 2.53 |
| 41 | Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc | 0.69 | 0.67 |
| 42 | Accidental Puncture/Laceration During Invasive Procedure | 0.49 | 0.50 |
| 49 | Iatrogenic Pneumothrax | 0.19 | 0.17 |
| 60 | Major Puerperal Infection and Other Major Obstetric Complications | 0.98 | 0.55 |
| 61 | Other Complications of Obstetrical Surgical & Perineal Wounds | 0.82 | 0.81 |
| 67 | Combined Pneumonia (PPC 5 & 6) | 1.80 | 1.97 |

| Rate >1.0 per 1,000 At-risk discharges | Rate >0.5 per 1,000 At-risk discharges |
|---|---|

# Appendix VI:  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 except 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](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.
- X (bar) 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 VII. PPC Benchmarks and Thresholds under Current and Expanded Methodology (CY 2016)

| PPC # | 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 VIII. PPC Benchmarks and Thresholds under Two Years (FY 2017 and FY 2018) and One Year (FY 2018) Data

| PPC Number | PPC Description | 2 Yr FY 17 & 18 | | 1 Yr FY 18 | |
|---|---|---|---|---|---|
| | | Threshold (10th) | Benchmark (90th) | Threshold (10th) | Benchmark (90th) |
| 3 | Acute Pulmonary Edema and Respiratory Failure without Ventilation | 1.8105 | 0.5751 | 2.0865 | 0.2067 |
| 4 | Acute Pulmonary Edema and Respiratory Failure with Ventilation | 1.7978 | 0.4678 | 1.8562 | 0.3138 |
| 7 | Pulmonary Embolism | 1.7773 | 0.3836 | 2.0905 | 0.0000 |
| 9 | Shock | 1.7988 | 0.4235 | 1.6344 | 0.3376 |
| 16 | Venous Thrombosis | 1.6437 | 0.2133 | 2.1852 | 0.0000 |
| 28 | In-Hospital Trauma and Fractures | 1.7259 | 0.3859 | 2.1406 | 0.0000 |
| 35 | Septicemia & Severe Infections | 1.7416 | 0.3659 | 1.7227 | 0.2691 |
| 37 | Post-Operative Infection & Deep Wound Disruption Without Procedure | 2.1254 | 0.4020 | 2.6941 | 0.2870 |
| 41 | Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D | 1.7871 | 0.3592 | 1.9566 | 0.0000 |
| 42 | Accidental Puncture/Laceration During Invasive Procedure | 2.5504 | 0.4797 | 2.3152 | 0.3221 |
| 49 | Iatrogenic Pneumothrax | 1.9877 | 0.1946 | 2.2594 | 0.3383 |
| 60 | Major Puerperal Infection and Other Major Obstetric Complications | 1.5373 | 0.2404 | 1.9441 | 0.0000 |
| 61 | Other Complications of Obstetrical Surgical & Perineal Wounds | 2.0641 | 0.1078 | 2.1750 | 0.0000 |
| 67 | Combined Pneumonia (PPC 5 and 6) | 1.5607 | 0.5899 | 1.7344 | 0.3922 |

## Appendix IX. Example of Calculation of Hospital Scores

| | | | | | Hospital A | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PPC | Threshold | Benchmark | Hospital O/E Ratio | ATTAINMENT POINTS | POSSIBLE DENOMINATOR | 3M Weight | Weighted Points | Weighted Denominators |
| | A | B | C | D = C relative to A and B | E | F | G = D * F | H = E * F |
| PPC 1 | 1.75 | 0.5 | 0.2 | 100 | 100 | 0.5 | 50 | 50 |
| PPC 2 | 2 | 0.3 | 1.1 | 53 | 100 | 2 | 106 | 200 |
| PPC 3 | 2.5 | 0.4 | 0.65 | 88 | 100 | 1 | 88 | 100 |
| Total | | | | | | | 244 | 350 |
| | | | | | TOTAL WEIGHTED SCORE G total /H total | | 70% | |

| | | | | | Hospital B | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PPC | Threshold | Benchmark | Hospital O/E Ratio | ATTAINMENT POINTS | POSSIBLE DENOMINATOR | 3M Weight | Weighted Points | Weighted Denominators |
| | A | B | C | D = C relative to A and B | E | F | G = D * F | H = E * F |
| PPC 1 | 1.75 | 0.5 | 2 | 0 | 100 | 0.5 | 0 | 50 |
| PPC 2 | 2 | 0.3 | 1.5 | 30 | 100 | 2 | 60 | 200 |
| PPC 3 | 2.5 | 0.4 | 1 | 71 | 100 | 1 | 71 | 100 |
| Total | | | | | | | 131 | 350 |
| | | | | | TOTAL WEIGHTED SCORE G total /H total | | 37% | |

