

Notes on Efficient Frontier Hospital Scores: February 2019

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The published hospital scores follow the methodology described in the working paper “An Efficient Frontier Approach to Scoring and Ranking Hospital Performance” (2019). We made two adjustments: 1) alternative denominators for the Safety of Care group, and 2) peer grouping.

Denominators in the Safety of Care Group

As explained in the *February 2019 Updates and Specifications Report*, and the *February 2019 Public Input Request*, volume-based denominators in the Safety of Care group are now available for some HAI measures that represent device-days and patient-days, while for other HAI measures represent number of procedures. Because our methodology compares denominators across measures, they need to be in the same units. Previously, denominators represented predicted numbers of infections, which are still available. However, there are several problems with using these:

- 1) The HAI data is based on the entire population of patients, while the PSI-90-Safety and COMP-HIP-KNEE measures are based only on Medicare patients.
- 2) As discussed in the *FAQ for Hospitals February 2019 Preview Reports*, the HAI measures cover 12 months while PSI-90-Safety and COMP-HIP_KNEE measures cover 21 and 36 months, respectively.
- 3) The PSI-90-Safety denominator is a weighted combination of denominators from the underlying measures, which represent discharges. The COMP-HIP-KNEE denominator represents discharges. This is not consistent with the predicted number of infections in the HAI measures.

To re-solve these inconsistencies, we use a different set of denominators computed at the national level. Specifically,

- 1) For the HAI measures, we use the CDC data for Observed infections from 2017, collected and published as part of their *2017 National and State Healthcare-Associated Infections Progress Report*.
- 2) To be consistent with using Observed infections with HAI's, for PSI-90 we use the total number of patient safety events aggregated over the underlying measures. These are provided in *National CMS PSI Results for the 2015-2017 Medicare Population, Supplementary Information, Fiscal Year 2019*. Because these are tabulated over 21 months (October 2015 – June 2017), we annualize them.
- 3) For COMP-HIP-KNEE, we multiply each hospital's Risk-Standardized Complication Rate by the number of eligible discharges, to obtain an estimate for the (risk-adjusted) number of observed complications. We then aggregate over all hospitals to obtain a national estimate.

- 4) COMP-HIP-KNEE and PSI-90 include only the Medicare population, which share a disproportionate number of hip/knee replacement surgeries as compared with the general population. In contrast, the HAI numbers calculated in item 1 above represent the entire U.S. patient population. So we re-scale them by the ratio of annual Medicare discharges (11.3 million, based on 2014 Medicare inpatient claims data) to annual all-population discharges (34 million, from the CDC National Center for Health Statistics, Table 82, for 2014 or 2015). This gives estimates for observed infections in the Medicare population, consistent with COMP-HIP-KNEE and PSI-90.

As a result, all numbers represent or estimate the number of observed patient safety events nationally, annualized, and in the Medicare population. We then use these instead of the usual denominators in our constraints on the relative magnitude of measure weights, for the Safety of Care group. We do not use the hospital-specific denominators for the Safety of Care group. These calculations are shown in the attached spreadsheet.

While measures within other groups are mostly consistent, a few measures are collected over time frames that are different than other measures in the same group (e.g. READM-30-HOSP-WIDE). However, we use the denominators (i.e. number of patients) as given in the CMS data without adjusting.

Peer Grouping

We employ three criteria for peer grouping, resulting in a total of 8 peer groups taking combinations. The criteria are

- 1) Socio-economic status (SES)

These come from the CMS Hospital Readmissions Reduction program, which assigns each participating hospital a SES indicator of 1 to 5, which 5 representing a hospital with the lowest socio-economic mix of patients. This is determined by the percentage of Medicare patients that are dual-eligible for Medicaid. A sixth category contains hospitals for which their SES is unknown, which include Critical Access hospitals.

- 2) Teaching versus non-teaching hospitals

We consider a hospital to be a teaching hospital if its resident-to-bed ratio meets or exceeds 0.25. Hospitals for which the resident-to-bed ratios are unknown are grouped as non-teaching hospitals.

- 3) Size

We categorize each hospital as either a Critical Access Hospital (i.e. rural with ≤ 25 beds), or an Acute Care Hospital that is small (< 100 beds), medium (between 100 and 400 beds), or large (≥ 400 beds).

We take as input all reported performance measures after standardization and winsorization across the entire population of hospitals. Depending on which of these

three criteria are turned on, we compute hospital scores including only hospitals in each hospital's peer group. For example, if only SES and Size are considered, then hospitals are placed in one of 24 groups (6 SES categories x 4 Size categories), and we compute each hospital's score only with respect to hospitals in its peer group. Please be aware that some cells may have too few hospitals to construct a reliable efficient frontier, although the cone constraints should still ensure sensible hospital scores. When there is only 1 hospital contained in a peer group, we drop it. Also, we drop hospitals that achieve the maximum in the peer group on every reported measure, i.e. that violate the "No Perfect Hospital" assumption as discussed in the paper; this happens rarely but generally occurs when hospitals report very few measures and are therefore not rated anyway.

While we re-compute Efficient Frontier hospital scores within each peer group, we use the CMS hospital and group scores without re-computing them within peer groups. However, when calculating quintiles (and percentiles) for both the Efficient Frontier and CMS approaches, we do so within the peer group associated with each hospital.