## Appendix X. By hospital Score Modeling

| Hospital ID | Hospital Name | Model 1: Improvement and Attainment | Model 2: Attainment Only | Model 3: Wider Performance Standards, Attainment Only |
|---|---|---|---|---|
| **RY 2021 MHAC Modeling by Hospital** | | MHAC score | MHAC score | MHAC score |
| 210001 | MERITUS | 28% | 27% | 57% |
| 210002 | UNIVERSITY OF MARYLAND | 26% | 21% | 56% |
| 210003 | PRINCE GEORGE | 34% | 28% | 46% |
| 210004 | HOLY CROSS | 72% | 71% | 85% |
| 210005 | FREDERICK MEMORIAL | 66% | 63% | 73% |
| 210006 | HARFORD | 23% | 11% | 44% |
| 210008 | MERCY | 48% | 38% | 62% |
| 210009 | JOHNS HOPKINS | 56% | 51% | 73% |
| 210010 | DORCHESTER | 70% | 70% | 80% |
| 210011 | ST. AGNES | 53% | 51% | 76% |
| 210012 | SINAI | 41% | 34% | 66% |
| 210013 | BON SECOURS | 22% | 12% | 17% |
| 210015 | FRANKLIN SQUARE | 22% | 16% | 49% |
| 210016 | WASHINGTON ADVENTIST | 31% | 29% | 49% |
| 210017 | GARRETT COUNTY | 76% | 76% | 89% |
| 210018 | MONTGOMERY GENERAL | 65% | 63% | 79% |
| 210019 | PENINSULA REGIONAL | 51% | 51% | 66% |
| 210022 | SUBURBAN | 60% | 58% | 77% |
| 210023 | ANNE ARUNDEL | 69% | 69% | 84% |

| 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 |
| 210024 | UNION MEMORIAL | 26% | 20% | 46% |
| 210027 | WESTERN MARYLAND HEALTH SYSTEM | 25% | 21% | 47% |
| 210028 | ST. MARY | 66% | 66% | 70% |
| 210029 | HOPKINS BAYVIEW MED CTR | 45% | 40% | 71% |
| 210030 | CHESTERTOWN | 41% | 28% | 28% |
| 210032 | UNION HOSPITAL  OF CECIL COUNT | 58% | 43% | 63% |
| 210033 | CARROLL COUNTY | 28% | 27% | 41% |
| 210034 | HARBOR | 28% | 22% | 37% |
| 210035 | CHARLES REGIONAL | 76% | 75% | 85% |
| 210037 | EASTON | 42% | 38% | 68% |
| 210038 | UMMC MIDTOWN | 58% | 58% | 74% |
| 210039 | CALVERT | 52% | 50% | 57% |
| 210040 | NORTHWEST | 51% | 51% | 69% |
| 210043 | BALTIMORE WASHINGTON MEDICAL CENTER | 30% | 29% | 55% |
| 210044 | G.B.M.C. | 21% | 18% | 39% |
| 210048 | HOWARD COUNTY | 69% | 64% | 76% |
| 210049 | UPPER CHESAPEAKE HEALTH | 73% | 68% | 84% |
| 210051 | DOCTORS COMMUNITY | 69% | 67% | 76% |
| 210055 | LAUREL REGIONAL | 71% | 63% | 75% |

| 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 |
| 210056 | GOOD SAMARITAN | 40% | 39% | 51% |
| 210057 | SHADY GROVE | 23% | 16% | 39% |
| 210058 | REHAB & ORTHO | 36% | 36% | 45% |
| 210060 | FT. WASHINGTON | 100% | 100% | 100% |
| 210061 | ATLANTIC GENERAL | 59% | 57% | 61% |
| 210062 | SOUTHERN MARYLAND | 20% | 4% | 21% |
| 210063 | UM ST. JOSEPH | 37% | 37% | 59% |
| 210064 | LEVINDALE | 64% | 48% | 63% |
| 210065 | HC-Germantown | 77% | 73% | 88% |

| | | | |
|---|---|---|---|
| Median | 51% | 43% | 63% |
| Average | 49% | 45% | 62% |
| Min | 20% | 4% | 17% |
| Max | 100% | 100% | 100% |
| 25th | 28% | 27% | 47% |
| 75th | 66% | 63% | 76% |

## Appendix XI. By Hospital Revenue Modeling

| RY 2021 MHAC Revenue Adjustment Modeling | | | Linear 60-70% Cutpoint | | Non-Linear 65% Cutpoint | |
|---|---|---|---|---|---|---|
| Hospital ID | Hospital Name | RY18 estimated Permanent Inpatient Revenue | MHAC score | % Adjustment | $ Adjustment | % Adjustment | $ Adjustment |
| 210001 | MERITUS | $190,799,459 | 57% | -0.10% | -$190,799 | -0.0037% | -$7,060 |
| 210002 | UNIVERSITY OF MARYLAND | $919,253,797 | 56% | -0.13% | -$1,225,672 | -0.0053% | -$48,720 |
| 210003 | PRINCE GEORGE | $215,464,625 | 46% | -0.47% | -$1,005,502 | -0.0500% | -$107,732 |
| 210004 | HOLY CROSS | $340,412,069 | 85% | 0.50% | $1,702,060 | 0.1866% | $635,209 |
| 210005 | FREDERICK MEMORIAL | $220,972,343 | 73% | 0.10% | $220,972 | 0.0119% | $26,296 |
| 210006 | HARFORD | $48,557,781 | 44% | -0.53% | -$258,975 | -0.0674% | -$32,728 |
| 210008 | MERCY | $223,932,822 | 62% | 0.00% | $0 | -0.0002% | -$448 |
| 210009 | JOHNS HOPKINS | $1,378,259,901 | 73% | 0.10% | $1,378,260 | 0.0119% | $164,013 |
| 210010 | DORCHESTER | $26,021,222 | 80% | 0.33% | $86,737 | 0.0787% | $20,479 |
| 210011 | ST. AGNES | $237,889,236 | 76% | 0.20% | $475,778 | 0.0310% | $73,746 |
| 210012 | SINAI | $398,036,508 | 66% | 0.00% | $0 | 0.0000% | $0 |
| 210013 | BON SECOURS | $65,798,042 | 17% | -1.43% | -$943,105 | -0.8054% | -$529,937 |
| 210015 | FRANKLIN SQUARE | $300,623,972 | 49% | -0.37% | -$1,102,288 | -0.0298% | -$89,586 |
| 210016 | WASHINGTON ADVENTIST | $158,337,604 | 49% | -0.37% | -$580,571 | -0.0298% | -$47,185 |
| 210017 | GARRETT COUNTY | $21,075,334 | 89% | 0.63% | $133,477 | 0.3224% | $67,947 |
| 210018 | MONTGOMERY GENERAL | $77,808,657 | 79% | 0.30% | $233,426 | 0.0640% | $49,798 |
| 210019 | PENINSULA REGIONAL | $241,466,813 | 66% | 0.00% | $0 | 0.0000% | $0 |
| 210022 | SUBURBAN | $197,431,392 | 77% | 0.23% | $460,673 | 0.0403% | $79,565 |

| RY 2021 MHAC Revenue Adjustment Modeling | | RY18 estimated Permanent Inpatient Revenue | MHAC score | Linear 60-70% Cutpoint | | Non-Linear 65% Cutpoint | |
|---|---|---|---|---|---|---|---|
| Hospital ID | Hospital Name | | | % Adjustment | $ Adjustment | % Adjustment | $ Adjustment |
| 210023 | ANNE ARUNDEL | $299,264,995 | 84% | 0.47% | $1,396,570 | 0.1600% | $478,824 |
| 210024 | UNION MEMORIAL | $235,346,415 | 46% | -0.47% | -$1,098,283 | -0.0500% | -$117,673 |
| 210027 | WESTERN MARYLAND HEALTH SYSTEM | $171,000,183 | 47% | -0.43% | -$741,001 | -0.0425% | -$72,675 |
| 210028 | ST. MARY | $76,303,058 | 70% | 0.00% | $0 | 0.0029% | $2,213 |
| 210029 | HOPKINS BAYVIEW | $357,620,585 | 71% | 0.03% | $119,207 | 0.0050% | $17,881 |
| 210030 | CHESTERTOWN | $21,139,936 | 28% | -1.07% | -$225,493 | -0.3689% | -$77,985 |
| 210032 | UNION HOSPITAL  OF CECIL COUNT | $66,514,320 | 63% | 0.00% | $0 | -0.0001% | -$67 |
| 210033 | CARROLL COUNTY | $132,801,017 | 41% | -0.63% | -$841,073 | -0.1007% | -$133,731 |
| 210034 | HARBOR | $112,526,840 | 37% | -0.77% | -$862,706 | -0.1599% | -$179,930 |
| 210035 | CHARLES REGIONAL | $75,199,112 | 85% | 0.50% | $375,996 | 0.1866% | $140,322 |
| 210037 | EASTON | $105,222,295 | 68% | 0.00% | $0 | 0.0006% | $631 |
| 210038 | UMMC MIDTOWN | $117,217,727 | 74% | 0.13% | $156,290 | 0.0170% | $19,927 |
| 210039 | CALVERT | $63,677,722 | 57% | -0.10% | -$63,678 | -0.0037% | -$2,356 |
| 210040 | NORTHWEST | $133,828,758 | 69% | 0.00% | $0 | 0.0015% | $2,007 |
| 210043 | BALTIMORE WASHINGTON MEDICAL | $229,151,792 | 55% | -0.17% | -$381,920 | -0.0073% | -$16,728 |
| 210044 | G.B.M.C. | $225,145,722 | 39% | -0.70% | -$1,576,020 | -0.1280% | -$288,187 |
| 210048 | HOWARD COUNTY | $183,348,539 | 76% | 0.20% | $366,697 | 0.0310% | $56,838 |
| 210049 | UPPER CHESAPEAKE | $130,150,364 | 84% | 0.47% | $607,368 | 0.1600% | $208,241 |
| 210051 | DOCTORS COMMUNITY | $144,686,192 | 76% | 0.20% | $289,372 | 0.0310% | $44,853 |

| RY 2021 MHAC Revenue Adjustment Modeling | | RY18 estimated Permanent Inpatient Revenue | MHAC score | Linear 60-70% Cutpoint | | Non-Linear 65% Cutpoint | |
|---|---|---|---|---|---|---|---|
| Hospital ID | Hospital Name | RY18 estimated Permanent Inpatient Revenue | MHAC score | % Adjustment | $ Adjustment | % Adjustment | $ Adjustment |
| 210055 | LAUREL REGIONAL | $58,931,276 | 75% | 0.17% | $98,219 | 0.0233% | $13,731 |
| 210056 | GOOD SAMARITAN | $140,674,848 | 51% | -0.30% | -$422,025 | -0.0200% | -$28,135 |
| 210057 | SHADY GROVE | $231,939,525 | 39% | -0.70% | -$1,623,577 | -0.1280% | -$296,883 |
| 210058 | REHAB & ORTHO | $69,966,359 | 45% | -0.50% | -$349,832 | -0.0583% | -$40,790 |
| 210060 | FT. WASHINGTON | $19,548,527 | 100% | 1.00% | $195,485 | 1.0000% | $195,485 |
| 210061 | ATLANTIC GENERAL | $37,316,219 | 61% | 0.00% | $0 | -0.0005% | -$187 |
| 210062 | SOUTHERN MARYLAND | $163,844,003 | 21% | -1.30% | -$2,129,972 | -0.6204% | -$1,016,488 |
| 210063 | UM ST. JOSEPH | $237,924,618 | 59% | -0.03% | -$79,308 | -0.0016% | -$3,807 |
| 210064 | LEVINDALE | $56,105,767 | 63% | 0.00% | $0 | -0.0001% | -$56 |
| 210065 | HC-Germantown | $60,632,167 | 88% | 0.60% | $363,793 | 0.2838% | $172,074 |
| | | | | | | | |
| | State Total | $9,219,170,455 | | State Total | -$7,041,420 | | -$668,994 |
| | | | | Penalty | -$15,701,800 | | -$3,139,074 |
| | | | | % Inpatient | -0.17% | | -0.03% |
| | | | | Reward | $8,660,380 | | $2,470,080 |
| | | | | % Inpatient | 0.09% | | 0.03% |
| | | | | # Penalized | 20 | | 24 |
| | | | | # $0 | 9 | | 2 |
| | | | | # Rewarded | 18 | | 21 |

# Appendix XII. Sensitivity Analysis of MHAC Scores

This histogram shows percent of hospital scores by percent change in revenue adjustments when modeling was done to test the sensitivity of the hospital MHAC scores to an increase in one PPC. Scores were run for each hospital for each PPC, meaning that if a hospital qualified for all fourteen PPCs the score was run fourteen times adding one to each PPC. The histogram shows that more than 60% of the hospital scores had no change in revenue when there was one additional PPC.
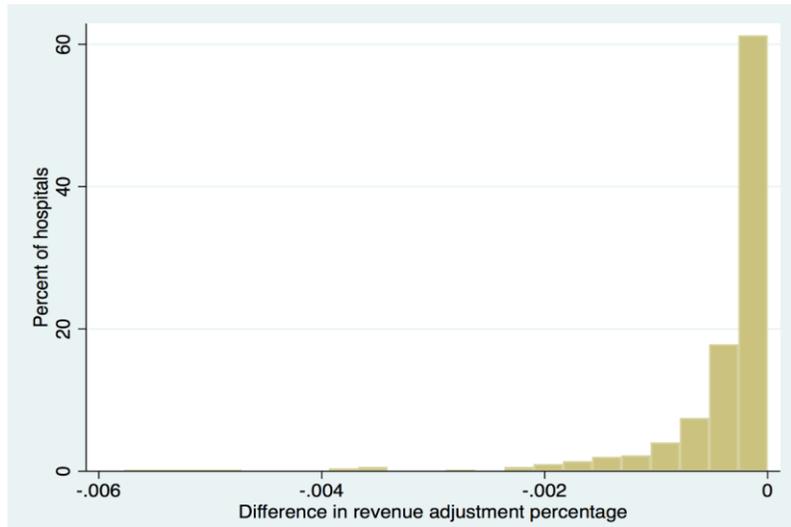


This bar chart is of each run of the hospital scores and shows that there are four scenarios where the addition of one PPC results in a revenue change that is greater than 0.40 percent. These four scenarios are for the three small hospitals that only are being measured on four PPCs (Levindale, Garrett, and Chestertown). Thus it is not surprising that the scores for these hospitals are influenced by a single PPC. However in reviewing the PPCs these hospitals are being evaluated on, staff believes it is clinically important to include these hospitals in the program.
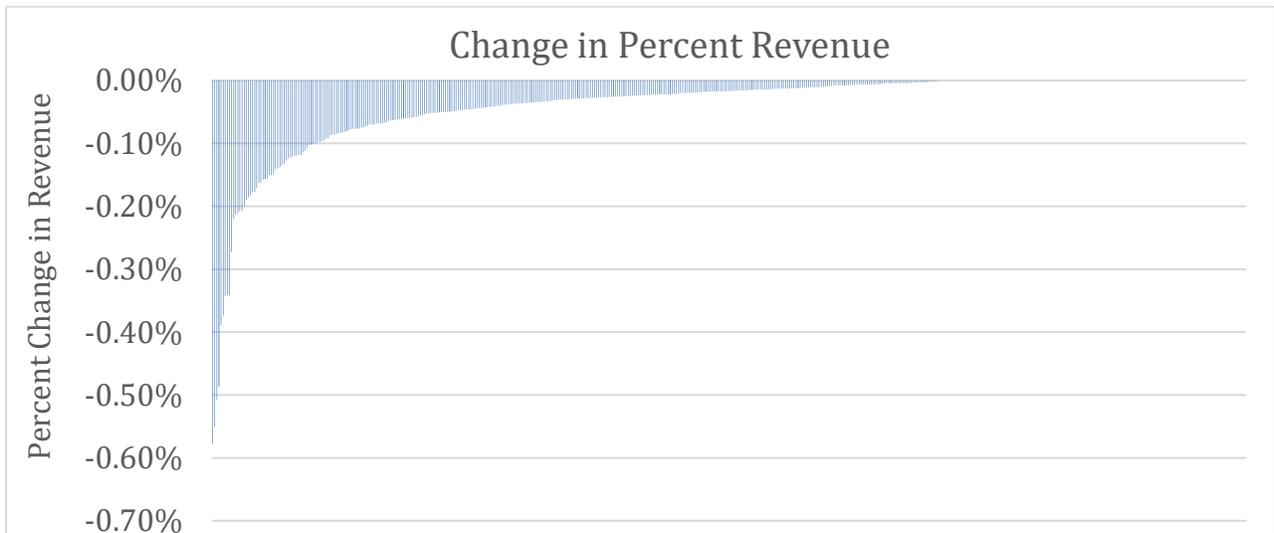
# Appendix XIII. Amended Revenue Adjustment Scale

Below is the abbreviated revenue adjustment scale amended to have potential rewards of 2%.

| Final MHAC Score | Revenue Adjustment |
|---|---|
| 0% | -2.00% |
| 5% | -1.83% |
| 10% | -1.67% |
| 15% | -1.50% |
| 20% | -1.33% |
| 25% | -1.17% |
| 30% | -1.00% |
| 35% | -0.83% |
| 40% | -0.67% |
| 45% | -0.50% |
| 50% | -0.33% |
| 55% | -0.17% |
| 60% | 0.00% |
| 65% | 0.00% |
| 70% | 0.00% |
| 75% | 0.33% |
| 80% | 0.67% |
| 85% | 1.00% |
| 90% | 1.33% |
| 95% | 1.67% |
| 100% | 2.00% |
| | |
| Penalty Cut-point | 60% |
| Reward Cut-point | 70% |